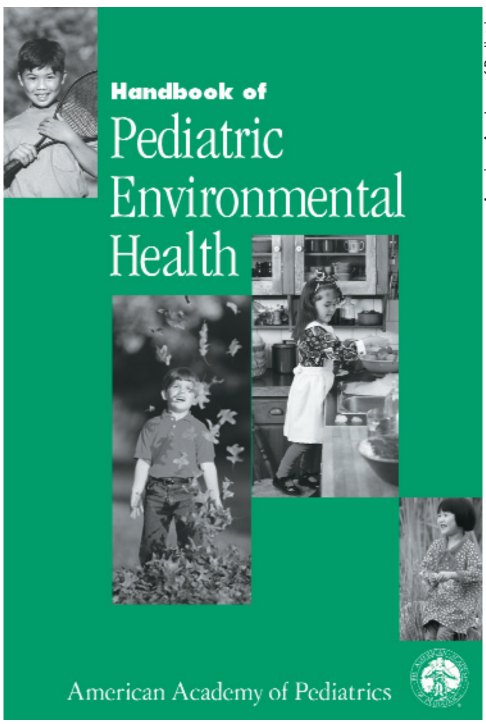
Since we have no choice but to be swept along by [this] vast technological surge, we might as well learn to surf.
Michael Soule
Conservation for the 21st Century, 1989

Environmental Handbook

In recent years, children's environmental health has become a dominant public policy issue and a focus of epidemiology and medical research. On 10 October 1999, the American Academy of Pediatrics released the *Handbook of Pediatric Environmental Health*, a 400-page desk reference written by pediatricians for pediatricians. The handbook pulls together clinically relevant information on children's environmental health and presents it to the practitioner in one easily accessible location. Says Ruth Etzel, a pediatrician and epidemiologist with the U.S. Public Health Service in Washington, DC, and the handbook's editor, "The handbook is the first of its kind. It's geared toward helping a doctor to assess a child with a health problem to determine whether the problem is linked to an environmental hazard." The book may also help pediatricians answer parent questions about how the environment may influence their children's health.



American Academy of Pediatrics

The specific topics covered in the handbook include prevention of exposure to nitrates and recognition of methemoglobinemia in children, diagnosis of acute pulmonary hemorrhage in infants associated with exposure to toxigenic molds, and more general topics such as lead and mercury poisoning and risks from exposure to ultraviolet light and outdoor air pollution.

The handbook, informally referred to as the Green Book, was written by the academy's Committee on Environmental Health (chaired by Etzel), which was created in 1957 to respond to pediatricians' concerns about fallout from weapons testing and fears of nuclear war. The book is arranged in four sections: background that instructs pediatricians on the subtleties of taking a comprehensive environmental history; a list of specific pollutants; information on the risks of specific materials, environments, and occupations; and discussion on complex issues such as multiple chemical sensitivity and environmental justice.

Sophie J. Balk, a pediatrician at the Montefiore Medical Center in the Bronx, New York, who assisted Etzel in editing the handbook, says that, although the book is geared mainly toward pediatricians, it also contains information that could be useful for parents and school nurses. "It's very practical and easy to use," she says. "Most of the chapters are followed by a section including frequently asked questions and answers."

The chapter on environmental tobacco smoke, for example, includes guidance on smoking cessation and a description of the health benefits that come with removing the exposure. According to Etzel, exposure to secondhand smoke is a major pediatric environmental health problem associated with increased risk of ear infections, sudden infant death syndrome, and asthma.

Many of the patients that Balk sees in her inner-city clinic have asthma, which is a growing problem among minority children in low-income urban environments. Balk says that the handbook provides useful information for clinicians who diagnose and treat asthma. For instance, there is information on environmental triggers of asthma as well as practical treatment and prevention measures such as how to get rid of the roaches, dust mites, and molds that can exacerbate the condition.

