



The unleashed power of the atom has changed everything save our modes of thinking, and we thus drift toward unparalleled catastrophes.

Albert Einstein, physicist
(1879–1955)

INDOOR AIR QUALITY

OPs Cause Bad Trips?

Do leaks of hydraulic fluids and jet engine lubricating oils cause potentially toxic fumes to be released into the cabins of commercial airliners? If so, do those fumes cause acute and chronic health problems such as headache, nausea, fatigue, memory loss, and neuromuscular damage in airline crew members and passengers? Those simple questions are at the heart of a brewing controversy.

Advocacy groups and trade unions representing pilots and flight attendants have collected hundreds of anecdotal reports from over the past 20 years that they claim show a long-term pattern of incidents involving smoke or foul-smelling fumes being released into airliner cabins, resulting in acute and chronic symptoms among the people exposed. The scenario that they and some scientists who have examined the issue have set forth is that these fumes may contain organophosphates or carbon monoxide.

Organophosphates are present in some hydraulic fluids and engine oils. It is suspected that in many cases the fumes are caused by leaks of hydraulic fluid or jet engine oil from faulty lines or seals into super-heated engine parts. There, the fluids are vaporized into gases and pass into the passenger cabin air supply. Carbon monoxide is produced when oils are chemically altered through heating.

Many people who have gotten sick in these incidents report neurotoxic symptoms that appear to be consistent with organophosphate or carbon monoxide exposure. Several crew members claim to have become temporarily or permanently disabled as a direct result of their exposure to toxic fumes. In one noteworthy case, 26 flight attendants employed by Alaska Airlines sued that carrier, claiming that noxious fumes in aircraft cabins had made them sick. In settling the case in January 2001, the flight attendants signed a statement acknowledging that the company had not intentionally caused them harm. But related litigation continues against Boeing, the manufacturer of the airplanes in the Alaska Airlines case, and Honeywell, the maker of an engine component suspected to be central to the problem.

Christiaan van Netten, head of the Division of Occupational and Environmental Health at Canada's University of British Columbia, who is analyzing leakage incidence data, says leakage occurs in about 1 out of 1,000 flights and is usually traceable to equipment failure. He adds that incidence depends largely on the type of aircraft and the maintenance habits of the airline.

Experts largely agree there is a lack of well-collected, objective exposure and health effects data. Most of the existing data are anecdotal, with only a few laboratory analyses done on oil and fluid constituents and some medical reports from flight attendants and crew members. But the evidence compiled to

date has been sufficient to generate several official inquiries into the issue of airliner cabin air quality.

The most comprehensive study so far, *Air Safety and Cabin Air Quality in the BAe 146 Aircraft*, was completed in October 2000 by an Australian Senate committee. The BAe 146, manufactured by British Aerospace, has been the subject of many toxic fume complaints in Australia and elsewhere. Notably, the committee concluded that "it appears . . . that contamination of cabin aircraft air on the BAe 146 aircraft has led to short-term and medium-term health problems for a number of BAe 146 flight crew," including vomiting, difficulty breathing, disorientation, and chemical sensitivities.

The Senate report recommends several actions, from improved maintenance of the aircraft and more stringent monitoring of air quality to further study of the issue in general and a review of the jet oil used in the BAe 146. That oil, Mobil Jet Oil II, contains the organophosphate tricresyl phosphate (TCP), which several witnesses in the Australian Senate hearing felt was the compound causing health problems among exposed crew members and passengers. Mobil officials testified, however, that "there is no record of a jet oil formulated with modern conventional TCP causing human toxicity."

The Science and Technology Committee of the British House of Lords responded less sympathetically to similar evidence of TCP-related adverse health effects in aircraft cabins. In its November 2000 *Fifth Report*, the House of Lords committee concluded that "the absence of confirmed cases of TOCP [a highly toxic isomer of TCP] poisoning from cabin air and the very low levels of TOCP that would be found in even the highly unlikely worst case of contamination from oil leaking into the air supply lead us to conclude that the concerns about significant risk to the health of airline passengers and crews are not substantiated."

