







# Environmental Health

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U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention





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# FOREWORD

Within these pages is a record of the activities that engage the minds and hearts of the people of the Centers for Disease Control and Prevention (CDC) who work at the National Center for Environmental Health. It is as well an affirmation of the importance we place on working across disciplines with a host of governments and agencies to improve the health of people in this country and across the globe. The programs we're involved with remind us on a daily basis of the diversity of the people we serve and the problems they face.

This book also reminds us that our predecessors at CDC were visionaries. Without their foresight, we would be unable to do much of the work that others now often consider routine. However, we must be vigilant about resisting complacency, because we still have much to accomplish. In this nation alone, we will double our population during the next 100 years. Among other things, this means that we must act now to strengthen environmental health programs and services. It means that we will have to rethink how we use our land and design our communities to enhance health rather than to contribute to its decline.

Finally, we must make sure that the work we do continues to do two things: (1) first and foremost, that it improves the health of the people we serve, both now and in the future; and (2) that it excites the imaginations of a new generation of "CDCers." We want to attract dedicated professionals from many disciplines who will see that we, as did those who came before us, mean to keep the faith of the people we serve.



Richard Joseph Jackson, MD, MPH  
Director  
National Center for Environmental Health







# OUR VISION, OUR MISSION, AND OUR PARTNERS

## **OUR VISION**

Healthy people  
in healthy communities  
free from disease  
due to the environment

## **OUR MISSION**

To promote health  
and quality of life  
by preventing or controlling  
those diseases or deaths  
that result from interactions  
between people  
and their environment

## **OUR PARTNERS**

State and local health departments  
Other CDC centers, institute, and offices  
Other federal agencies  
Foreign governments  
International health organizations  
Nongovernmental organizations  
Academic institutions  
Philanthropic foundations



# The Essence of Our Environmental Health Work

CDC's environmental health work cuts across several centers. Here at the National Center for Environmental Health, we focus on the following program areas:

- Safeguarding the health of people from environmental threats
- Providing leadership in the use of environmental health sciences—including environmental epidemiology, environmental sanitation, and laboratory sciences—to protect public health
- Responding and sharing solutions to environmental health problems worldwide
- Communicating information about genes, diseases, and environmental risk factors

The following paragraphs provide an overview of divisions and offices that are actively engaged in environmental health activities.

The Division of Environmental Hazards and Health Effects (EHHE) conducts surveillance and investigations that increase knowledge about the relation between human health and the environment and uses this knowledge to develop national public health programs and policies aimed at preventing disease. EHHE studies ways to prevent or control health problems associated with exposure to air pollution, nuclear radiation, lead, and other toxicants, as well as

those health problems resulting from natural and technologic disasters.

The Division of Emergency and Environmental Health Services (EEHS) provides national and international leadership in coordinating, delivering, and evaluating emergency and environmental health services. EEHS helps local, state, federal, and international agencies plan, prepare, and respond to emergencies, including terrorist attacks, technologic accidents, and natural disasters. EEHS also provides grants, technical assistance, scientific guidance, and in some cases, direct service delivery to state, local, and nongovernmental agencies engaged in environmental health services such as food safety, rodent control, water quality, and sanitation.

The Division of Laboratory Sciences (DLS) develops and applies laboratory science to prevent disease and death caused by exposure to environmental chemicals and to improve the diagnosis, treatment, and prevention of selected chronic diseases. DLS specializes in biomonitoring, which is the assessment of individual human exposure to environmental chemicals by measuring them in human specimens (e.g., blood or urine). Biomonitoring provides valuable and unique information that guides health officials in risk assessment, treatment, and prevention.

The Office of Global Health works with partners to improve health worldwide. Five global priorities of this office are childhood lead poisoning prevention; water, sanitation, and hygiene; urban health and megacities; micronutrient malnutrition; and emergency preparedness and response.

The Office of Genomics and Disease Prevention (OGDP) integrates advances in human genome discoveries into public health research, policy, and programs. OGDG's activities focus on conducting applied research, evaluating genetic testing, disseminating information, and training the public health workforce.

The work we do in environmental public health is based on strong science and focuses on linking environmental conditions with specific measures of human health—the goal of which is to discover specific public health interventions to improve human health. Such meaningful efforts, which influence the quality of life of people in this country and throughout the world, comprise the essence of our environmental health work.

## Asthma

**S**tate-Specific Asthma Data Made Available for the First Time Asthma's effect on health and quality of life and on the economy is substantial, and asthma rates are increasing. However, there are few data on the prevalence of the disease at the state level or in specific populations. To help address this public health concern, the Centers for Disease Control and Prevention (CDC) added optional asthma questions to the Behavioral Risk Factor Surveillance System (BRFSS) in 1999. BRFSS is a state-based telephone survey of noninstitutionalized U.S. adults 18 years of age and older that measures modifiable risk factors for chronic diseases and other leading causes of death. In 2000, these questions were made part of the core data collection process in all 50 states, the District of Columbia, and Puerto Rico. In August 2001, CDC published a summary article in *Morbidity and Mortality Weekly Report (MMWR)* (<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5032a3.htm>) about the data gathered with the new questions. More extensive demographic tables have since been developed and are available on the CDC Web site at <http://www.cdc.gov/nceh/airpollution/asthma/brfss/default.htm>. The continued use of the BRFSS asthma questions will enable state health departments to monitor trends in asthma prevalence and to better direct management efforts by providing prevalence rates for detailed demographic subgroups at the state level.



Accomplishments





**More Health Departments Funded to Develop and Implement Asthma Control Programs**

In 2001, CDC provided funds to 13 additional state health departments plus the Washington, D.C., Health Department to develop or implement asthma control programs. This brings to 26 the number of health departments now receiving funds to plan programs that will have surveillance, intervention, and partnership components. The 25 states funded for asthma control programs are California, Colorado, Connecticut, Georgia, Idaho, Illinois, Iowa, Maine, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Oregon, Rhode Island, Texas, Utah, Vermont, Virginia, West Virginia, and Wisconsin.

**Funds Provided to Implement Asthma Interventions**

Within the past year, CDC funded eight sites to implement one of two proven asthma interventions (Asthma Care Training for Kids and Open Airways for Schools). The purposes of these funds are to decrease hospital and acute care visits and to increase compliance with asthma care and medication plans. The eight sites are Chula Vista Elementary School District (California); Bronx-Lebanon Hospital Center (New York); the American Lung Association of Metropolitan Chicago; the American Lung Association of Colorado; the Philadelphia Department of Health; Harris County Hospital District (Texas); Babyland Family Services, Inc. (New Jersey); and the Asthma and Allergy Foundation of America (Washington State chapter).

**CDC Organizes a Public Health Response to Asthma**

CDC and the Public Health Training Network conducted live interactive satellite broadcast training, "A Public Health Response to Asthma," on May 17, 2001. More than 1,000 people received continuing education credit for the broadcast, which provided an overview of the disease and demonstrated sound approaches for conducting asthma surveillance, building statewide coalitions, and implementing interventions in schools. Several state health departments used the broadcast as a kickoff event for their scheduled asthma coalition meetings.

**Funds Provided to Seven Grantees for Controlling Asthma in American Cities Project**

CDC provided funds to seven grantees to use innovative collaborative approaches to improve overall asthma management among urban children and adolescents up to 18 years of age. The grantees are the St. Louis Regional Asthma Consortium, Children's Hospital of Philadelphia, the American Lung Association of Minnesota, the University of Illinois, Columbia University (New York), the Central Virginia Asthma Consortium, and the University of California. The desired outcome of this project is a decrease in asthma-related morbidity.

**Asthma Case Tracking Under Way**

To provide better estimates of asthma incidence, CDC is funding the Kaiser Foundation Research Institute (Portland, Oregon) and the Miami-Dade County Health Department (Miami, Florida) to develop

models for identifying new asthma cases. This project will define a network of providers within each population base and determine the health care utilization practices of people with asthma who visit those providers. This project will also facilitate the identification of population-based factors that are associated with the development of asthma.

### **CDC and Malaysian Researchers Analyze**

**Forest Fire Health Effects** In 2001, CDC continued working with the Malaysian Ministry of Health to analyze data gathered in conjunction with forest fires that occurred in that country in 1997. Malaysian researchers came to Atlanta and worked with CDC epidemiologists to prepare the data and to start the preliminary analysis. CDC epidemiologists traveled to Malaysia and conducted workshops focused on improving the quality of hospital discharge data collected there. This study will provide a better understanding of the health effects that occur from exposure to air pollutants caused by forest fires.

## Biomonitoring

### *National Report on Human Exposure to Environmental Chemicals*

**CDC Launches First *National Report on Human Exposure to Environmental Chemicals*** In March 2001, CDC released this major scientific examination of the U.S. population's exposure to 27 environmental

chemicals—24 of them for the first time in history. CDC scientists looked at levels of all 27 chemicals in people who participated in the 1999 National Health and Nutrition Examination Survey (NHANES). NHANES is a series of surveys that CDC conducts which collect data on the health and nutritional status of the civilian, noninstitutionalized U.S. population. The *Report* provides information about exposure to important environmental chemicals, including metals such as lead and mercury; organophosphate pesticides; phthalates; and cotinine, a marker for exposure to tobacco smoke. In addition to levels of three chemicals—lead, cadmium, and cotinine—that had been measured in other surveys, the laboratory determined reference ranges for 24 environmental chemicals from a nationally representative group of people not known to have any specific exposure to the chemicals beyond that experienced in the general population. These reference ranges will be extremely helpful to public health officials, physicians, and health researchers because levels above these ranges usually indicate exposure worthy of further investigation. The overall purpose of the *Report* is to provide unique exposure information to public health officials, scientists, and physicians to help prevent disease that results from exposure to environmental chemicals.

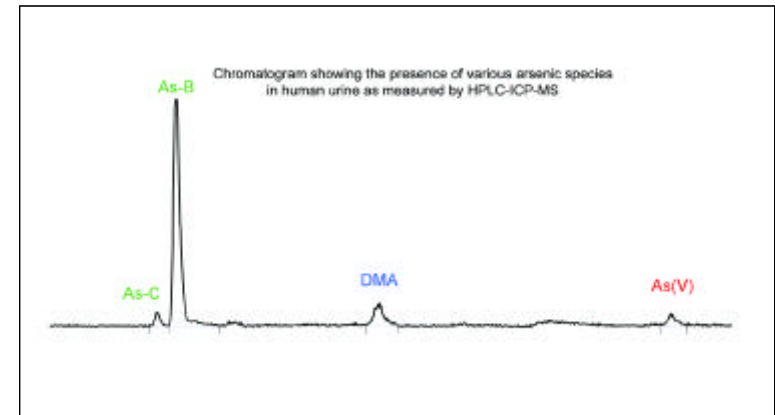
## Methods

**New Methods Strengthen Biomonitoring Capacity** During fiscal year 2001, CDC laboratory scientists developed several new methods for measuring low levels of environmental chemicals in people. These methods, which are essential to studying the relation between exposure levels and adverse health effects, will help public health officials, physicians, and researchers learn more about what chemicals are getting into people's bodies. Hazardous substances that can be better measured in blood and urine using these new methods include the following:



Using improved methods, CDC scientists can measure 31 different volatile organic compounds in people's blood.

