How serious is dioxin’s cancer risk?

If they expected clarity on how to classify the carcinogenicity of dioxin from their in-house panel of experts, U.S. EPA policy makers were out of luck. In March, EPA’s Science Advisory Board (SAB) was unable to reach a consensus on whether 2,3,7,8–tetrachlorodibenzo-p-dioxin (TCDD) is a human carcinogen. This lack of consensus leaves EPA policy makers back where they started, as the U.S. government struggles to reach agreement on the seriousness of dioxin exposure to human health.

The board was reviewing EPA’s reassessment of dioxin and related compounds, a revised document officially released by EPA last June. The report was the subject of major news coverage then, because it characterized TCDD as a human carcinogen, adding that other dioxins and some dioxin-like compounds are likely human carcinogens. The cancer risk for people exposed to these chemicals ranges from 1 in 100 to 1 in 1000, EPA wrote.

EPA’s conclusion on TCDD is in agreement with both the World Health Organization’s International Agency for Research on Cancer (IARC), which labeled TCDD a human carcinogen in 1997, and the U.S. National Toxicology Program, said Richard Clapp of Boston University’s School of Public Health, also on the SAB panel. The U.S. Agency for Toxic Substances and Disease Registry also considers TCDD a known carcinogen.

EPA began its review of dioxin and related compounds in 1991, following an industry-led outcry that the agency’s dioxin risk assessments were too conservative. The reassessment includes a summary of the science, exposure routes, and possible human and animal health risks related to exposures.

In March, the SAB wrote that although there is “compelling evidence of carcinogenicity in laboratory animals for TCDD,” the same is not true for humans.

The reason? “There is a lack of consensus” in the panel over whether TCDD meets current EPA cancer guidelines for a human cancer hazard. In addition, there is just not enough epidemiological data indicating that dioxin is carcinogenic in humans, nor are there adequate scientific data demonstrating similar modes of action in humans and laboratory animals, according to the SAB draft.

But several panel members strongly support EPA’s conclusion that TCDD is carcinogenic, saying there was a “broad consensus” on....

Perfluorinated compounds linked to carcinogenicity in vitro

Michigan State University (MSU) researchers have found that perfluorooctane sulfonate (PFOS) and several other perfluorinated compounds act on cells in a way that has been linked to the carcinogenicity of several environmental contaminants.

In a series of in vitro experiments using cell lines from dolphins and rats, Wenyou Hu and colleagues found that a group of perfluorinated compounds inhibit gap junction intercellular communication. Gap junctions are protein channels that pass chemicals between cells to coordinate normal growth and function. Inhibiting this function can promote tumor development. Hu is expected to report the findings at this month’s Society of Environmental Toxicology and Chemistry European meeting in Madrid, Spain.

In March, MSU researchers showed that PFOS is distributed globally and can bioaccumulate (Environ. Sci. Technol. 2001, 35 (7), 1339–1342). They found low levels in many marine mammals. Hu and colleagues used both rat and dolphin cell lines because even closely related animals can have dramatically different responses to contaminants, according to MSU zoologist Paul Jones.

In perfluorinated chemicals, all of the carbon–hydrogen bonds are replaced by carbon–fluorine bonds (Environ. Sci. Technol. 2001, 35 (7) 154A–160A). Hu finds that the inhibitory effect on intercellular communication is determined by the length of the fluorinated carbon chain, not the functional group. This result is consistent with a 1998 study of other perfluorinated compounds (Int. J. Cancer 1998, 78 (4), 491–495).

The MSU scientists, in collaboration with the U.S. EPA are now performing in vivo studies to verify the in vitro studies.

—REBECCA RENNER
TCDD among the panel members expressed during its last meeting in November 2000. The report from that meeting does not reflect that consensus, Clapp says.

“If [EPA] were to release it today, we would be agreeing to disagree,” says Dennis Paustenbach, SAB member and vice president of Exponent, Inc. “But if they incorporated our changes, we would just say there is inadequate science to refine it any further.”

“This is largely more about politics than it is about science,” asserts Kip Howlett, executive director of the Chlorine Chemistry Council. Howlett and those who disagree with EPA’s characterization of TCDD say that IARC acknowledged that the epidemiological data were insufficient to support a human carcinogen classification, but went ahead and issued that determination anyway.