Now the U.S. Federal Aviation Administration is sponsoring a congressionally mandated review that is being conducted by a National Academy of Sciences committee. The review is assessing air quality conditions, associated health effects, and factors contributing to potentially toxic exposures in passenger cabins of commercial aircraft, with particular attention to be paid to the toxicologic effects of contaminants of concern, including those in engine oils and hydraulic fluids. The committee plans to release a final report in the autumn of 2001. —Ernie Hood



Chemicals in the cockpit? Anecdotal evidence of adverse health effects due to in-flight exposure to organophosphates and carbon monoxide has some airline personnel fuming.

APPhoto/DK

GLOBAL WARMING

Hot New Report on Climate Change

At a January 2001 meeting in Shanghai, China, the United States and other members of the Intergovernmental Panel on Climate Change (IPCC) agreed that human activities are the likely cause of most of the global warming that has occurred in the last 50 years. They also predicted a 1.4–5.8°C (2.5–10.4°F) increase in global average surface temperatures between 1990 and 2100. The specific use of “likely” reflects the panel’s judgment that its conclusion has a 66–90% chance of accuracy. That finding is considerably more forceful than a similar assessment completed in 1995 in which the IPCC reported that evidence suggested a “discernible human influence” on global climate.

The IPCC works to assess human impacts on the global climate, the potential effects of climate change, and options for mitigating those effects through the efforts of three separate working groups, which primarily review existing literature and data. Collectively, the working groups have produced two assessment reports, the most recent in 1995. The report of Working Group I will be combined with findings from the other two groups into a report to be presented in September 2001.

In Shanghai, IPCC members unanimously approved a summary for policy makers that highlights key findings of Working Group I, a panel of hundreds of scientists charged with assessing the scientific basis for human-induced climate change. The summary of the Working Group I report cites a 0.6°C ($\pm 0.2^\circ\text{C}$) increase in the global average surface temperature over the twentieth century, which is approximately 0.15°C higher than was estimated in 1995. Because of improved ability to reconstruct historical meteorologic data and through factoring in the relatively high temperatures of 1995–2000, Working Group I was able to assert that it is likely that the 1990s was the warmest decade and 1998 the warmest year in the last 1,000 years in the Northern Hemisphere. The summary also cites a “very likely” (90–99% probability) decrease in lake and river ice in parts of the Northern Hemisphere and widespread retreat of mountain glaciers in nonpolar regions during the twentieth century. Additionally, a 0.1–0.2 meter increase in the global average sea level is also likely to have occurred during that time.

The extent of warming since the 1950s was unprecedented and unlikely to be entirely natural in origin, according to the summary. Moreover, the summary predicts that warming will very likely persist into the twenty-first century, producing higher maximum and minimum temperatures, fewer cold days, and fewer frost days over nearly all land areas, along with an increased risk of drought over most mid-latitude continental interiors.

Such projections are based on computer models that have improved since 1995, according to David Griggs, a meteorology and climate scientist who heads Working Group I’s Technical Support Unit. And, although every step of the modeling process has uncertainties, he says, those uncertainties are factored in to the level of confidence with which assertions are made and are reflected in the ranges of possible effects.

John Christy, a professor of atmospheric science at the University of Alabama in Huntsville and a lead author of the Working Group I report, believes the uncertainties limit the report’s usefulness for policy makers. Computer models suggest that if humans are inducing climate change, tropospheric temperatures would warm along with surface temperatures, says Christy. Yet satellite data indicate that tropospheric temperatures have warmed much more slowly than surface temperatures in the last 22 years. Although Christy says the inconsistency does not refute a conclusion that humans are inducing warming, he believes it indicates that the report may not make a fully reliable basis for policy making.