- Polyaromatic compounds, many of which are known to be carcinogenic. CDC currently is analyzing the blood and urine specimens of firefighters who responded to the World Trade Center (WTC) attack to determine whether they were exposed to these chemicals.
- Phthalates, which are chemicals that have the potential to be hormonally active and are found in soap, shampoo, hair spray, nail polish, and durable and flexible plastic products. Phthalates given at very high doses to pregnant animals have caused birth defects among offspring.
- The endocrine disruptor bisphenol A, which is used in dental sealants.
- Nonpersistent pesticides.
- Nicotine, nicotine metabolites, free nicotine, and menthol from tobacco products. The method for measuring menthol is particularly noteworthy, given that African Americans who smoke mentholated cigarettes may have an increased risk for smoking-related disease.
- Trihalomethanes, which are water-disinfection by-products associated with an increased risk for bladder cancer and birth defects. CDC laboratory scientists can now measure eight times as many samples at one time as they were able to measure using previous methods.



Separating arsenic into its various types (species) allows scientists to measure both dietary and environmental exposures to this toxic chemical.

- Mercury, uranium, thorium, and both total and speciated arsenic.
- Selenium, an element essential to human health but toxic at high levels.
- Plutonium, a deadly radioactive element.
- Volatile organic compounds (VOCs), some of which are associated with cancer and neurological dysfunction. CDC developed an improved method for measuring 31 different VOCs in human blood. By improving methods of sample handling, analysis, and data reduction, environmental health scientists can now measure 10 times as many samples at one time as they could only 2 years ago. Such strides enabled CDC to rapidly address questions about exposure to VOCs among firefighters who participated in WTC rescue efforts.

### **CDC Calls for Renewed Interest in Children's Exposure to Environmental Chemicals**

Monitoring levels of environmental chemicals in children presents several difficulties. Among these are the small sample volumes that can be obtained from children, the invasive nature of the sampling, and the Institutional Review Board concerns. At the American Chemical Society's national meeting, CDC chaired a session addressing these difficulties and then contributed to and edited a special issue of the *Journal of Exposure Analysis and Environmental Epidemiology* devoted to assessing children's

exposures to hazardous environmental chemicals. This special issue (*J Expo Anal Environ Epidemiol* 2000;10[6 Pt.2]:611–29) contains seven articles by CDC authors. One article is an overview of the challenges and complexities researchers face in assessing children's exposure to environmental chemicals. The other articles address sample collection, measurements of chemicals in various media (including umbilical cord blood, serum, and urine), and techniques and methods for measuring certain chemicals such as phytoestrogens and pesticide metabolites. Laboratory scientists and public health officials will find this information useful as they work to find the best ways to handle scientific and policy matters related to biomonitoring in children.

**Methanol Identified as Contaminant in El Salvador Poisoning** During late spring 2001, a rash of poisonings from methanol-contaminated liquor in El Salvador left 120 people dead. In response to this massive exposure, CDC's environmental health laboratory developed methods for identifying methanol, ethanol, and relevant metabolites in human blood. CDC data confirmed that methanol contamination was the likely cause of this poisoning epidemic. These data assisted local public health officials in minimizing additional poisonings from contaminated liquor.





After a fire burned much of Bandelier National Monument and parts of Los Alamos National Laboratory, CDC tested the urine of people who were evacuated to determine whether these people had been exposed to hazardous substances from the fire.

### *The Role of Biomonitoring in Public Health Investigations*

**Urine Analyzed for Heavy Metals After National Monument Forest Fire** In May 2000, a controlled fire at Bandelier National Monument unexpectedly got out of control, burning much of the monument and parts of the Los Alamos National Laboratory. Authorities evacuated 25,000 people to reduce their exposure to the forest fire smoke and possible exposure to radioactive releases from the laboratory. Although testing of urine for environmental chemicals revealed elevated levels of nickel, CDC investigators

determined that the nickel was not released from the laboratory and that the health of the evacuated population was not compromised.

**Levels of Fetal Exposure to Organophosphate Pesticides Measured** Working with academic institutions from several regions of the country, CDC laboratory scientists measured levels of organophosphate pesticides in the cord blood and postpartum meconium of infants. These infants are being studied to determine the relation between adverse neurobehavioral effects and exposure to environmental chemicals, particularly to these pesticides. Although the studies are still in progress, preliminary results

indicate that the pesticides generally pass through the placenta and thus expose the fetus to these pesticides, which are neurotoxicants.

**Proximity to Agricultural Fields Is Not Significantly Associated with Overall Pesticide Levels in Urine**

In 2001, CDC completed an investigation of exposure of children to pesticides in Yuma County, Arizona. The purpose of this cross-sectional study was to determine whether children who lived or attended school in the vicinity of agricultural fields were exposed to greater amounts of pesticides than were children who lived or attended school further from agricultural fields. From October 1999 to February 2000, CDC collected urine and dust samples; a total of 152 households and six schools participated. Urine samples were tested for organophosphate pesticide metabolites, and dust samples were tested for 43 specific pesticides. Levels of pesticide metabolites in urine and levels of pesticides in dust were low. There was no association between the summary variable of all pesticide metabolites in urine and distance from agricultural fields. However, there was an association between distance and some of the individual pesticide metabolites in the urine.

*Building State Capacity in Biomonitoring*

**Funding Awarded to States** In 2001, CDC awarded 25 planning grants totaling \$5 million to 33 states to develop, implement, and expand

state-based biomonitoring programs to help prevent disease from exposure to toxic substances. Individual states, as well as consortia comprising several states, received funding. Grants are designed to help states strengthen their public health infrastructure. States will also be able to plan how they will track exposure trends and assess effectiveness of efforts to reduce exposure to toxic substances. Finally, states will be able to increase their capacity to measure many toxic substances in people, including such vulnerable groups as children, the elderly, and women of childbearing age.

**Public Health Emergency Response**

**Unannounced Bioterrorism Exercise Held** A full field exercise developed and managed by CDC called “Exercise Hanuman Redux 2001” (HR 2001) was held during 2 days in August 2001 in Louisville, Kentucky. It was one of a very few “no-notice” (unannounced), 24/7, player-driven exercises ever held in the United States. From the local perspective, the August exercise evaluated the community’s ability to execute its emergency operations plan, policies, and procedures and use its systems and facilities to deal with a bioterrorism event. In response to the exercise scenario, CDC rapidly field-deployed two



A CDC scientist and a local health educator use a global positioning system to plot sample extraction locations for investigating children’s exposure to pesticides in Yuma County, Arizona.





A CDC staffer works at the on-site Emergency Operations Center for Exercise Hanuman Redux 2001, a no-notice bioterrorism response exercise held in Kentucky in August 2001.

emergency response coordinators and 10 epidemiologists to investigate the event. HR 2001 marked the first time the National Pharmaceutical Stockpile Program had field-deployed its assets. The lessons learned from HR 2001 proved invaluable in responding to the World Trade Center and Pentagon events less than 1 month later.

**Emergency Response Efforts Put into Action on September 11** During the past several years, CDC has responded to a variety of natural and technologic disasters, each of which had significant public health consequences. CDC also participated in chemical, radiological, and biological terrorism exercises. These activities proved invaluable in preparing CDC emergency

response personnel to rapidly and effectively respond to the event that began September 11. CDC's Emergency Operations Center was functioning within minutes of the World Trade Center and Pentagon attacks, maintaining 24/7 coverage through mid-December. CDC also deployed hundreds of specialists to New York City to conduct on-site activities. These activities included serving as a liaison with other federal agencies and the New York state and city health departments in areas such as worker protection and environmental sampling and helping identify and quantify respiratory, eye, and other risks to workers at Ground Zero. Additionally, CDC recently used funds received from the Federal Emergency Management Agency to award two



Hundreds of CDC specialists were deployed to New York City to conduct activities such as biochemical monitoring at Ground Zero.

grants: \$4.8 million to the New York City fire department and \$2.4 million to the New York State Department of Health to conduct biomedical monitoring for responders at Ground Zero.

**Nearly 3.75 Million Antibiotic Tablets Delivered to Treat Anthrax** CDC's National Pharmaceutical Stockpile (NPS) Emergency Operations Center was still fully functioning with staff on 24-hour alert after the September 11 attacks when CDC responded to the first case of anthrax in Florida. At the request of state and local officials, CDC, through the NPS Program, arranged for the transportation of a CDC epidemiologist and the NPS Program's Technical Advisory Response Unit to Florida and North Carolina to investigate and respond to anthrax exposures. CDC also transported specimens and a CDC epidemiologist to a specialty lab in Flagstaff, Arizona. From October 15 to November 29, CDC delivered nearly 3.75 million tablets of three different antibiotics (amoxicillin, ciprofloxacin, and doxycycline) for postexposure preventive treatment of postal workers, mail handlers, postal patrons, and other employees in affected buildings. CDC accomplished this feat in response to 65 separate requests from 10 different states and the District of Columbia. CDC's average response time from request to delivery was 5 hours.



Specialized containers designed to fit into wide-bodied aircraft enabled thousands of pounds of antibiotics, medical supplies, and protective equipment to be shipped through the National Pharmaceutical Stockpile Program to rapidly respond to the September 11 and anthrax attacks.

**CDC and New York City Department of Health Collaborate on Post-September 11 Health Assessment** The New York City Department of Health (NYCDOH) and CDC collaborated on an assessment of health effects and needs among residents of Lower Manhattan affected by the evacuation and environmental contamination caused by the attack on the World Trade Center. Staff from NYCDOH and CDC developed a questionnaire to obtain information from residents concerning (1) demographics, (2) access to utilities and health services, (3) mental and physical health status, and (4) urgent needs and concerns. The survey instrument included a 17-item screening test for symptoms of posttraumatic stress disorder validated for a U.S. population. Survey teams comprising CDC and NYCDOH staff members received training on how to administer the questionnaire and respond to interviewee concerns. From October 25 through November 1, 2001, these teams conducted 414 interviews of statistically representative, randomly selected households from three well-defined communities in Lower Manhattan. Within 1 week of data collection, CDC provided NYCDOH with a report that included recommendations for public health interventions. On the basis of the results of this assessment, NYCDOH developed a plan to facilitate communication, mitigate the effects of poor air quality, and address mental health concerns in these neighborhoods.





The New York City Department of Health collaborated with CDC to develop a plan to facilitate communication, mitigate effects of poor air quality, and address mental health concerns in neighborhoods affected by the World Trade Center attack.