Balk emphasizes that pediatricians confronted with a child with a complex or potentially life-threatening situation such as acute poisoning should consult a pediatric specialist for immediate guidance on appropriate treatment. But for most situations, practitioners will be able to turn to the new handbook for referencing a wealth of pertinent information designed to facilitate diagnosis, treatment, and prevention, as well as improve education regarding environmental health problems in children. The AAP can be accessed through its Web site, located at **http://www.aap.org**.

Ulcer-Causing Bacterium Found in Well Water

Although the primary mode of transmission of *Helicobacter pylori*—the bacterium that causes 75% of stomach ulcers—is unknown, experts suspect some type of person-to-person route of infection, perhaps fecal–oral or oral–oral. Now, researchers in the Department of Environmental Engineering at Pennsylvania State University at Harrisburg are the first U.S. scientists to report preliminary data linking contaminated drinking water with *H. pylori* infection.

In 1983, two Australian physicians first isolated a spiral-shaped bacterium (later named *H. pylori*) from ulcer patients and proposed that it caused gastritis (stomach inflammation) and ulcers. However, few physicians accepted the idea because stress and acidic foods were believed to be the cause of ulcers. To convince the medical community, the Australian researchers swallowed *H. pylori* and demonstrated that their digestive tracts subsequently became inflamed. The bacterium is now accepted as the major cause of stomach ulcers. Moreover, *H. pylori* is associated with two cancers, gastric carcinoma and lymphoma of the mucosa-associated lymphoid tissue (MALT). In fact, the presence of *H. pylori* confers about a six-fold risk of gastric cancer, which is the second most common cancer worldwide, and biopsies show that 90% of MALT lymphomas are associated with the bacterium. More recently, Italian researchers reported in the 5 May 1998 issue of *Circulation* that *H. pylori* may contribute to heart disease by causing low-grade, lifelong infections and smoldering inflammation. In their study of 88 heart disease patients and 88 controls, *H. pylori* was found in 62% of people with heart disease and only 40% of those without the disease.

In 1998, the Penn State Harrisburg team, headed by microbiologist Katherine H. Baker, discovered that *H. pylori* contaminated surface water and shallow private wells in rural areas of Pennsylvania and Ohio. Of 42 surface water samples and 20 shallow private well samples collected, 40% and 65% of samples, respectively, tested positive for *H. pylori*. The findings demonstrate a major reservoir for the bacterium outside the human body and support the possibility of a waterborne transmission route of *H. pylori*.

A traditional indicator of microbial water quality involves testing for coliforms (microbes used as markers of fecal contamination) such as *Campylobacter* and *Salmonella*. Baker found that approximately 85% of the surface water samples contained coliforms. However, in four well water samples, *H. pylori* was detected in the absence of coliforms, suggesting that routine screening of water supplies for such bacteria may fail to protect consumers from exposure to *H. pylori*. These findings have been accepted for publication in the *Journal of Applied Microbiology*.

Baker and her team also analyzed water samples from the private wells of 10 people who were diagnosed with *H. pylori*-related illnesses or who had concerns about their drinking water source. Samples of tap water were collected and eight of the wells were found to be contaminated with *H. pylori*. The small sample size "is definitely a limitation of the study," says Baker, but the statistical agreement "is enough to raise a red flag." This first direct link between contaminated drinking water and stomach ulcers was presented 2 June 1999 at the American Society for Microbiology meeting held in Chicago, Illinois.

Baker suspects that *H. pylori* contamination of private well water could be caused by other household members infected with *H. pylori*; since the bacterium is believed to be transmitted through fecal–oral transmission, septic tanks could contribute to private well contamination. Although septic tanks should be located at least 100 feet from drinking water wells, siting regulations often are not enforced in rural areas. In one case, Baker found a well just 15 feet from a septic field.