Others believe the report will be a useful tool. Bill Hare, climate policy director for Greenpeace International, thinks the report will put pressure on countries such as the United States to achieve previously agreed upon emissions limits. (The Bush administration nevertheless still strongly opposes the Kyoto Protocol. In a 28 March 2001 news briefing, press secretary Ari Fleischer said, “The president has been unequivocal—he does not support the Kyoto treaty. It exempts the developing nations around the world, and it is not in the United States’ economic best interest.”) But Hare also believes the summary understates the risks associated with human impacts on climate. “[IPCC members] focused on writing down everything that could be agreed upon among everyone, and hence the summary is a lowest-common-denominator statement,” he says. Consequently, the summary “hasn’t presented the worst-case [scenario], or even what risks are likely to happen.” —Karen Breslin

The Scent of Cancer

Mothballs may be as bad for you as they are good for your sweaters. On 25 January 2001, the National Toxicology Program published its 500th two-year rodent chemical safety test on naphthalene, the chemical that gives mothballs their smell. The study found clear evidence that naphthalene caused cancer in male and female rats who were exposed by inhalation, the main route of exposure for humans. Regulators will use this information to determine if the chemical presents a risk to humans.



Naphthalene is also used in chemical manufacturing and by veterinarians for controlling lice and disinfecting wounds. The chemical can enter the human food chain when it is used on livestock. Naphthalene was nominated for study after German workers exposed to it were diagnosed with laryngeal, gastric, nasal, and colon cancers.

Green U

Student residence halls on U.S. college and university campuses are going green, and we don’t mean the paint on the walls—at least, not yet. Eco-friendly dorms are a growing trend. Northland College’s Environmental Living and Learning Center in Ashland, Wisconsin, features wind towers and solar panels for energy generation, waterless compost toilets, furniture made of recycled milk jugs and newsprint, and floor coverings of organic-based linoleum. The dorm, which opened in 1998, also has digital meters that students use for monitoring their electricity usage and two greenhouses where they can grow plants.

Last fall, Furman University in Greenville, South Carolina, opened its Eco Cottage, where students use only recycled paper products, limit water and energy use, and monitor the environmental effects of the food and toiletries they use. Currently 28 colleges and universities are members of the U.S. Green Building Council.

African Rainfall Up in Smoke

Scientists led by Daniel Rosenfeld, a professor of meteorology at Hebrew University of Jerusalem, have determined that smoke pollution from agricultural and cooking fires in the tropics of Africa may be contributing to current drought conditions there. Using data gathered by the Tropical Rainfall Measuring Mission satellite, which maps storms in the area using radar and microwave instruments, the researchers found that clouds formed in dirty, particle-filled air produce as little as half the rainfall as same-size clouds formed in clean air. Rosenfeld said in a presentation at the December 2000 meeting of the American Geophysical Union that pollution particles in clouds distribute the water into droplets that are so small that they are very slow to combine into raindrops.



NATURAL RESOURCES

The Future of Fresh Water

By 2025 at least 3.5 billion—about half the world's population—will live in areas without enough water for agriculture, industry, and human needs, according to a report released 21 October 2000 by the World Resources Institute (WRI). *Pilot Analysis of Global Ecosystems (PAGE): Freshwater Systems* is one of a five-part series being prepared by the WRI to provide a comprehensive assessment of the state of the world's ecosystems. According to the report's authors, worldwide water quality conditions appear to have degraded in almost all regions with intensive agriculture and in large urban and industrial areas.

In developing countries over 90% of raw sewage is discharged directly into rivers and lakes without treatment. As a result, each year about 5 million people die from waterborne diseases such as cholera, and millions more are sickened, according to the report. In some respects, surface water quality in Europe and the United States has improved over the last two decades with advances such as better sewage treatment and reduced use of phosphorus in detergents. But other problems such as nitrate pollution from fertilizer runoff are increasing in these regions and worldwide. In addition

to affecting human health, the degradation of the world's rivers, lakes, and groundwater has also caused an alarming decline in aquatic biodiversity. "People hear about the loss of species in the Amazon jungle, but the situation in the world's freshwater systems is much worse," says Carmen Revenga, one of the report's coauthors.

The primary goal of *PAGE: Freshwater Systems* is to show how sources of fresh water must be managed as systems, says Revenga.



Dirt thirst. A new report forecasts a serious lack of fresh water for half the world's population by 2025.