**Terrorism Response Planning Guidance Put on the Web** The planning guidance for biological and chemical terrorism response recently Web-posted by CDC is designed to help state and local public health officials determine the roles of their departments in responding to biological and chemical terrorism and to understand how public health response activities fit within the overall federal, state, and local emergency management system. This guidance can also be used to help health departments coordinate their efforts with the many agencies and organizations at all levels of government that ultimately would respond to a biological or chemical terrorism event. The 106-page guidance document is available on CDC's

Web site at <http://www.bt.cdc.gov/documents/planning/planningguidance.pdf>.

**Training Video Created for State and Local Health Departments** The ability of public health and emergency management officials to provide a coordinated response at the local level has made, and will always make, a tremendous difference in minimizing injury, illness, and death in an emergency situation. This new National Pharmaceutical Stockpile video will provide CDC staff with an opportunity to train thousands of individuals across the country quickly and inexpensively, helping to ensure rapid procurement, transport, and staging of CDC



assets in an emergency situation. The video format is particularly important because push package sites are at undisclosed locations and cannot be toured. (A push package is a portable, fully stocked repository of drugs, antidotes, and medical/surgical supplies designed to resupply state and local public health agencies within 12 hours of a terrorism incident.) For most public health and emergency management planning officials, this video will provide the only opportunity for them to view a push package.

### **Applied Research Leads to Program**

**Innovations** In 2001, CDC conducted applied research that led to program innovations in several areas, such as the development of adult and pediatric dosing guidelines. Working with an interagency panel of medical and pharmaceutical experts and industry representatives, CDC outlined the specific dosing requirements for adults and children in an emergency setting and incorporated these guidelines into drug information sheets for patients. In addition, in 2001, CDC scientists wrote two articles that were published in major pharmaceutical journals. The first article presented an overview of CDC's National Pharmaceutical Stockpile Program and the second provided technical advice for pharmacists involved in terrorism planning.

### **Drug Information Provided in More than 40 Languages**

The mass postexposure preventive medication needed by thousands, possibly millions, of people under chaotic conditions following a bioterrorism event may put uncommon stress on routine medical practice

associated with dispensing medications, including providing dosing instructions and drug information to patients. It may be particularly problematic to provide this type of information to people who best understand a language other than English and who would benefit from dosing instructions and drug information in their native language. Consequently, CDC developed dosing instruction labels and drug information sheets for ciprofloxacin, doxycycline, amoxicillin, and penicillin in more than 40 languages. The drug information sheets will provide a clear and understandable reference for patients about how many tablets to take, when to take them, what precautions to watch for, and what side effects to expect. CDC distributed CDs containing easily viewable files of the multilingual drug information sheets and dosing instruction labels to all state and local health departments in January 2002.

### **More Staff Trained on International Emergency Response**

CDC has enlarged its reservoir of staff members capable of responding to requests for CDC assistance in international emergencies. In 2001, 12 CDC staff members completed the 2-year International Emergency Capacity Development (IECD) training program. The program provides trainees with language instruction, teaching seminars on technical topics, and supervised international field experience. Many past graduates of the IECD program have increased their international responsibilities in their current jobs, thereby enhancing the ability of CDC to respond to global health threats. For example, the Division of

Reproductive Health has in the past few years provided the first epidemiologic assessments of the burden of reproductive health-related morbidity and mortality in several refugee camps worldwide. These activities were initiated and led by members of the first and second IECD classes, which graduated in 1997 and 1999.

### **Palau Center for Emergency Health**

**Established** As part of the Pacific Emergency Health Initiative, CDC staff traveled to Palau in September 2001 to launch the Palau Center for Emergency Health (PCEH), the first Pacific regional training center for emergency public health and medical facilities. PCEH is a CDC venture developed in partnership with the Republic of Palau and the Palau Community College. In addition to opening the center, CDC representatives conducted two training sessions for 11 Pacific Island nations participating in PCEH. The first course, the Emergency Public Health Planning Workshop, introduced the participants to the fundamental concepts of emergency preparedness as applied to the public health and medical effects of natural and technological disasters. Each of the participating jurisdictions ended the 40-hour course by developing public health emergency operations plans. The second course, the Emergency Medical Services Workshop, provided 80 hours of hands-on emergency medical services training to first responders.



The first class to graduate from the Palau Center for Emergency Health (PCEH). PCEH, opened by CDC in 2001, trains citizens of 11 participating Pacific Island nations on fundamental concepts of emergency preparedness and emergency medical services.

## Childhood Lead Poisoning Prevention

**L**ead Screening Plans Submitted to CDC  
 An important element of a comprehensive program to eliminate childhood lead poisoning is an effective lead screening strategy. The goal of lead screening is to identify children who need individual interventions to reduce their blood lead levels. CDC is committed to eliminating childhood lead poisoning by 2010. Because childhood lead poisoning no longer is considered to be a broad, society-wide problem but rather one that exists in particular at-risk populations, CDC refocused its intervention efforts and has been conducting high-intensity targeted screening in specific communities. When this crucial effort has been completed, the

path will be paved for the implementation of effective and successful interventions. In 2001, all lead grantees developed and submitted their screening plans to CDC. These plans are currently undergoing review.

**Regional Lead Conferences Generate Great Interest** Eight regional lead conferences (Pittsburgh, Pennsylvania; Portland, Maine; Asheville, North Carolina; Indianapolis, Indiana; Austin, Texas; Des Moines, Iowa; Salt Lake City, Utah; and Oakland, California) were held during 2001 to give state and municipal Childhood Lead Poisoning Prevention Program (CLPPP) grantees and CDC the opportunity to participate in formal and informal dialogue and to exchange information about critical program issues. These conferences helped build and strengthen regional networks and increased participants' knowledge about data management and childhood lead poisoning prevention. These conferences also created a forum for states and local CLPPPs to develop strategies and innovative approaches to improve the overall impact of childhood lead poisoning prevention programs. Attendance was greater at the regional conferences than at previous annual national conferences.

**Strategic Partnership Promotes National Lead Poisoning Prevention Week** CDC collaborated with the U.S. Environmental Protection Agency and the U.S. Department of Housing and Urban Development to commemorate the first-ever National Lead Poisoning Prevention Week, which was observed the week of October 21, 2001. A

major outcome of this partnership was the development of a Lead Poisoning Prevention Media Outreach Kit for state and local health departments. The toolkit is intended to facilitate relationships with local and state media representatives and to increase awareness about childhood lead poisoning.

**CDC Lead Poisoning Prevention Web Site Redesigned** The content, design, and navigation of CDC's Web site on lead poisoning prevention has been updated and upgraded. The revised Web site is intended to better serve the public and national program needs for childhood lead poisoning prevention information and resources. To access the site, go to <http://www.cdc.gov/nceh/lead/lead.htm>.

## Diversity/Disparities

**Mold Growth Investigated in Homes on Turtle Mountain Indian Reservation** CDC conducted an investigation of mold growth in residential dwellings and of the potential health effects of exposure to mold among residents on the Turtle Mountain Indian Reservation in North Dakota. The investigation included three phases: environmental assessment of dwellings, human health survey, and environmental sampling. Environmental and human health data were collected on a stratified, weighted, randomized sample of reservation homes. A total of 137 homes were initially surveyed by CDC

environmental assessment teams. A high prevalence of mold growth was identified in more than 60% of the homes surveyed during the visual inspection. In addition, a number of critical public health threats were discovered, including several electrical system hazards; two gas leaks; several sewage/sump pump leaks; several pest infestations; and in one home, the potential for carbon monoxide poisoning. This project will help researchers understand environmental factors associated with mold growth, knowledge that in turn will help improve problem housing and that may help eliminate environments that allow molds to thrive.

### **Native American Tribes Receive Radiation**

**Dose Estimates** CDC provided Northwest Native American tribes with radiation dose estimates for representative individuals who were exposed to radioactive iodine released from the Hanford Nuclear Reservation in Washington State. These dose estimates will help members of eight separate Native American tribes and nations determine how historic releases of radioactive iodine from Hanford may have affected their health. These dose estimates are based on specific Native American lifestyle and dietary practices that individual tribes reported.



A home on the Turtle Mountain Indian Reservation in North Dakota shows damage caused by the wet environmental conditions in the community. The high moisture levels both indoors and outside are likely the main contributor to CDC's finding that 60% of the homes inspected had visible mold contamination.

## Environmental Health Services

### *Chemical Weapons Disposal*

**P**rogress Continues in Disposing of Stockpiled Chemical Weapons CDC continues to maintain a strategic partnership with the Department of Defense involving funding in excess of \$1 million to support CDC's oversight of the safe disposal of the nation's chemical weapons. This partnership enables CDC to effectively protect the health of the almost one million people working or living near chemical weapons stockpile sites. Since September 2001, more than 14.9 million pounds



of chemical agents and weapons have been safely destroyed. CDC will continue to keep its promise of protecting the public's health while managing the safe disposal of the remaining 48 million pounds of chemical agents and weapons.

### **Nerve Agent Munitions Found Near Children's Nature Trail Safely Destroyed**

CDC provided public health and safety oversight in the safe destruction of six "bomblets" found at a landfill at Rocky Mountain Arsenal, Colorado, in close proximity to a children's nature trail. Each bomblet is only about the size of a grapefruit but has enormous deadly potential. Together these six bomblets contained a total of eight pounds of sarin nerve agent, enough to kill more than 77,000 people. The bomblets originally were designed for a 1950s-era missile but had never been used. CDC partnered with the U.S. Army and the state of Colorado to identify a safe technology and process for disposal of the bomblets, which were successfully destroyed with no potential health threat to the nearby community. The disposal process will serve as a model for destruction of any chemical munitions found in the future. Rocky Mountain Arsenal was formerly used by the U.S. Army to manufacture chemical weapons and was later leased by industry to produce agricultural pesticides. The facility is located about 10 miles northeast of downtown Denver, Colorado.

### **Limits Published for Exposure to Nerve Agent**

CDC finalized and published its recommendations for protective exposure limits to chemical nerve agents during disposal. CDC's recommendations

are based on information obtained from a scientific workgroup of nationally recognized scientists and medical professionals. The recommended limits, which were published in the *Federal Register* for public comment, will ensure that workers and nearby communities are protected from adverse health effects caused by nerve agent exposure.

### **Open Forum Held on Exposure Limits for Blister Agent**

During September 10–11, 2001, CDC convened a panel of national scientific experts and medical professionals in an open forum to review and discuss exposure limits for sulfur mustard agent at chemical agent disposal facilities. Currently, seven national chemical stockpile sites in the United States are storing sulfur mustard agent that must be safely disposed of under congressional mandate. The panel's scientific findings have been analyzed by CDC and will be used to prepare CDC's final recommendations on exposure limits for sulfur mustard. CDC's recommendations will be both conservative and protective of the health of the more than 900,000 workers and residents in the nearby communities. The exposure limits will be published in the *Federal Register* to provide an opportunity for public review and comment.