Unfortunately for private well owners, testing for *H. pylori* is not a routine laboratory task. Baker uses an expensive and time-consuming research method that involves a commercial monoclonal antibody specific for *H. pylori* and immunofluorescence, followed by direct microscopic examination. "The last thing I want is people paying a lot of money to have their water tested for *H. pylori*," says Baker. Instead, she recommends that people with well water have it checked for coliforms, an inexpensive test performed by local health departments. "The presence of coliforms is a good, but not absolute, indicator of the likelihood of *H. pylori*," Baker says. Levels of chlorine that kill coliforms also kill *H. pylori*. For this reason, municipal water supplies treated with chlorine will not be contaminated with *H. pylori*.

Scientists Find MTBE Degrades Naturally

The reformulated gasoline additive methyl *tert*-butyl ether (MTBE) is a mixed blessing: the oxygen it contains decreases the production of smog-producing carbon monoxide during combustion, but it can be a pollutant in its own right, and it is classified as a possible human carcinogen by the U.S. Environmental Protection Agency (EPA). But the scales may be tipping, thanks to a study published in the 1 June 1999 issue of *Environmental Science & Technology* in which scientists found that naturally occurring microbes can digest MTBE and convert it into less toxic by-products.

MTBE enters the environment by leaking from underground gasoline storage tanks and through gasoline that evaporates as vehicles are being fueled. It migrates much more quickly through the soil than most petroleum distillates and has been found in groundwater at numerous sites in the United States. Despite MTBE's utility in reducing carbon monoxide, in July the EPA suggested to Congress that the use of the chemical be "reduced substantially" (the phrase was not defined further) because of fears over water contamination. In California, where traces of MTBE have been measured in 10,000 wells, the state has ordered a phaseout of the additive by 2002.

In the June *Environmental Science & Technology* article, researchers from the U.S. Geological Survey in Columbia, South Carolina, reported on a study in which they extracted sediment from beneath two streambeds that received groundwater discharge from storage tanks that had each leaked about 1,000 gallons of gasoline containing MTBE. The study sites were "typical, garden-variety underground storage tank releases that were adjacent to sensitive receptors," says research hydrologist James Landmeyer, an author of the study. "We didn't want something so unique that the results would not be transferable to other locations." The sediments were taken from an aerobic zone of sand and gravel about 2 inches below the streambed.

In the laboratory, the researchers added radioactively labeled MTBE to the sediment samples, then measured how much radioactive carbon dioxide was produced as an indicator of how much MTBE was degraded. After 100 days, microorganisms from one site had degraded 30% of the MTBE. The comparable number for the other site was 73%. The reason for the difference is unclear. The degradation only occurred, however, in samples that were maintained in aerobic conditions. MTBE was not degraded when oxygen was not available or when the samples had been heated to kill microbes. After 80 days, 84% of *tert*-butyl alcohol, another component of reformulated gasoline, had also been degraded in samples from both sites.

"Our results indicate that [certain] microorganisms are able to degrade MTBE to nontoxic by-products if oxygen is present in the microbial environment," says lead author Paul Bradley. The decay microbes have not been identified yet, but the researchers suspect that a community of microbes is responsible.

Although the samples were taken from active spill sites, there is evidence that the decay process is more effective in nature than in the laboratory. The maximum groundwater concentration of MTBE at

Microbial maids? New research suggests that naturally occurring microbes in streams may degrade the gasoline additive MTBE, which is leaked into groundwater from underground storage tanks.

two sites upgradient from the stream was 64 milligrams per liter at one site and 138 micrograms per liter at the other. Yet no MTBE was detected in the stream water at either site, indicating that microbes in the streams were indeed cleaning the groundwater. "The fact that we're not seeing any MTBE in the stream water means the groundwater is probably discharging slowly to the stream at both sites, [giving the microbes time to digest the MTBE]," says Landmeyer.

Learning what happens to MTBE in the environment is a critical question as scientists and regulators continue debating the costs and benefits of oxygenated fuels. About 3 billion gallons of MTBE were produced in 1997, according to John Zogorski of the Rapid City, South Dakota, office of the U.S. Geological Survey. Zagorski says the additive is one of the most widely used organic compounds. And, despite the improved regulation of underground storage tanks, leaks continue to be a problem: Landmeyer estimates that South Carolina alone has 3,000 past or present tank leaks, although not all feed directly into surface waters. "I don't think the problem of MTBE in groundwater is going away by any means, even if it is banned tomorrow," he says. "We will have this legacy for 10 to 30 years."