"Humans often divert water for a single purpose such as irrigation or power generation without looking at the ways those withdrawals affect the capacity of the system to continue to function and provide water and other goods and services in the future," she says. The authors believe the value of crucial freshwater services such as water purification and flood

control is often ignored because such services are not traded like, for instance, agricultural products. "This makes it harder to assess the trade-offs at stake when different uses of a freshwater resource are proposed," they write.

"In general, [*PAGE: Freshwater Systems*] is an important contribution, a good status report," says Sandra Postel, director of the Global Water Policy Project in Amherst, Massachusetts, which promotes the protection and sustainable use of water. However, in preparing the report the authors often faced the problem of information that was incomplete or incompatible for extrapolation from one region to another. Says Revenga, "The amount of data on water is much scarcer in the 1990s than it was in the 1980s because many governments have reduced or stopped funding for water monitoring."

Highlighting such gaps in information is a major goal of the *PAGE* reports. The WRI states that the reports lay the groundwork for future efforts to collect more detailed and integrated information about world ecosystems.

Findings from the report have already been used by the World Commission on Dams. *PAGE: Freshwater Systems* is available on the WRI Web site at <http://www.wri.org/wri/wr2000/>. The WRI has also released *PAGE* reports on forests, grasslands, and agroecosystems, and has announced it will soon release a report on coastal ecosystems. —Kris Freeman

FOOD SAFETY

Australia Cuts Cadmium in Food

In many ways it makes sense to recycle sludge from sewage treatment plants into fertilizer; it's cheaper than dumping at sea, and it helps crops. But sewage sludge can pick up agricultural, roadway, and industrial contaminants via runoff—contaminants such as cadmium, which can cause major human health problems when it enters the food chain through plants grown in soil treated with the fertilizer. Cadmium bioaccumulates in the liver, kidneys, and bone, where it can cause effects such as renal dysfunction, kidney stones, weakened bones, and cancer. Because cadmium concentrations in Australian soils are growing, the government has taken the proactive step of launching the National Cadmium Minimisation Strategy for Agriculture.

Although cadmium occurs naturally in the environment, its accumulation in soils and plants has been exacerbated by human activities, chiefly the application of cadmium-contaminated phosphate fertilizers, certain animal manures, sewage effluents, sewage sludge, and composted biosolids. Cadmium, like other metals, binds strongly to soil particles and persists indefinitely in the environment.

Various guidelines throughout Australia govern cadmium concentrations in fertilizers, sewage sludge, water, and soil. The aim of the national strategy is to integrate the efforts of all sectors into a coordinated framework of best practices and guidelines. The strategy comprises four key elements designed to minimize the addition of cadmium to soils in areas with a potential or existing cadmium problem. The elements include good farming practices, proper fertilizer labeling, use of

low-cadmium fertilizers in high-risk areas, and tighter regulations for cadmium concentrations in soil. A committee representing the state governments, the commonwealth, farmers, the fertilizer industry, and academia is pursuing the development of these practices and principles to implement the strategy.

The strategy will be funded over the next five years by the fertilizer, cereal grains, and horticulture industries. "The strategy is an important move to ensure our food supply and agricultural exports continue to meet international environment and health standards," says Mike McLaughlin, a soil and environmental chemist with the Commonwealth Scientific and Industrial Research Organisation Land and Water, who serves as the strategy's national coordinator. "Australia promotes the sale of its agricultural commodities to its export markets on the image of 'clean and green,'" he says. "We need to make quite certain there is no increase in risk."

The Australia New Zealand Food Authority recently published revised maximum permissible concentrations for cadmium in a range of food commodities. Peter Abbott, principal toxicologist for the authority, says, "A guiding principle was that a maximum level would only be established where it serves an effective risk management function. Maximum levels have been set for those foods which provide, or may potentially provide, a significant contribution to the total dietary intake of cadmium." Such foods include chocolate, peanuts, mollusks, and certain organ meats. However, Abbott adds, food standards can only play a part in controlling cadmium exposure; improving primary commodity production practices must also be part of an overall cadmium minimization strategy. —Lisa Saffron



The Bellona Foundation

The private Bellona Foundation was formed in 1986, a few months after the nuclear accident at Chernobyl, by environmentalists Frederic Hauge and Rune Haaland, who saw the need for a new, more involved environmental action organization in Norway. Bellona's scope grew in the 1990s to include international

BELLONA

environmental protection, specifically in Russia. Today, Bellona strives to inform the public, policy makers, and the media about environmental haz-

ards, particularly those related to energy production and nuclear power, and helps draft policy responses to these problems. The Bellona Foundation Web site, located at <http://www.bellona.no/>, provides an extensive archive and up-to-date source of news stories regarding nuclear power, energy, and the environment.