“What [the IARC] did is not unlike what the EPA staff did in this reassessment document, and that is to rely on mode of action data to characterize the risk of cancer from dioxin exposure,” Howlett says. Both IARC and EPA based their classification on toxicological data, a decision Howlett called “too conservative.”

At the same time, total dioxin releases to the environment have dropped by 80% from 1987 to 1995, largely because of EPA regulations, says David Cleverly, in EPA’s Office of Research and Development. Seventy-five percent of those emissions were curtailed from municipal, medical and cement kiln incinerators, and secondary smelter metal operations. Some of the identified unregulated sources are backyard burners, residential fireplaces, and agricultural and forest fires.

The SAB’s Executive Committee, which comprises the chairs of each subcommittee, was scheduled to meet late May to review the document, which it was expected to approve. “It’s not unknown for the Executive Committee to suggest improvements to [a] report, although it is rare,” says EPA’s Sam Rondberg, who is overseeing revisions to the SAB document. “I don’t think that is going to happen with dioxin,” he adds. And although EPA is not legally bound to incorporate SAB’s critique into its reassessment, it might be hard pressed to ignore it, Rondberg notes. “The outside world generally pays a lot of attention to what we say.” For a copy of SAB’s “Draft Report, Review of Revised Sections of ORD’s Reassessment of Dioxin, March 12, 2001”, go to www.epa.gov/sab/drrep.htm.

—CATHERINE M. COONEY

**Global action on POPs**

A treaty that could ultimately eliminate or at least minimize the use of persistent organic pollutants (POPs) around the world will be formally adopted this month in Stockholm, Sweden. When at least 50 governments have ratified it, a process that could take several years, the treaty will enter into force.

The treaty was finalized in Johannesburg, South Africa, last December by representatives from 122 countries at a negotiating session organized by the United Nations Environment Programme.

Initially, measures will apply to a list of 12 chemicals. Production of most will be banned immediately; however, an exemption is included for DDT in some countries. Continued use of PCBs in existing equipment such as electrical transformers will be allowed until 2025, provided the equipment is free of leaks.

**Canada’s ozone plan**

Environmentalists charge that Canada is unlikely to meet the commitments of the Canada–U.S. Ozone Annex announce on February 19, because of the lack of a coherent plan and opposition from the province of Ontario.

Signed in December 2000, the Annex commits both countries to reduce smog-forming nitrogen oxides (NOx) and volatile organic compounds by 43% by 2010 during the summer ozone season in Ontario, Quebec, Atlantic Canada, and 18 U.S. states (Environ. Sci. Technol. 2000,34 (21), 453A). To meet this goal, Canada’s $77 million plan would match U.S. emission stan-

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tion as part of the ongoing National Health and Nutrition Examination Survey. Of the 27 chemicals and metals they measured, only three—lead, cadmium, and cotinine (a nicotine metabolite)—had been measured before. The others, including metabolites of mercury, phthalates, and organophosphates, offer a new look at the nation’s exposure to contaminants.

The sample is designed to represent the entire population, but the small overall size of the sample, 3800 people, limits the accuracy with which it reflects the entire population, according to report coauthor Jim Pirkle of CDC’s Environmental Laboratory in Atlanta, GA. In addition, analyses of most contaminants were conducted on smaller subsamples, from more than 3000 for lead and cadmium, down to 700 for some other substances. For 1999, the CDC convoy traveled to 12 locations. The year 2000 study sampled about 5000 people from 15 locations and added 24 new chemicals, including arsenic.

Compared with previously measured cotinine and lead levels, the results offer good news. Lower blood cotinine levels show that nonsmoker’s exposure to cigarette smoke has plummeted to one-fourth of 1991 exposures. Blood lead levels in children also continue to decrease.

The report’s first look at mercury exposure across the nation revealed that levels in children were lower than expected and well below federal limits. But for women of childbearing age, mercury levels were higher, although not above current limits.

“The report should provide researchers with a wealth of information for better understanding the distribution and correlates of exposure in the population,” says Lynn Goldman, professor of environmental health at Johns Hopkins University, in Baltimore, MD. But because CDC is not making the raw data available, “This year’s data is just a taste of what is to come,” she says.

As a result, CDC will wait and combine three years’ worth of data before releasing it to the public. This means that the data from 1999 to 2001 will not be available until the fall of 2002.