Green Light for Alternative to Rabbit Test

On 22 June 1999, the National Toxicology Program and the NIEHS, along with 13 other federal agencies that support the Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM), announced the results of an ICCVAM-sponsored independent peer review of Corrositex, an *in vitro* test for corrosivity. The test provides an alternative to the traditional assay in which the sample material is applied directly to the skin of a rabbit. This review provides the basis for regulatory agencies such as the Occupational Safety and Health Administration and the U.S. Department of Transportation to determine whether and how the Corrositex test may used to assess dermal corrosivity, proper chemical packaging and labeling, and safe transportation and storage methods. ICCVAM was established in 1997 to coordinate the development, validation, acceptance, and harmonization of new toxicological test methods throughout the federal government, including alternative tests that reduce, refine, or replace animal use.

William Stokes, the ICCVAM cochair and director of the National Toxicology Program Interagency Center for the Evaluation of Alternative Toxicological Methods, says, "This is the first *in vitro* test to be reviewed by an ICCVAM scientific panel and recommended for consideration by regulatory agencies. The review of this method showed that the test may be useful even when it does not completely replace the current animal test." Corrosivity tests are used to determine whether a chemical will cause irreversible damage to human skin or eye tissue. They are also used to ascertain the type of packaging necessary for shipping a particular chemical in order to comply with Department of Transportation regulations.

NICEATM

Color proof. In the Corrositex assay, a test chemical is applied to a biobarrier membrane suspended over a chemical detection fluid contained in the test vial. Corrosive agents will penetrate the membrane and cause the detection fluid to change from yellow (left) to a shade of orange/red (right). The time it takes the fluid to change color helps determine the potency of the test chemical.

Corrositex was developed by InVitro International of Irvine, California. The test method apparatus is a glass vial filled with a chemical detection system consisting of water and pH indicator dyes, and overlaid with a collagen matrix biobarrier membrane. If a sample is able to penetrate the biobarrier either by diffusion or destruction, the fluid will change color. The tester records the time it takes (usually between 3 minutes and 4 hours) for the sample to break through the membrane.

ICCVAM's evaluation considered Corrositex data (either provided by InVitro International or obtained from peer-reviewed sources) from tests of 163 different materials for which there were corresponding *in vivo* rabbit corrosivity data. At a public meeting held 21 January 1999 to formulate a final recommendation on Corrositex, the ICCVAM Peer Review Panel determined that the test is useful as a stand-alone assay for acids, bases, and acid derivatives, and as part of a tiered assessment strategy for testing other chemical and product classes. When used as a stand-alone assay in some testing situations, Corrositex replaces the use of animals for corrosivity testing; when used as part of a tiered approach, the test reduces and refines the use of animals in testing by providing a basis for decisions on which, if any, further *in vivo* tests need to be conducted.

Robert Scala, a toxicology consultant who served as the panel chair, says, "The ICCVAM report states very carefully that a negative test may suggest that the investigator may want to pursue further testing using alternative methods such as knowledge of chemistry of the material or a limited animal test." Follow-up tests using *in vivo* methods could employ fewer animals and less potent test doses to minimize possible pain in any individual animal. In addition to its animal welfare advantages, Corrositex is less expensive than the traditional rabbit test, displays results more quickly, and requires no special equipment, facilities, or training.

Before testing with Corrositex, all test chemicals are prescreened by directly applying a small amount of the test material to the detection fluid. If a chemical is unable to shift the pH of the fluid to less than 4.5 or greater than 8.5, it does not qualify for testing with Corrositex and must be tested using another method. Some nonqualifying chemicals may actually be corrosive, and in fact, the primary limitation noted in Corrositex is the proportion of test chemicals that do not qualify for use with the test, which, in the case of the chemicals culled from different databases for the ICCVAM assay, came to about 18%. However, of the 75 nonqualifying test chemicals evaluated, 85% were not corrosive according to available *in vivo* test results, indicating that nonqualifying test materials are most often not corrosive.