### **Independent Investigation of Oregon Chemical Weapons Storage Site Eases Concerns**

The Oregon State Health Department and Department of Environmental Quality asked CDC to conduct an independent review of the current monitoring strategy and program at the Umatilla Chemical Depot (UMCD). UMCD is one



CDC provided oversight in the safe destruction of nerve agent munitions (shown here) found close to a children's nature trail in Colorado.



of eight continental U.S. chemical weapons stockpile sites. Prior to destruction of chemical weapons, the U.S. Army is required to monitor them to verify that there are no leaks posing a health risk to the workers or the community. CDC conducted a thorough technical evaluation of the chemical agent monitoring program put in place by the U.S. Army at UMCD. Overall, the monitoring strategy was deemed to be protective of public health. CDC did provide some recommendations for improvement, which were implemented by the U.S. Army.

**New Chemical Agent Monitoring Concepts Explored** CDC met with Oregon state officials and U.S. Army officials to review innovative monitoring technologies that are able to detect more than one type of chemical agent at the same time. Simultaneous detection of more than one chemical agent is helpful at a chemical agent disposal facility that must destroy multiple agents. CDC formulated a preliminary monitoring strategy that makes recommendations from the perspective of public and worker health protection.

**CDC Meets with Concerned Citizens** One way in which CDC fulfills its role of oversight of eight chemical weapons stockpile sites is to meet with potentially affected local citizens to address their concerns. Currently, only one stockpile site is destroying chemical agents in the continental United States. Two other sites are scheduled to begin disposal operations within the next year. As these facilities near completion, members of the public are requesting more independent public

health information. In response to their requests, CDC has visited the disposal sites and met with community members to address their concerns about chemical weapons disposal near their homes.

### *Capacity-Building Activities*

**Strategy Implemented for Reviving Environmental Health Services System** CDC followed a rigorous schedule in producing a strategy to revitalize the environmental health services system in the United States. Although many major accomplishments have been made in the environmental health services field, over time the resources and capacity of public health agencies to deliver environmental health services have steadily declined. The initial draft of the strategy was developed in 3 months with the participation of an internal steering committee and a 31-member external partners working group representing the environmental health and protection practice community; special populations; academia; advocacy groups; and representatives from the Agency for Toxic Substances and Disease Registry as well as other CDC centers, institute, and offices. The draft plan, which is viewed as a working document, has been reviewed by more than 100 additional environmental health and public health experts and advocacy organizations. CDC made significant progress toward revitalization in 2001 by awarding millions of dollars to state and local health departments and universities to build public health capacity and improve environmental health services. The next step is to

finish identifying needed resources, organizing and implementing activities described in the strategic plan, and creating a time line for accomplishing the objectives.

**CDC Awards \$3 Million in Cooperative Agreements to Boost Environmental Health Services**

As part of its plan to revitalize the nation's environmental health services system, CDC awarded \$1.5 million in cooperative agreement grants to three state and four local health departments. The grants cover several different projects or focus areas, such as building environmental health capacity in state and local health departments and controlling rodents and improving unhealthy home environments in Philadelphia and New York City. CDC also awarded \$1 million in cooperative agreement grants to four universities to support a program called "Building Communities of Excellence in Environmental Health." This program uses schools of public health to assist state and local health departments in developing state-of-the-art environmental health programs. Additionally, CDC awarded \$500,000 to four other universities to improve the ability of environmental health programs and practitioners to provide environmental health services nationwide. These cooperative agreement funds will enable the universities to determine which procedures are effective for conducting environmental assessments at public events, to develop training modules on essential environmental health services, and to craft training modules for practitioners new to the field of environmental health.



In 2001, CDC made significant progress toward revitalizing the environmental health services system in the United States.

**Environmental Health Specialist Network Expanded**

In fiscal year 2001, CDC awarded \$700,000 to seven additional states to implement the Environmental Health Specialist Network (EHS-Net). EHS-Net was created to facilitate the exchange of information and ideas between epidemiologists and environmental health specialists. EHS-Net is based on the existing infrastructure of FoodNet, which is a Web-based communications tool that addresses the needs of food professionals in various occupations. EHS-Net is designed to (1) enable understanding of the environmental causes of foodborne illness; (2) strengthen the relationships among epidemiologists, environmental specialists, and laboratory staff at the state and local levels; and (3) identify and offer training opportunities for environmental health specialists. Currently, an EHS-Net partnership exists among CDC, the Food and Drug Administration, and eight states (California, Colorado, Connecticut, Georgia, New York, Minnesota, Oregon, and Tennessee). An EHS-Net environmental assessment tool is undergoing pilot testing.

**Workshops on Drinking Water Systems Conducted**

Up to half of the population of some states in this country drink water from small systems not regulated by the Safe Drinking Water Act. The quality of the drinking water from these systems is generally unknown and may be suspect. For these reasons, CDC convened two workshops to allow state and local practitioners to present their perspectives, discuss public health problems, and explore avenues for resolving issues pertaining to small, nonfederally

regulated drinking water systems. Three broad areas of common concern were identified: (1) state and local resources are inadequate for addressing issues related to small systems, (2) members of the general public being served by these small systems are often overconfident or complacent about their drinking water quality, and (3) states need technical assistance and guidance in developing and maintaining these systems. CDC is working with state and local representatives to prepare a joint report describing the issues and potential strategies to address the concerns.

**Cause of Wyoming Waterborne Outbreak Identified** In conjunction with the Wyoming Department of Health and several other state and federal agencies, CDC coordinated an investigation of environmental risk factors and system failures potentially associated with acute gastroenteritis among people who had recently been on a snowmobiling vacation in the Big Horn Mountains. Environmental assessments conducted in three area lodges included food service operations, water supply systems, and sewage disposal. To determine risk factors associated with the illness, a retrospective cohort study was conducted among people identified from guest registers. Stool and water system samples were collected for laboratory analysis. Statistical analysis from the retrospective cohort study suggested that the illness was associated with water consumption and that risk of illness increased significantly with the number of glasses of water consumed. Laboratory results were positive for Norwalk-like virus, genotype II.

The environmental assessment of the property revealed that an inadequately installed sewage system was delivering effluent into shallow soil that had poor filtering capacity. This effluent likely reached the underground sources of the facility's water supply. The resulting illness event represented the largest waterborne outbreak ever reported in Wyoming. The success of this investigation demonstrated the advantages of coordinating environmental public health practice with traditional epidemiologic and laboratory practices.

### *Cruise Vessel Sanitation*

**“No-Sail Order” Issued** A cruise vessel with 224 passengers and a crew of 100 received a “no-sail order” from CDC because the vessel was critically deficient in storing food at proper temperatures, cleaning and sanitizing dishware, and providing properly chlorinated potable water. CDC maintained close inspection of the vessel to ensure that all deficiencies were corrected before allowing the ship to sail. CDC has conducted approximately 550 of these inspections since 1999. This was only the second no-sail order to have been issued during that time period.

**CDC Ensures Healthy Conditions on Cruise Ships** *The Vessel Sanitation Program Operations Manual 2000*, published by CDC in November 2000, allowed cruise lines to transition to compliance with new requirements during 2001. During the transition period, cruise lines were to implement provisions of the 1999 Food and Drug

Administration Model Food Code required by the new manual. CDC conducted a series of training sessions on the new requirements, followed by unannounced operational inspections of the vessels to ensure implementation and compliance. Procedures and instructions on how to design and build potable water systems and food-handling areas for cruise vessels were revised and published by CDC in *Guidelines for the Sanitary Construction of Cruise Vessels Destined to Call on U.S. Ports, August 2001*. This manual has become the international standard for sanitary construction of cruise vessels.

**Illnesses Aboard Ship Can Now Be Reported by E-Mail**

At-sea cruise vessels can now electronically file mandatory reports of illness directly to a CDC database using the Gastrointestinal Illness Surveillance System, an E-mail-based reporting system. Data submitted by vessels are electronically reviewed, and if threshold levels for illness are reached, the system automatically notifies CDC personnel for follow up.

## Environmental Health Tracking Network

### Workgroups Provide Input on Implementing CDC/ATSDR Proposed Plan for an

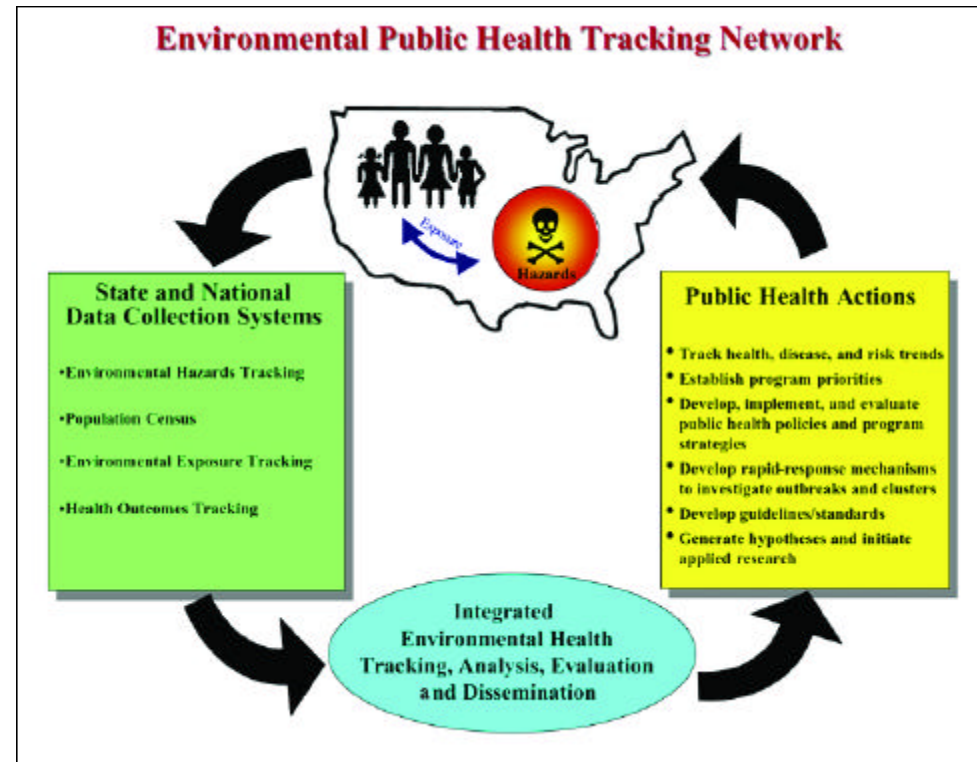
### Environmental Public Health Tracking

**Network** In January 2001, the Pew Environmental Health Commission issued the report *America's Environmental Health Gap: Why This Country Needs a Nationwide Health Tracking Network*. By August 2001, CDC and the Agency for Toxic Substances and Disease Registry (ATSDR) staff developed a plan for such a network entitled *CDC and ATSDR's Proposed Plan for an Environmental Public Health Tracking Network*. The two agencies then assembled 60 scientists, managers, and policy specialists to serve on workgroups to address pertinent tracking issues. Workgroup members represent CDC and ATSDR, the U.S. Environmental Protection Agency (EPA), the Department of Housing and Urban Development, academia, advocacy groups, professional organizations, and state and local public health and environment agencies and the national organizations that represent these agencies.