Christopher Portier, head of the National Institutes of Environmental Health Sciences, is one of the researchers keen to see the raw data. Portier wants to establish a multiagency data interpretation group. He is also currently trying to interpret phthalate exposures based on a much smaller study published last year (Environ. Sci. Technol. 2000, 34 (21), 451A).

That study, which was based on 289 analyses of phthalate metabolites, found that personal care products like soap, shampoo, hair spray, and nail polish expose people to higher levels of phthalates than previously estimated. Portier says that publishing the summary report first is a good strategy. “It feeds the debate about how to analyze and interpret the data. Everybody who is interested has a chance to get involved, and that makes for a better result in the end,” he says.

Although he’s itching to see the raw data, Portier says that publishing the summary report first is a good strategy. “It feeds the debate about how to analyze and interpret the data. Everybody who is interested has a chance to get involved, and that makes for a better result in the end,” he says. —REBECCA RENNER

Joint Global Change Research Institute

College Park, MD, will soon become the home of a new institute that will bring together some of the world’s leading researchers to explore the scientific, social, and economic aspects of global climate change. Taking advantage of what researchers say are synergies and similar research interests, the University of Maryland and Pacific Northwest National Laboratory (PNNL) will team up to create the Joint Global Change Research Institute.

In late summer, some 25 PNNL climate change researchers with expertise in energy conservation and the interactions between climate, energy, economics, and the environment, will relocate from Washington, DC, to nearby College Park, where they will join some of Maryland’s top faculty and research scientists in economics, public policy, earth and environmental sciences, engineering, and social sciences.

“This promises to be a major science collaboration to explore climate change and its impact on energy, the environment, and society,” says Gerald M. Stokes, a former PNNL associate laboratory director, who will head the new institute. William Destler, vice president for research and dean of the University of Maryland’s graduate school, views the new institute as an opportunity to attract scholars from around the world as visiting faculty. “The two institutions are already bonding faculty, students, and lab researchers through research projects and student research advisory committees, and we expect our collaborations to grow quickly,” he says. —BRITT E. ERICKSON
NRC committee evaluating sewage sludge health risks

In the wake of recent U.S. government reports linking pathogens in sewage sludge to gastrointestinal illness, a National Research Council (NRC) committee will take a fresh look at a 1993 U.S. EPA regulation in a study of the health effects of using treated sewage for fertilizer when they convene June 4–5 in Irvine, CA.

Sewage sludge, a byproduct of wastewater treatment, consists primarily of human excreta with additional inputs from industrial discharges. Although an excellent fertilizer, sludge is often contaminated with metals, such as arsenic, cadmium, copper, and zinc; organic compounds, such as nonylphenols, brominated fire retardants, dioxins and PCBs; and pathogens, or disease-carrying microbes. This is why the use of sludge is regulated in many countries (Environ. Sci. Technol. 2000, 34 (19), 430A–435A).

At the request of EPA, the 16-member committee will assess the adequacy of the science and methodology behind EPAs 1993 regulations for the management of sewage sludge, known as the Part 503 rule. In 1996, a different NRC committee, which did not consider pathogens, concluded that in other respects, the rule did protect crops, consumers, and the environment (http://books.nap.edu/catalog/5175.html).

Last July, the National Institute for Occupational Safety and Health (NIOSH) reported that workers exposed to Class B sludge could be exposed to organisms associated with gastrointestinal symptoms and illness. And last year, microbiologist David Lewis, on leave from EPA, proposed that Class B sludge could produce concentrations of gaseous organic amines high enough to irritate and damage the respiratory system, making workers and local communities more vulnerable to sludge pathogens. Class B sludge has detectable pathogen levels and is intended for use on agricultural lands where little exposure to humans is expected. Citizen groups allege that exposure to Class B sludge is linked to the death of individuals in New Hampshire and Pennsylvania.

“The committee wants to take a fresh look at all available data,” says Chair Thomas Burke, an epidemiologist at Johns Hopkins University in Baltimore, MD, who notes a number of significant advances since the rule’s inception. Principle among these are refined approaches to risk management; new contaminants of concern, in particular, organic compounds; and pathogens in sludge, says Burke, a former director of science and research for the New Jersey Department of Environmental Protection.

Some researchers cast doubt on the regulations, questioning the scientific basis of EPA’s sludge standards and the data used to establish them, noting data gaps, nonprotective policy choices, and more stringent standards set by other countries. The agency stands behind its 1993 sludge rule, but wants to review the science, which is more than 10 years old, according to Alan Hais, associate director of EPA’s Health and Ecological criteria division in Washington, DC.