The panel recommended several changes to the current test method protocol that will address issues of tester instruction and variability in testing conditions. Overall, says Scala, "For those categories of materials for which there is evidence that the test worked well, this report is a strong endorsement.

Connecting for Kids

The weight of an infant more than doubles in the first four months after birth. During this time and throughout childhood, the human body exists in a dynamic state of growth, building the structures and systems that will sustain it into old age. As children grow, they assimilate large amounts of material from the environment, often at rates proportionately higher than those of adults. Many toxic substances are absorbed at very high rates as well. Thus, some toxicants can have their greatest effect during the childhood years, when the process of growth and development makes the individual especially vulnerable.

Because of this disparity between children and adults, the Children's Environmental Health Network (CEHN) would like to see greater consideration given to the special needs of children when environmental standards are adopted. Currently, this public interest organization is lobbying the U.S. Environmental Protection Agency (EPA) to require testing of pesticides for their effects on the developing nervous systems of children. According to the group, such tests have been completed and results submitted to the EPA for only 9 out of the 350 pesticides registered for use on food crops.

Information about these lobbying efforts can be found on the CEHN's Web site, located at http://www.cehn.org/. By following the Policy link under the About the Network heading on the home page, visitors to the site can find a letter jointly submitted to the EPA by the CEHN, the American Public Health Association, and the National PTA requesting developmental neurotoxicity testing of all pesticides. Also available under this link are CEHN position statements, congressional briefings, and reports on the numerous bills related to children's environmental health that have been introduced in Congress recently. All of these materials are organized into an index that can be found through the Keyword Index link on the Policy page.

Also under the About the Network heading on the CEHN home page is a link labeled Research that takes visitors to information on the conferences, symposia, and workshops that the group conducts for health care providers and faculty. Along with the NIEHS, the group sponsored the country's first national symposium on pediatric environmental health in 1994. The report from this symposium, which contains over 100 recommendations for protecting children, is linked to the Research page, as is the September 1995 issue of *Environmental Health Perspectives Supplements*, a monograph that includes papers by presenters at this symposium. A detailed report from the group's 1997 conference is also linked to this page. (For information on the CEHN's latest conference, however, visitors must return to the CEHN home page and follow the link labeled Pediatric Environmental Health: Putting It Into Practice. Available here is the agenda from the June 1999 conference with links to abstracts for each presentation made there.)

A third link under the About the Network heading on the CEHN home page is labeled Education and takes visitors to information on CEHN programs such as the "Train-the-Trainers" project. This program was established to teach medical and nursing faculty how to integrate children's environmental health into their respective hospitals and institutions.

The people behind these programs and the CEHN's advocacy efforts are generally experts in the fields of medicine, nursing, and environmental science. Information about them and their mission is available by clicking on the About the Network heading link on the CEHN home page.

The heart of the CEHN Web site, however, is the Resource Guide on Children's Environmental Health. This huge directory is designed to make all materials related to this issue accessible from a single point on the Internet. Under the Organizations link on the Resource Guide page, for example, is a list of 98 government agencies and nonprofit groups that do work related to children's environmental health. Each entry in the list is a link to a page where visitors will find a description of the organization including details on its mission and activities, a summary of the organization's information services, a link to its Web page, and links to other similar organizations. These organizations are also arranged in other portions of the guide by the audience they target (e.g., academia, children's organizations), the type of work they do (e.g., research, advocacy), their location, and the geographic region they focus on. Also included in the resource guide is a comprehensive listing of databases, surveys, Internet sites, and hotlines related to children's environmental health. These can be found by following the Information Sources link on the Resource Guide page. All of these resources—both information materials and organizations—are catalogued together under the guide's All Index Categories link. The guide is updated monthly, with the most recently added materials listed under the What's New link.