CDC and ATSDR have begun developing practical recommendations for implementing the proposed plan. These workgroups and the issues they will address are as follows:

- **Organization and management** to (1) define roles and establish collaborative linkages among state and local public health and environmental agencies and among CDC/ATSDR, EPA, and other partners and (2) identify state and local capacity needed to implement the tracking network
- **Data technology and tracking methodology** to (1) identify relevant national data standards, (2) establish system specifications, and (3) describe potential prototypes or models for automating, linking, and analyzing hazard, exposure, and health-outcome data
- **Tracking system inventory and needs assessment** to (1) identify and describe existing tracking systems at the national, state, and local levels, (2) determine priorities for integrating existing tracking systems, and (3) identify and prioritize the development of new systems
- **Translation, policy, and public health action** to define state, local, and federal actions that can ensure a rapid and effective response to data and other information



CDC and ATSDR have developed a model in their proposed plan for an environmental public health tracking network.

generated by the environmental public health tracking network (e.g., implementing disease prevention strategies and initiating prevention research)

To date, CDC and ATSDR have cosponsored a kickoff meeting in Atlanta for workgroup members. In addition, one workgroup already has crafted recommendations for the plan's implementation.



## Genomics

**N**ew Centers for Genomics and Health Established In 2001, CDC awarded funding to three schools of public health, establishing the first Centers for Genomics and Public Health. The University of Michigan, the University of North Carolina, and the University of Washington will each receive approximately \$300,000 per year for 3 years. Through a cooperative agreement between the Association of Schools of Public Health and CDC, each center will develop a regional hub of expertise to use information about gene-environment interactions associated with disease to develop new strategies for improving health. The centers will build on and complement existing programs at the universities (in public health, medicine, genetics, and other disciplines) and will establish relationships with local and state health departments.

Centers may also draw on other regional resources, such as professional organizations, the clinical community, and industry, to develop activities in three areas: contributing to the knowledge base on genomics and public health; providing technical assistance to local, state, and regional public health organizations; and developing and providing training for the current and future public health work force. Although some of these activities now exist at schools of public health, the prevailing thought is that establishing the centers will generate a high level

of synergy, collaboration, and networking among schools of public health and other public health institutions. With this collaborative approach, CDC hopes to draw attention to gaps in translating gene discoveries into disease prevention and to demonstrate, through examples, a way to begin addressing the gaps.

**Genomics Toolkit Project Initiated** Building capacity in genomics in state public health agencies requires tools that are useful in achieving the aims of health promotion and disease prevention. Success also depends upon a sufficient level of commitment from public health agencies to use these tools in public health programs. To help make these tools readily available and to encourage the commitment to use them, CDC is developing a Genomics Toolkit for state and local public health agencies. The toolkit will be the product of a working group coordinated and convened by the Association of State and Territorial Health Officials (ASTHO) that includes representatives from CDC and other public health organizations with interests in laboratory science, chronic disease, public policy, genetics, maternal and child health, local public health, and epidemiology. The project is also being guided by the results of ongoing needs assessments of state and local public health agencies. The Genomics Toolkit is intended to be an evolving document that will be updated as new resources are identified and as genetic science evolves.

### Public Health Impact of Genetic Tests

**Assessed at the End of the 20<sup>th</sup> Century** As more genetic tests are considered for population screening, and as associations among genes, environment, and common diseases are discovered, the number of people who might benefit from genetic testing will most likely increase. Establishing the extent to which genetic tests are currently used for clinical and public health purposes will provide a baseline for future monitoring of the impact of genetic tests on society. In response to this need, CDC classified the 751 genetic tests listed in the GeneTests database as of November 2000 on the basis of their use for population-based testing and on the prevalence of the disease or condition being tested. Of the 423 clinical tests, 51 had potentially greater impact on public health because of their use either in statewide newborn screening programs or in other population screening programs or because of their use in testing for common diseases with a prevalence of more than 1 in 2,000 people. Among the 328 tests performed for research purposes, only 18 met the criteria for potentially greater public health impact. CDC concluded that at the end of the 20<sup>th</sup> century, fewer than 10% of genetic tests were relevant to public health. At the present time, the majority of genetic tests are used in diagnosis or genetic counseling for rare, single-gene disorders in a limited number of people. However, in reviewing the diseases for which genetic tests are being developed in research settings, CDC foresees that tests for more common conditions are likely to become more prevalent.

### Standard Approach Being Developed to

**Evaluate Genetic Test Data** In spite of the continued proliferation of genetic tests, only a few have been evaluated for clinical validity and utility. In a cooperative agreement with the Foundation for Blood Research, CDC is establishing a standard approach for evaluating data on genetic tests. ACCE, named for the four components of evaluation—analytic validity; clinical validity; clinical utility; and ethical, legal, and social implications—is a model process for evaluating data on emerging genetic tests. The process includes collecting, evaluating, interpreting, and reporting data about DNA and related testing for disorders with a genetic component, then putting the data in a format that allows policy makers to have access to up-to-date and reliable information for decision making. An important part of this process is the identification of gaps in knowledge about the validity of genetic tests. Conditions to be examined in the first year of this effort will include cystic fibrosis, hereditary hemochromatosis, and factor V Leiden. Cancer-related genetic tests will be assessed in the second year. The long-term goal of this project is to develop a process that can be used by others to critically review genetic tests.

### Prevalence and Penetrance Data to Aid Decisions About Screening for Hereditary

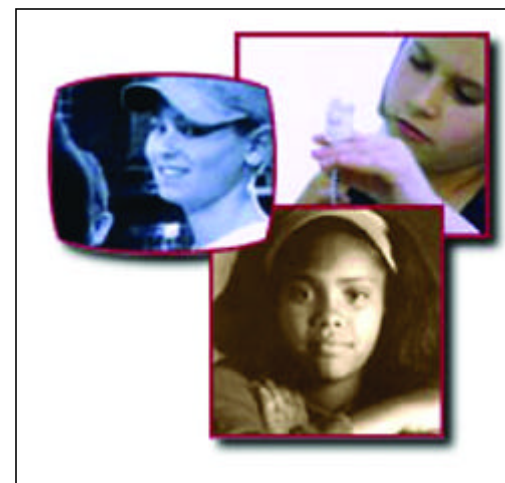
**Hemochromatosis Gene** The National Health and Nutrition Examination Survey (NHANES) is the only nationally representative survey that collects samples suitable for use in genetic studies; NHANES is unequaled as a resource to



Through a cooperative agreement with the Foundation for Blood Research, CDC is establishing a standard approach to evaluating data on genetic tests.

help medical and public health communities understand the role of genetic susceptibility in health outcomes for all segments of the U.S. population. In the first use of the NHANES III DNA Bank, CDC's environmental health laboratory determined the number of people in the U.S. population who have gene variants associated with hereditary hemochromatosis (prevalence of gene variants) and the probability that having one of these variants will cause abnormalities related to excess iron absorption (penetrance of the gene variant). Hereditary hemochromatosis, the most common genetic disease in the United States, is a condition in which excess dietary iron accumulates in organs such as the heart and kidneys and causes disease and death. This use of the NHANES III DNA Bank by CDC environmental health scientists represents the achievement of a public health milestone because prevalence and penetrance estimates are needed to make public health decisions about whether or not to screen for this genetic disorder.

**Program Established to Improve the Prediction of Diabetes** CDC, in collaboration with the Immunology of Diabetes Society, established the Diabetes Autoantibody Standardization Program (DASP) to improve the analyses of type 1 diabetes autoantibodies. These analyses are crucial for predicting the onset of the disease. DASP evaluated the performance of the analytical assays at 47 major international laboratories in 15 countries and identified factors



In the United States, about one million people, most of them children, have type 1 diabetes, an autoimmune disease in which the body destroys the pancreatic cells that make insulin.

that contribute to the highest sensitivity and specificity for the assays. The results of meetings and extensive data analysis indicated that the following actions are needed to improve these autoantibody measurements worldwide: developing CDC reference assays, developing reference materials to provide an accuracy base for these measurements, conducting training programs for performing these complex autoantibody assays, and obtaining normal control sets (sets of serum from healthy people) to increase agreement of normal cutoff values. DASP is addressing the needed improvements so that these analyses, which provide the most sensitive and meaningful measures for accurately targeting program interventions for the prevention of type 1 diabetes, can identify more accurately those at risk.

### Major New Genetic Resource Launched

CDC is collaborating with the Juvenile Diabetes Research Foundation, the Joslin Diabetes Center, and George Washington University to determine genetic risk factors for diabetes and its complications. In June 2001, CDC began testing and banking samples for researchers throughout the world through the Genetics of Kidneys in Diabetes (GoKinD) Study. In the course of developing methods for genotyping in the study, CDC encountered a major problem. One of the genes, DQA1, has many different forms in the population. If the gene is genotyped using conventional direct sequencing, the sequences for some people are garbled and do not “line up” correctly, and the identity of the gene cannot be determined.



In the Genetics of Kidneys in Diabetes study, CDC is testing and banking genetic samples with which scientists can learn to identify people at risk for developing diabetes and its complications.

CDC scientists solved the problem by separating the forms of the gene so that each could be sequenced separately and by designing a novel spreadsheet so that individual forms of the gene could be identified easily from the sequence. The carefully characterized samples in this collection will provide high-quality genetic material for determining the contribution of candidate genes and genomic regions to the development of type 1 diabetes and its complications. The GoKinD Study will help scientists across the world understand the genetics of diabetic kidney disease by providing them with sets of samples that help them learn how to identify people who may be at risk of developing diabetes and its complications.

### CDC Collaborates with Seven States to

**Identify Risk Factors for Birth Defects** CDC is collaborating with seven states on one of the largest case-control studies ever conducted to identify risk factors for birth defects. The National Birth Defects Prevention Study is unique in that it will identify infants with major birth defects from population-based registries using improved case definitions; interview mothers about their medical histories, environmental exposures, and lifestyles; collect cheek swabs from infants and parents to study gene-environment interactions; and establish a specimen bank to store biologic samples for future study. CDC’s environmental health laboratory played a key role in developing and implementing quality control and proficiency testing programs for participating centers and serves as a reference laboratory for any problems identified by the



quality control program. CDC's environmental health laboratory not only developed and implemented genotyping methods that ensure the identity and quality of specimens but also coordinates the specimen bank. To date, cheek-swab specimens have been collected from 1,200 study participants.

**Human Genome Epidemiology Network Expanded** The Human Genome Epidemiology Network (HuGENet™), a global collaboration of individuals and organizations that develop and share epidemiologic information about the human genome, has expanded its Web site with the inclusion of HuGE Case Studies, the HuGE E-Journal Club, and the HuGE Published Literature Database.