EPA’s risk assessment used point estimates and a range of different exposure scenarios to determine risk. The committee is likely to recommend that EPA use current methods to perform a probabilistic risk assessment to account for natural variability, according to Burke.

The probabilistic approach also provides a mechanism for considering the cumulative effects of sludge. “Sludges are complex mixtures with many contaminants that can have cumulative impacts, which we want to consider,” he says.

With its main focus on human health, the committee will be “cast- ing a very broad net to understand occupational risks and any human epidemiological information,” says Burke.—REBECCA RENNER

Government Watch

EU chemical policy

Roughly 100,000 chemicals in commercial use would receive tougher scrutiny under a regulatory framework proposed by the European Commission (EC) in February. The proposal puts the responsibility on industry to prove that products are safe for their intended uses.

Under the current regulatory scheme, only so-called new chemicals—those marketed after September 1981—are required to undergo tests and risk assessments. Consequently, for most of the “existing” chemicals, representing 99% of the total substance volume on the market, general knowledge regarding their properties and uses is lacking.

Like the high-production volume chemical testing program under way in the United States (Environ. Sci. Technol. 1999, 4 (1), 15A), the new EC strategy would require registration of basic information for all new and existing chemicals produced in volumes exceeding one metric ton. Substances suspected of being persistent and bioaccumulative would be subjected to a more stringent evaluation focusing on the effects of long-term exposures.

The proposal now goes to the European Parliament and Council.

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Chickens, manure, and arsenic

Chicken farmers on the Delaware–Maryland–Virginia peninsula along the eastern shore of the United States are introducing 20–50 metric tons of arsenic into the environment annually, and researchers are not sure where it is ending up. At some point, however, this arsenic could become mobilized and contaminate surface and groundwater.

The poultry industry in the region—second in size only to the state of Arkansas’ chicken operations—raises some 600 million chickens annually, according to the U.S. Department of Agriculture. In the process, these chickens are fed organic arsenic compounds like roxarsone to control infections and increase weight gain. Keeping with U.S. Food and Drug Administration limits, little of the roxarsone is retained in the meat. Most of it ends up unchanged in the roughly 1.5 million metric tons of manure excreted annually by the chickens.

Transporting this litter for disposal elsewhere costs money, so farmers tend to stockpile the litter in long rows on fields called windrows or apply it directly to corn and soybean fields as fertilizer. Of course, the arsenic contained in the manure gets applied to crops too and could be contaminating surface and groundwater.

In an attempt to determine the distribution, occurrence, transport, and fate of arsenic from the poultry-feeding operations in this region, U.S. Geological Survey (USGS) researchers have been analyzing arsenic concentrations in soils from agricultural fields where poultry waste has been applied, soils from more pristine environments such as nearby forests, bed sediments from the Pocomoke River, water from the river itself, surface water from ditches throughout the river’s basin, and groundwater throughout the basin.

Dissolved arsenic concentrations in the Pocomoke were not much higher than 1 µg/L during base flow; but during storm events, levels increased to around 4 µg/L, says Tracy Connell Hancock, a USGS hydrologist. Arsenic concentrations in ditch water samples also rose during storm events from a base flow level of 0.5 µg/L to as high as 10 µg/L, indicating a surface source such as manure particles mobilized by storm runoff.

Hancock and colleagues also looked at levels of arsenic in pore water from cored sediments and shallow groundwater wells that was collected beside an agricultural field using piezometers. Here, arsenic concentrations were highest at the surface, fluctuating with depth, also indicating a surface source and possibly some near-surface concentration by evapotranspiration, Hancock says.

Although the arsenic levels observed at each of the monitoring points were higher than background, “the levels we’re seeing aren’t incredibly high,” Hancock says. Additionally, the USGS investigators found mostly inorganic arsenic forms, As(V) and As(III), rather than roxarsone.
In fact, the only place they have found roxarsone is directly in the poultry litter. Fresh litter samples contained 30–50 µg/kg of arsenic, says John Garbarino, a USGS research chemist. Of that, at least 70% is easily mobilized with water, suggesting that roxarsone can readily be introduced to the environment by either agricultural field irrigation or rainfall on uncovered windrows.