Under the main menu on the home page, viewers can click on the All About Nuclear Russia link to read background information about nuclear-powered plants, icebreakers, and naval vessels in that country. Resources include news articles and fact sheets on current facilities and past accidents. Also located under the main menu is the Energy link. Clicking here takes readers to information about renewable energy sources and oil and gas production policies.

Other links on the home page lead to information about Russian activists working on nuclear problems. The Nikitin Case link goes to news archives covering the controversial story of Aleksandr Nikitin. Nikitin was accused and eventually acquitted of high treason and divulging of state secrets for his part in coauthoring the 1996 Bellona report *The Russian Northern Fleet*, which describes problems the fleet is facing with the storage of spent nuclear fuel and other radioactive waste generated by the operation of submarines and other vessels. The downloadable text of *The Russian Northern Fleet* is also available on the home page. The Pasko Case link takes visitors to information on Grigory Pasko, who was accused of high treason in relation to his investigation of nuclear safety issues in the Russian Pacific Fleet. [For more information on the Nikitin and Pasko cases, see "The Whistle-Blowers," p. A169.]

Visitors can click on Environmental Facts and Info under the main menu for fact sheets on radioactivity, the nuclear industry, biodiversity, and chemical compounds. The foundation's working papers are also available here for download, including titles such as *Comments on a Trading System for Greenhouse Gases*, *Securing Radioactive Waste in Murmansk and Archangelsk Counties*, and *Reprocessing Plants in Siberia*, a report on nuclear waste and pollution from nuclear reprocessing facilities in the Arctic region.

Back on the home page, the Recommended Sections link leads to archives of stories on other topics of interest, including the sinking of the *Kursk* in August 2000 and the Bellona report *Green Heat and Power: Eco-Effective Energy Solutions in the 21st Century*, an overview of alternative energy policies and strategies being used in Norway. —**Lindsey A. Greene**

Mexico's New Political Environment

Mexico's new president, Vicente Fox, has chosen Victor Lichtinger as the country's new environment and natural resources secretary. The Stanford University-educated Lichtinger, who represented Mexico at the 1992 United Nations Earth Summit, worked for four years as executive director of the North American Commission for Environmental Cooperation, which promotes effective enforcement of environmental laws by the United States, Canada, and Mexico.

Lichtinger said his agency will encourage economic growth through efficient use of natural resources. He also said he will work to ensure broad access to environmental information.

Mexican environmentalists are pleased with Lichtinger's appointment. Martha Delgado, leader of Unión de Grupos Ambientalistas, believes Lichtinger has a good grasp of the environmental problems Mexico faces and is willing to work with nongovernmental groups.



Over 45 Billion Served

Environmentalists in China are campaigning to significantly reduce the number of disposable wooden chopsticks used in the country from the current annual number of 45 billion pairs.

Chopsticks have been China's primary eating tool since at least 1500 B.C. Traditionally, chopsticks are carved from bamboo, cedar, sandalwood, teak, or pine. Over 25 million trees are used each year in chopstick manufacturing, a number that could result in the total loss of China's forests within a decade, environmentalists say. Since devastating floods in China in 1998, which were blamed on deforestation, support has risen for more careful use of forest resources.

Efforts toward phasing out disposable wooden chopsticks are paying off. Many people now carry stainless steel chopsticks that can be washed and reused after eating. In February 2001, more than 100 of Beijing's state-owned restaurants agreed to begin reusing chopsticks, while in Shanghai a tax on disposable wooden chopsticks took effect 1 October 2000. China's Ministry of Finance is said to be working on enacting similar legislation nationwide.



<http://ehis.niehs.nih.gov>