The purpose of HuGE Case Studies is to train health professionals in the practical application of human genome epidemiology and to help readers acquire conceptual and practical tools for critically evaluating the growing scientific literature in specific disease areas. The knowledge gained from case studies will inform readers of diverse backgrounds on how epidemiologic data can provide a scientific basis for using genetic information to improve health and prevent disease.

The HuGE E-Journal Club is an electronic discussion forum where new human genome epidemiologic findings, published in the scientific literature and included in CDC's Office of Genomics and Disease Prevention's Weekly Update, are abstracted, summarized, presented,

and discussed through a newly created HuGENet™ listserv. The E-Journal Club presents epidemiologic information in a standardized format and promotes discussion among HuGENet™ members and other interested public health and clinical professionals on selected articles from the current published literature.

The HuGE Published Literature Database is a database of indexed epidemiologic literature on gene variant frequencies, gene-disease associations, gene-gene and gene-environment interactions, and genetic test assessments. Database users are able to obtain a list of relevant articles by querying the database using selected search terms. In addition, key information from each article is provided, along with a direct link to PubMed's abstract of the research article.

These additional features offer a new dimension to the HuGE Net Web site and provide opportunities for discussion among professionals from clinical, public health, and other diverse backgrounds about human genome epidemiology and about education for decision-making involving the use of genetic tests and services.

**Public Health Perspective Series Presents Complex Information to a Diversified Web Audience** Recent advances in human genetics emanating from the Human Genome Project present interesting challenges and opportunities for both health communicators and educators. Information about genes, diseases, and



environmental risk factors is complex and must be communicated in a way that is meaningful for professionals in public health and related health professions. CDC has developed a communication tool designed to present scientific information in a clear and factual manner to a diversified audience. Each Public Health Perspective is essentially a Web site that contains information and commentary on a single topic. Complex topics such as hereditary hemochromatosis, informed consent, pharmacogenomics, and genetic testing are examined from a public health perspective. Readers will find both scientific information as well as popular press news stories, videos, and commentary geared to public health professionals. This "something for everyone" approach allows readers to examine and understand discoveries of genetic variants; related disease outcomes; and complex social, legal, and ethical issues surrounding genetic discoveries. Perspectives are published by CDC's Office of Genomics and Disease Prevention (OGDP) in collaboration with other CDC offices and centers and are featured in the Weekly Update every 4 to 6 weeks. The entire series of Public Health Perspectives can be found on the OGDP Web site at <http://www.cdc.gov/genomics/info/perspective.htm>.

## International Health

**CDC Responds to Complex Afghan Crisis** Since September 11, 2001, an estimated 300,000 Afghan refugees have entered Pakistan and up to 80,000 have entered Iran. They join the more than 3.5 million Afghan refugees already in Pakistan and Iran. The immediate health concerns facing these refugees are malnutrition, measles, malaria, and diarrheal disease (including cholera). Rising to the challenge of addressing these critical concerns, CDC staff members served as medical coordinators for the United Nations High Commissioner for Refugees in Quetta, Pakistan, from September 2001 through January 2002. In this capacity, CDC staffers assisted in the planning of new refugee camps inside Pakistan for Afghan refugees; chaired coordination meetings between the Pakistani government and other organizations; and set health priorities, conducted assessments, and implemented a health information system for newly arriving refugees. CDC also furnished a staff member to coordinate the measles immunization campaign in Afghanistan. This staff member is directing the measles campaign for the entire country. The World Health Organization estimated that the measles campaign will prevent the deaths of 35,000 children. During the first week of the campaign, more than 500,000 children were immunized. In addition to addressing immediate health concerns in Afghanistan, CDC in conjunction with the Vietnam Veterans of America Foundation is currently assisting the



Two men sit outside an Afghan refugee camp. CDC is addressing the Afghan crisis on several fronts, including improving refugee health, coordinating the measles immunization campaign, and partnering with other organizations to resolve the problem of landmines and unexploded ordnance.



A Mongolian family completes a nutritional survey with help from a CDC staffer.

United Nations Mine Action Program for Afghanistan to conduct several projects related to landmines and unexploded ordnance (UXO). Even before the recent conflict, Afghanistan was more heavily affected by landmines and UXO than any other country in the world. Current CDC efforts include on-site technical assistance for a postconflict contamination assessment that will pave the way for the safe return of millions of Afghan refugees and enable the entire country to increase its agricultural output by reclaiming contaminated land. Other projects include a national war-victims survey and several local capacity-building projects, both of which will aid the international community in improving the lives of all Afghans.

### **Winter Storm Effects Assessed in Mongolia**

During the winters of 1999–2000 and 2000–2001, many areas of Mongolia suffered from extreme cold and greater-than-normal snowfall that led to transportation difficulties and loss of livestock. Because most rural families are dependent on livestock for food and income, Mongolian health authorities were concerned that children's nutritional status would suffer as a result of the loss of animals. In collaboration with the World Health Organization and the United Nations Children's Fund, CDC assisted the Nutrition Research Center of the Mongolia Ministry of Health in conducting a nationwide nutrition survey. One feature of the survey was that it measured for the first time the prevalence and

severity of several micronutrient deficiencies suspected to be endemic in rural Mongolia. Survey results indicated that acute protein-energy malnutrition was not common among children 6–59 months of age in rural Mongolia. However, chronic protein-energy malnutrition affected about one-third of children overall, anemia afflicted 30%, and vitamin D deficiency appeared to be common. As a result of this survey, the Mongolian Ministry of Health enhanced the pre-existing program of vitamin A and D supplementation for young children. In addition, because this survey did not include rural residents who recently migrated to urban centers, CDC plans to survey this very vulnerable population in 2002.

**Workshop Focuses on Adult Malnutrition Assessments** CDC assisted in the organization and implementation of a special workshop on assessment of adult malnutrition. The results of this workshop were a set of recommendations for measurement of acute protein-energy malnutrition in adults in humanitarian emergencies. These recommendations will allow the many nongovernmental organizations and United Nations agencies concerned with malnutrition and feeding programs to more accurately measure the extent of malnutrition in this largely neglected age group. Such measurement will help reduce the frequency with which adults are overlooked when assessing nutritional status. CDC will play an active role in coordinating evaluation of these recommendations

and in training others to incorporate them into nutrition assessment activities.

**Refugees in Guinea Given Health and Nutrition Aid** From January through May 2001, CDC staff members served as United Nations (UN) High Commissioner for Refugees medical coordinators in Guinea. CDC coordinated health care and nutrition activities for all refugees throughout Guinea while working with the Guinean government, nongovernmental organizations, and other UN agencies. A sentinel health information system implemented by CDC in refugee camps produced data that formed a baseline of information on illnesses and deaths. CDC also conducted a survey of families registering in a new refugee camp. Surveyors gathered data on illness, injury, and death; reproductive health; and mental health.

**Refugee Mental Health Surveys Conducted in Thailand** CDC conducted two surveys assessing the prevalence of mental illness related to traumatic experiences among the Karenni State refugees in three camps in Mae Hong Son, Thailand. One study focused on the experience of the general population and the other study reviewed the experiences among land mine injury survivors. The latter was the first epidemiologic mental health assessment conducted among land mine injury survivors. CDC's survey results will help the International Rescue Committee develop culturally appropriate and ultimately sustainable strategies and



intervention programs for addressing these mental health issues.

### **Training Manual for Humanitarian Assistance Developed**

In 1997, a group of humanitarian organizations launched the Sphere Project to improve the quality of assistance provided to people affected by disasters and to enhance the accountability of the humanitarian system in disaster response. CDC recently drafted the *Sphere Training Manual* to accompany *The Sphere Project Humanitarian Charter and Minimum Standards in Disaster Response*. The objective of the manual is to provide training to individuals and organizations involved in humanitarian assistance on the public health priorities and minimum standards during emergencies. This training is expected to minimize preventable diseases in emergency situations. The manual will be piloted in 2002.

### **Mexico and Peru Welcome Intensive Environmental Epidemiology Training**

CDC conducted two week-long training courses at the National Institute of Public Health of Mexico in Cuernavaca. The first course was an applied course designed to train health officials on practical skills needed to perform health needs assessments and environmental exposure assessments in communities affected by natural disasters. The second course was an environmental epidemiology course that covered the fundamentals of epidemiology, the specifics of environmental epidemiology, and the basics on how to design and conduct environmental epidemiologic studies. This course was also



A CDC laboratorian injects calibration compound into a mass spectrometer used to measure levels of persistent organic pollutants in human samples.

taught in Lima, Peru, and comprised five lectures designed to address the specific environmental epidemiology needs of Latin American countries. The intention of the latter course was to enable each module to stand alone so that a student or group could choose the specific module(s) that best met their needs. The course is being converted into a distance-based learning course for Spanish speakers.

### **CDC Contributes Biomonitoring Expertise to International Agreement**

In fiscal year 2001, CDC continued to assess human exposure to persistent organic pollutants (POPs) and to determine the human health effects of such exposure. POPs are chemicals that persist in the environment, bioaccumulate through the food chain, and pose a risk of causing adverse effects on human health. These chemicals, which include



polychlorinated dibenzo-*p*-dioxins, polychlorinated dibenzo furans, polychlorinated biphenyls, and nine chlorinated pesticides, were the subject of the Stockholm Convention Treaty, which called for global actions to reduce and eliminate releases of these chemicals. The treaty sets out control measures covering the production, import, export, use, and disposal of POPs. Governments are to promote the best available technology and practices for replacing existing POPs while preventing the development of new ones. More than 100 nations, including the United States, signed the treaty in May 2001. The treaty has yet to be ratified, but CDC is helping formulate guidelines to assess the effectiveness of the treaty after it is ratified and implemented.

**Support Provided for International Micronutrient Assessment Programs** During the past year, CDC provided technical and analytical support for many international studies that assessed the nutritional status of the population. These studies included a national nutrition survey for iron, vitamin A, and iodine deficiency in Malawi; an anemia study among children in Kenya; a vitamin A follow-up survey in Chuuk State, Micronesia, that involved measuring levels of lead, iodine, folate, and iron indicators; an anemia study in Mongolia; a national iodine and anemia survey in the Ukraine; and a national vitamin A survey in Brazil.

CDC's environmental health laboratory also provided technical support and training to laboratories in some of the countries that performed these analyses and was actively



Malawi health care workers used this central area to collect fingerstick samples of whole blood from participants in a nutrition survey.

involved in designing the surveys, selecting appropriate indicators of nutritional status, and helping with the logistics of setting up the survey or study. CDC's involvement helps to ensure that quality data are obtained. These data are needed for making key public health decisions, such as whether to introduce a fortification or supplementation program, and for determining whether such decisions have had the desired impact.