In degradation experiments, the USGS scientists leached the poultry litter with water at room temperature, steadily monitoring the amount of roxarsone collected in the leachate. “After 24–48 hours, all of the roxarsone is gone, and it seems to change into a compound we haven’t identified yet,” Garbarino says. The rate of transformation seems to be bacteria-related because when the litter extract was sterilized, the roxarsone remained stable for at least 10 days.

Indirect evidence indicates that roxarsone undergoes more extensive degradation after it is introduced into soil. Arsenic speciation of soil extracts show that amended soils have 5–10 times more water-extractable arsenic than the nonamended controls and that As(V) is the predominant species. In contrast, As(III) was the predominant species in the extract of bed sediments from a ditch adjacent to the agricultural field, making it likely that in anoxic environments, bacteria are promoting the reduction of arsenate to arsenite.

However, a one-time water extraction of the amended soils only mobilized about 20% of the total arsenic applied to the field, according to Garbarino, meaning that the arsenic is not leaching from the soils quickly in one storm event.

But so far, “even though a lot of arsenic is being added to the environment, we can’t account for it all,” Garbarino says. “Because we can leach roxarsone from the litter so easily, we know it’s getting mobilized on fields.” But how does it get from being roxarsone to As(V) in the soils and As(III) in the sediments?, he asks. “Those are all the steps we’re missing.”

“We know that the water-extractable arsenic correlates directly with the amount of litter applied to a field and that the litter is the source of most of the water-extractable arsenic,” Garbarino says. “The good news is that so far it seems that even though we’re applying lots of arsenic, it seems to be leaching from the soils at a gradual rate and not being released in a big slug that would cause big problems.”

But the arsenic is still being stored in the soils, associated with either organic matter, metal oxides, or hydroxides. Arsenic extracted with water from poultry litter-amended soil was found to be associated with the organic matter and was primarily in the As(V) form. The greatest percentage of the total arsenic in this soil was sorbed to the metal oxides and hydroxides and could not be mobilized by water alone. Soil in corn or soybean fields is generally dry and oxic, thus promoting an environment where As(V) is favored. However, during unusually wet periods, soil conditions could become anoxic and promote microbial reduction of As(V) to As(III), a much more mobile form of arsenic. Consequently, at some point, either form of arsenic might be mobilized to contaminate surface or groundwater, Garbarino says.

Plus, the litter stored in uncovered windrows could be a point source. “Conceivably, if there’s a rain event onto a pile of this, it could mobilize a lot of arsenic quickly,” Garbarino says. “If we get 70% in the lab, you’d think it would be similar in the field.”

Hancock and her team will be monitoring storm events in ditches, river tributaries, and the Pocomoke River, looking at the level of both particle-bound and dissolved arsenic. “Arsenic often behaves like phosphorus—it’s sticky and adheres to particles, so it’s possible that it could be getting transported downstream during storm events while stuck on marine particles or sediment particles,” she says. —Kris Christen

**Government Watch**

for further consideration. The Swedish government, which holds the European Union presidency until the end of June, has made the proposal’s passage a top priority.

**NJ goes national**

A New Jersey program that provides regulatory relief in exchange for decreased emissions from industrial facilities will eventually be applied on a nationwide basis, according to Catherine Tunis, senior analyst with the U.S. EPA’s Office of Policy Economics and Innovation.

Launched in 1995, New Jersey’s Chemical Industry Project comprised four pilot projects that helped the batch chemical industry comply with regulations and set up an effluent trading system. In addition, the projects allowed extended storage of hazardous wastes to facilitate recycling and rewarded facilities that went beyond compliance with relaxed environmental requirements. The state has just released a report on the five-year program.

In the summer, EPA will fold New Jersey’s program into the national Project XL, which will allow facilities in the state to bend federal regulations in exchange for superior environmental performance (Environ. Sci. Technol. 1999, 33(1), 15A). The New Jersey Project XL agreement will ask participating companies to cut pollutant emissions 5% every 5 years over a 15-year period for the privilege of gaining an exemption to the definition of hazardous waste to boost recycling.

EPA is modifying New Jersey’s Project XL to develop a new federal program called National Performance Track, says Tunis. Still, these programs do not provide enough flexibility to attract new participants, some company officials say.

The New Jersey report Learning to Listen: A Cooperative Approach to Developing Innovative Strategies is available on the Web at www.epa.gov/emergingstrategies/
Roughly 10% of women have mercury levels within one-tenth of what is considered hazardous, according to the U.S. Centers for Disease Control and Prevention (CDC). This is the first national measures of mercury exposure in human tissue. Although mercury levels in the United States generally fall below hazardous levels, the finding prompted the CDC to recommend further regulatory efforts to limit the toxin in air emissions from waste incinerators, chlorine production facilities, and electric power utilities. To see the report, which was published in CDC’s March 2nd Morbidity and Mortality Weekly Report, go to www.cdc.gov/mmwr/preview/mmwrhtml/mm5008a2.html.

Finland is the world's most sustainable country, according to a study of 122 countries conducted by Columbia University, Yale University, and a task force from the World Environment Forum. Using the Environmental Sustainability Index, which identifies 22 indicators of sustainability, including air quality, public health, and environmental regulations, they found Finland does the best job of protecting the health of its citizens. Norway and Canada were ranked 2nd and 3rd, the United States 11th, and Germany was a surprising 15th. To see the entire list, go to www.ciesin.org/indicators/ESI.

“Despite superior fuel economy and low emissions, hybrid-electric vehicles cost too much at present to make economic sense,” concludes a cost-analysis report by Lester Lave of Carnegie Mellon University and Heather MacLean of the University of Toronto. When comparing the Prius, Toyota's hybrid-electric car, with the similarly sized Toyota Corolla, gasoline prices would have to be more than $3.50 a gallon and the social value of pollution abatement efforts would have to increase 10-fold before the Prius’s $3500 premium is justified. Are Hybrid Vehicles Worth It? is available at www.spectrum.ieee.org.

Ray Anderson, industrial engineer, chief executive officer, and chairman at Interface, Inc., is the winner of the 2001 George and Cynthia Mitchell International Prize for Sustainable Development, which is administered by the U.S. National Academy of Sciences. “Ray Anderson is a pioneer in using innovative approaches to change past practices and to eliminate waste,” says George Mitchell. In the past six years, Interface, a world leader in carpet manufacture, has undertaken more than 400 sustainability initiatives, including the design of new carpets and fabrics that are 100% recyclable and the development of the first “climate-neutral” floor-covering product.

Although the purpose of the Partnership for a New Generation of Vehicles (PNGV) program is to produce cleaner cars, it is targeted for elimination in the 2001 Green Scissors report found at www.greenscissors.org/publications/GreenScissors2001. Compiled annually, the reports target “programs whose elimination could protect the environment and save taxpayers $55 billion.” This year’s report calls for cutting the PNGV’s $1.2 billion budget because it fails to require automakers to market highly efficient vehicle and relies on diesel-based designs.

Asthma and lead poisoning are continuing threats to children in the United States, according to the U.S. EPA’s first report on indicators of children’s environmental health. Although the percentage of children exposed to dirty air dropped from 28% to 24% from 1990 to 1998, asthma increased by 78%. Lead contamination was more common for African-American and poor children. America’s Children and the Environment: A First View of Available Measures can be found at www.epa.gov/children/indicators.

Marine reserves are crucial to reverse the collapse of global fisheries and declining ocean health, according to a consensus statement released by an international team of 160 top marine scientists. After two years of studying existing reserves, the group finds that these protected areas help increase underwater abundance. Currently, less than 1% of the world’s oceans are protected in reserves, but networks of reserves need to span large geographic distances and encompass the diversity of marine habitats. Download the National Center for Ecological Analysis and Synthesis’s statement at www.nceas.ucsb.edu.

Stronger evidence than ever indicates rising temperatures worldwide, according to the Inter-governmental Panel on Climate Change. New analyses of tree rings, corals, ice cores, and historical records suggest that the temperature increase seen during the 20th century was the largest of the past 10 years; the 1990s was the warmest decade; and 1998 was the warmest year. Climate Change 2001: The Scientific Basis projects further global warming of 1.4–5.8 °C over the coming century. The report can be downloaded from www.ipcc.ch.

Although the U.S. EPA is making progress toward implementing a national air-quality research program to examine the health effects of exposure to airborne particulate matter, data analysis efforts are limited, according to a National Research Council report. The third report to examine the EPAs research on airborne particles recommends finding better ways to handle the vast data expected to emerge from nationwide air monitoring. Research Priorities for Airborne Particulate Matter: III. Early Research Progress is available at http://books.nap.edu/catalog/10065.html.