**International Iodine Laboratory Network Established** For more than a billion people throughout the world, getting enough iodine in their diets is a major problem. Iodine deficiency disorders (IDDs) are the main cause of preventable retardation, and the most cost-effective and sustainable way to eliminate IDDs is to iodize all edible salt. The public health goal is

for 90% of all households in the world to consume adequate amounts of iodized salt. The key to reaching that goal is assessing iodine status by measuring iodine's concentration in urine, but not all laboratories in the world measure urinary iodine or salt iodine the same way. That makes it difficult to monitor iodine status and salt iodization in many countries and regions. Thus, researchers, public health professionals, and policy makers from 31 countries attending an international conference in Bangkok, Thailand, in May 2001, agreed to establish an international iodine laboratory network. The conference, jointly sponsored by CDC, the World Health Organization, the United Nations Children's Fund, and the Micronutrient Initiative, included a review and discussion of country experiences and technical and practical barriers to analyzing iodine in both urine and salt in developed and developing countries.

This international iodine laboratory network will comprise resource laboratories and a global external quality assurance program for both urinary and salt iodine. CDC is currently working with international organizations to select resource laboratories from various regions for inclusion in the global network. Programs to monitor salt iodization and to evaluate the iodine status of at-risk populations have begun in most countries. The indispensability of reliable laboratory data to such programs is beyond question. An international iodine laboratory network will greatly improve the quality of data that regional and national laboratories produce

and thus enhance the success of programs to eliminate IDD worldwide.

**Training Workshop Conducted for Eastern Mediterranean Region Countries** In anticipation of the soon-to-come fortification of flour in several eastern Mediterranean nations, CDC organized and conducted a training workshop on epidemiologic and laboratory methods for conducting a national survey focusing on indicators of iron status. Epidemiologists, nutritionists, and laboratory scientists from eight countries in the region participated in the 2-week workshop that provided theoretical background and hands-on training. This well-received workshop will help countries develop national nutrition surveys and implement surveillance systems to track the impact of nutrition programs. A second workshop took place in March 2002.

## Improving the Diagnosis, Treatment, and Prevention of Chronic Diseases

### *Tobacco-Related Issues*

**L**ower Environmental Tobacco Smoke Exposure Found in U.S. Population The use of tobacco products is the leading cause of preventable morbidity and mortality in the United States. In addition, exposure to environmental tobacco smoke (ETS) is a

significant health risk for many nonsmokers, especially vulnerable groups such as pregnant women and children. Beginning with the National Health and Nutrition Examination Survey (NHANES) III (1988–1994), CDC's environmental health laboratory analyzed serum cotinine levels using a sensitive method developed at CDC for NHANES participants aged 4 years and older to evaluate tobacco smoke exposure. During fiscal year 2001, CDC's environmental health laboratory reported serum cotinine results from the analysis of 3,242 individuals who participated in NHANES 1999. Groups previously found in NHANES III to be at elevated risk for ETS exposure, including non-Hispanic blacks, males, and children, also had relatively higher exposure levels in NHANES 1999. However, ETS exposure levels of the overall population in 1999 were much lower than in NHANES III, documenting a significant and continuing decline in the exposure of the U.S. population to ETS during the past decade and reflecting substantial progress by the public health community in reducing ETS exposure.

### **New Cotinine Analysis Measures Passive Exposure Levels Among Pregnant Women**

Previous studies have suggested that exposure of pregnant women to environmental tobacco smoke may contribute to adverse birth outcomes, including an increased risk of giving birth to babies with low birth weights. During the past year, CDC's environmental health laboratory completed data analysis in a study of cotinine levels measured by liquid chromatography/atmospheric pressure ionization tandem mass

spectrometry in 2,777 serum samples from a group of women in the middle trimester of pregnancy who were enrolled in California's prenatal screening program. Using this novel method enabled CDC to examine passive exposure levels that were previously inaccessible. In this study, after controlling for gestational age and five other covariates, scientists found an inverse dose-response effect between log cotinine and mean birth weight ( $-110 \text{ g}$ ,  $p = 0.04$ ) over the entire range of log cotinine values. The results indicate that the odds of an adverse pregnancy outcome increased 2.4-fold ( $p = 0.01$ ) over the range of log cotinine values. These effects are larger than have previously been reported for nonsmoking women, a finding that may reflect a more accurate assessment of the true "nonexposed" reference population.

### **Cigarette Brand-Switching from High- to Low-Tar Cigarettes Found to Be Ineffective**

Considerable evidence exists that people who smoke so-called "light" cigarettes are exposed to as much nicotine as are smokers of higher yield ("full-flavor") cigarettes. However, the effect of brand switching on exposure to other toxic substances in tobacco, including "tar" (carcinogenic aromatic amines) and tobacco-specific nitrosamines, is limited. CDC's environmental health laboratory collaborated on a study with the University of California, San Francisco (UCSF), to examine the biochemical exposures of a group of 20 volunteer smokers who switched between cigarettes of different yields in a study with a multiweek crossover, A-B-A design. During the past year, the



CDC continued its investigations of the health effects of cigarette smoking with several important studies related to hazardous constituents in tobacco.

laboratory completed this study, including the analysis of the tobacco-specific nitrosamines 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL), 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol-glucuronide (NNAL-glucuronide), and urinary 4-aminobiphenyl, in all participants at each time interval. Additional markers were measured at UCSF. As expected, the preliminary data suggested that “low tar and nicotine” cigarettes did *not* produce significant reductions in exposure to these hazardous components of tobacco smoke.

### **CDC Examines Prenatal Exposure to Tobacco and Risk for Sudden Infant Death Syndrome**

Prenatal exposure to tobacco smoke increases the risk for sudden infant death syndrome (SIDS) by a factor of twofold to fourfold. CDC’s environmental health laboratory designed a study to evaluate how prenatal nicotine exposure influences the newborn heart rate by continuously monitoring cardiac rates immediately after birth and relating the findings to cotinine concentrations in cord blood as an index of recent, prenatal nicotine exposure. Results indicated that infants with serum cotinine levels above a cutoff of 6 nanograms per milliliter (ng/mL) differed significantly from nonexposed infants (cotinine levels < 0.05 ng/mL) in maximum heart rate, range, and variance. Prenatal nicotine exposure accounted for 48% to 53% of the difference in the heart-rate variables. These findings indicate that newborns exposed prenatally to nicotine are

less able to maximize their heart rate and thus their cardiac output during reduced inspirations, resulting in lower oxygen levels and putting them at higher risk for SIDS.

### **Tar, Nicotine, and Carbon Monoxide Levels in International Cigarette Brands Analyzed**

Nicotine, tar, and carbon monoxide (CO) were considered for many years to be good markers for the addictiveness (nicotine), carcinogenicity (tar), and toxicity (CO) of tobacco smoke. Although scientists now know that evaluating tobacco smoke requires more sophisticated analysis, these substances are still the primary markers of the dangers posed by using tobacco. During the last year, CDC laboratorians measured nicotine, tar, and CO smoke yields from 77 cigarette brands purchased in 36 countries. The goal of this study was to compare these yields in mainstream smoke from cigarettes manufactured by a leading U.S. transnational corporation with non-U.S., locally popular brands to determine whether there were any differences associated with cigarette brands consumed in different geographic regions. Not unexpectedly, results showed large differences in mainstream smoke deliveries, which varied from 6.8 to 21.6 mg of tar/cigarette, from 0.5 to 1.6 mg of nicotine/cigarette, and from 5.9 to 17.4 mg of CO/cigarette. These findings suggest that cigarettes from certain regions tend to have higher smoke deliveries of tar, nicotine, and CO than do cigarettes from other regions.



In a study of how prenatal nicotine exposure influences newborn heart rates, CDC found that pregnant women who smoke are greatly increasing their babies' risk for sudden infant death syndrome.



## Diabetes

**CDC Collaborates with Manufacturers to Improve Clinical Laboratory Testing** Reliable laboratory results are the key to defining risk for and monitoring the progression of chronic diseases and their associated complications. Working with manufacturers of diagnostic assays in calibrating and standardizing their methods is the most efficient and direct approach to improving laboratory testing. CDC conducted three manufacturer-focused workshops in 2001 to address measurement issues for hemoglobin A1c (HbA1c), blood glucose for diabetes, and high-sensitivity C-reactive protein (hsCRP) for cardiovascular disease (CVD). The workshops gave manufacturers the opportunity to comment on new performance criteria for certifying the performance of assays used to measure HbA1c, which provides a long-term estimate of glycemic control; to learn about CDC's program to harmonize the performance of blood glucose monitoring devices; and to discuss approaches to standardizing measurements for hsCRP, which can be a powerful predictor of CVD.

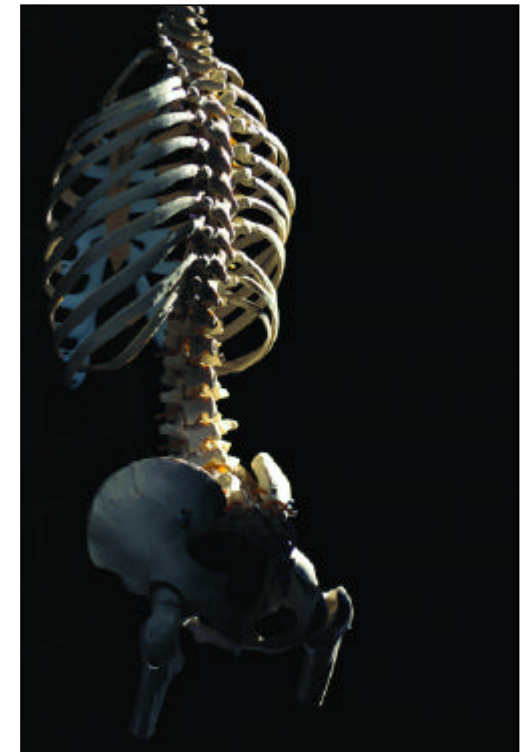
## Cardiovascular Disease

**Cholesterol Reference Method Laboratory Now Certifies Triglyceride Measurements** Through its collaboration with the National Heart, Lung, and Blood Institute, CDC continues to provide external quality assessment and standardization support to 97 laboratories involved

in investigating the causes of cardiovascular disease (CVD) and its complications. Furthermore, CDC's Cholesterol Reference Method Laboratory Network (CRMLN) continues its work with clinical laboratories and manufacturers of diagnostic products to certify the performance of their analytical systems for measuring lipids and lipoproteins. In collaboration with Italian scientists, CRMLN also expanded its services to include certification of triglyceride measurements. As a result, CRMLN can now provide manufacturers with the complete lipoprotein profile that is recommended by the National Cholesterol Education Program for assessing a person's risk for CVD.

## Bone Disease

**Method Developed to Measure Biomarkers for Bone Disease** As the U.S. population ages, diagnosing, treating, and monitoring metabolic bone disease will become a major public health issue. With the development of powerful new drugs, effective treatment of bone disorders is possible. The use of refined techniques in measuring bone-mineral density, as well as the use of biochemical bone markers to measure bone formation and resorption, help physicians detect these disorders more accurately and monitor treatment more efficiently than in the past. However, the lack of standards and reference materials for bone markers makes it difficult to compare results obtained by different laboratories, so the value of using biochemical bone markers as a diagnostic tool is debatable. To



Two biomarkers used to manage bone diseases and assess bone metabolism can now be measured with great accuracy using a new urinary method that CDC developed.

address this problem, CDC is working to establish a system for obtaining consistent and uniform results across methods and sample matrices when measuring these markers. In 2001, CDC scientists completed development of a highly accurate, specific, and sensitive urinary method to measure two biomarkers, pyridinoline and deoxypyridinoline, that are used to manage bone diseases, such as osteoporosis, and to assess bone metabolism in epidemiologic studies. Currently, CDC's environmental health laboratory is the only place in the world where these markers can be measured with such accuracy.

### *Age-Related Vision Loss*

**Antioxidant Vitamins and Zinc Reduce Risk for Age-Related Vision Loss** Believing that visual impairment is unavoidable as they get older, many people are unaware that they are simply at risk for age-related vision loss. Moreover, results from an 11-year clinical trial show that a high-dose combination of vitamins C and E, betacarotene, and zinc could reduce that risk. Since 1990, CDC, in collaboration with the National Eye Institute (NEI), has participated in a major clinical trial called the Age-Related Eye Disease Study. This randomized, placebo-controlled trial of nutritional supplements for preventing macular degeneration involved 4,757 participants aged 55 through 80 years in 11 clinical centers nationwide. Study participants

were given one of four treatments: (1) zinc alone, (2) antioxidants alone, (3) a combination of antioxidants and zinc, or (4) a placebo. CDC provided key data to support the effectiveness of selected antioxidant supplements in delaying the progression of age-related macular degeneration (AMD), the leading cause of visual impairment and blindness in the United States. CDC scientists measured serum concentrations of vitamins C, A, and E; carotenoids; zinc; copper; and lipids to ensure compliance and determine concentrations achieved in study participants. NEI used the data to determine that people at high risk of developing advanced AMD lowered their risk by about 25% when treated with a high-dose combination of vitamins C and E, betacarotene, and zinc. In the same high-risk group, which included people with intermediate AMD or advanced AMD in one eye only, the nutrients reduced the risk for vision loss caused by advanced AMD by about 19%. The nutrients provided no apparent benefit for those participants with either no AMD or early AMD.

As baby boomers age, AMD will become a more prevalent cause of blindness in our nation than diabetic retinopathy and glaucoma combined. The causes of the disease are unclear, but oxidative damage to the retina may be involved. The supplementation phase of the study ended in 2001; the follow-up phase will continue for a minimum of 5 years.



In an 11-year study involving 4,757 participants, CDC and the National Eye Institute demonstrated that taking a high-dose combination of vitamins C and E, betacarotene, and zinc can reduce a person's risk of experiencing age-related vision loss.



Using tandem mass spectrometry, laboratories performing newborn screening tests can detect twice as many metabolic disorders as can be detected using other dried-blood-spot technologies.

## Newborn Screening

**T**andem Mass Spectrometry Signals Big Changes for Newborn Screening The ability of tandem mass spectrometry (MS/MS) to scan a single sample for a large group of inherited disorders promises to change the way newborn screening is done in the near future. Using this technology, laboratories can detect more than double the number of metabolic disorders than can be detected using other dried-blood-spot technologies alone. Advocacy groups are strongly urging the use of this technology, arguing that MS/MS can detect a wide variety of devastating conditions and that affected children have a better chance of survival through detection and early intervention. This year, CDC issued recommendations and guidance aimed at helping newborn screening programs implement and use this technology. CDC's environmental

health laboratory also piloted a proficiency-testing (PT) program for detecting disorders using MS/MS. Currently, 21 laboratories in 11 countries and all 15 programs in the United States participate in this new PT program. Initial data, however, revealed discrepancies in measurements. These discrepancies were traced to a calibration problem and were resolved, thus increasing harmonization in measurements among all participants and building confidence in the validity of the test results using this new technology.

**Performance Is Improved for Filter-Paper Blood-Collection Device** The filter-paper blood-collection device has achieved the same level of precision and reproducibility that analytical scientists and clinicians have come to expect from standard methods used to collect and aliquot blood specimens. The device involves some level of imprecision that can be measured to standardize the device and to minimize variations in measurements. Understanding and controlling sources of imprecision are essential to the appropriate analytical use of specimens that are collected on filter paper; thus, CDC developed criteria that contribute to a national standard for ensuring filter paper's uniform performance. Without the criteria, laboratories would be unable to perform reliable quantitative measurements. During fiscal year 2001, CDC evaluated several production lots of filter paper from commercial sources before their release to newborn screening programs and determined that all lots met approved performance criteria. Activities of this validation program for filter



A baby's heel is stuck to obtain blood to screen for metabolic and other disorders. CDC is the sole provider of comprehensive external quality assurance services for newborn screening programs.



paper have improved performance of the device and its acceptance for use in a variety of assays.

**Quality Ensured for Newborn Screening Tests**

CDC's Newborn Screening Quality Assurance Program ensures that newborn screening services provided by participating laboratories are accurate and of the highest quality. In the past year, 256 laboratories in 46 countries participated in external quality assurance (EQA) activities for inherited metabolic disorders. Forty-nine new participants, including the Ukraine, Luxembourg, Colombia, Turkey, and Denmark, were enrolled in the EQA program. This program provides a check for laboratories, giving immediate feedback to those who misclassify specimens so that they can take timely corrective action. Through close interaction with screening laboratories, CDC helps to ensure that affected babies are correctly identified, cases of disease are not missed, and the number of false-positive test results is minimized. CDC is the sole provider of comprehensive EQA services for newborn screening. In fiscal year 2001, CDC expanded the program to include EQA services for an additional 20 disorders that screening programs can detect using new technologies.

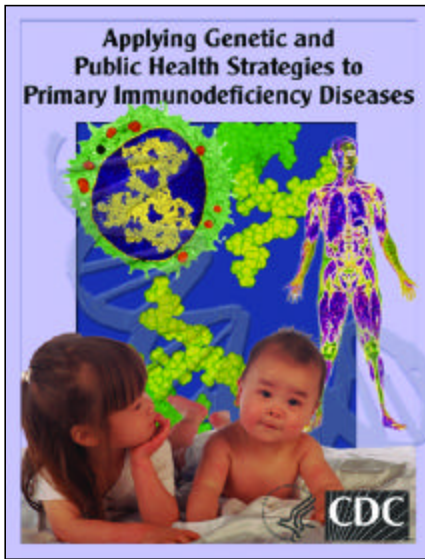
**Primary Immunodeficiency Diseases Get Public Health Scrutiny**

To identify emerging targets for prevention research, CDC convened an international conference on immunodeficiency diseases caused by single-gene disorders. Attendees reported that children born with severe combined immunodeficiency disorders

(SCIDs) can be rescued from early death by new interventions, such as stem-cell transplants (from donor bone marrow or umbilical cord blood) and gene-replacement therapy. Effective intervention must begin during the first few months of life while immunity transferred from the mother still protects the baby. Attendees also called on CDC to investigate newborn screening for SCIDs because of this narrow window of opportunity and the invariably fatal outcome of untreated disease. CDC identified candidate tests and is evaluating their technical feasibility.

**Blood Spots from Newborns Used to Test for Diabetes Risk**

During 2001, scientists supported by CDC tested dried blood spots obtained from more than 10,000 newborns in Washington State to identify a cohort at higher risk than other newborns for type 1 diabetes. The dried blood spots had been collected for newborn screening and stored by the Washington State Department of Health, making this the first time that samples from a newborn screening repository were used for diabetes research. CDC also collected 12,000 dried blood spots from other people with known genetic risk factors to use as reference materials. Using these materials, CDC designed a proficiency-testing program involving six diabetes research centers in Europe and the United States. The purpose of the program is to help ensure the equivalency of performance in all centers that conduct diabetes research. The program will be expanded to additional centers that undertake similar population-based studies on type 1 diabetes.



An international conference convened by CDC focused on immunodeficiency diseases caused by single-gene disorders.



## Environmental Health Studies

**CDC Investigates Nevada Cancer Cluster** In February 2001, the health officer for the state of Nevada reported a statistically significant increase in the incidence of acute lymphocytic and myelocytic leukemia (ALL/AML) in Churchill County. Local residents had expressed concern about pesticides applied to agricultural fields, pesticide run-off from these fields to irrigation ditches in which local children swim, arsenic in drinking water, and jet fuel used at the Fallon Naval Air Station. Fifteen children were diagnosed with ALL or AML from 1997 through 2001; for the previous decade, the expected rate of occurrence for the illness was 2.4 cases per 100,000 children, or one case every 5 years.

The Nevada State Health Division asked CDC to evaluate risk factors or etiologic exposures linked to this cluster of childhood leukemia and to design and conduct a cross-sectional exposure assessment of selective contaminants using environmental and biologic specimens collected from the case families and a reference population. The Agency for Toxic Substances and Disease Registry (ATSDR) was also asked to conduct an exposure-pathway assessment.

From August to November 2001, CDC operated a field office in Fallon, Nevada, that was equipped with a temporary laboratory facility that allowed precise aliquoting of blood and urine samples prior to shipment to CDC's environmental health

laboratory. Staff from the Nevada Division of Environmental Protection coordinated field teams to collect environmental samples from study subjects' current and previous residences. Samples were collected from more than 130 homes and from approximately 200 people, including case children, their parents, and their siblings as well as from reference children and their parents.

In December 2001, CDC began analyzing questionnaire, biologic, and environmental data. CDC scientists will assess chemical and radiologic exposures among participating children and their families. CDC's environmental health laboratory is analyzing urine and blood samples for the presence of 132 chemicals and is also measuring levels of 15 volatile organic compounds in the blood of the affected children and their families. CDC laboratory scientists will assess variations in genes involved in metabolizing toxic substances and any DNA repair occurring as a result of environmental exposures. CDC scientists will also extract DNA from blood and buccal cells and store it for future studies.

A statistical analysis group formed within CDC began refining an analysis plan that includes cross-sectional analysis for exposure assessment and a comparison of case and control data. CDC is working with ATSDR to use geographic information system technology to map the locations of study subjects' homes and of possible points of contamination to determine likely exposure routes. A committee comprising representatives from CDC and ATSDR, the United



The small town of Fallon, Nevada, is the site of an intense investigation into the causes of a higher-than-expected number of leukemia cases among area children.

States Geologic Survey, the Nevada State Health Division, and the Nevada Department of Environmental Protection will interpret analytical results and inform Nevada's state epidemiologist if elevated levels of environmental contaminants are found in any samples.

Data from the investigation will be useful in evaluating the contribution of environmental factors or chemical exposures to the elevated incidence of ALL/AML among children in Churchill County. CDC will release a final summary report in August 2002.

## Radiation Studies

**N**evada Test Site Study Takes a Step Forward CDC currently has a cooperative agreement with the University of Utah to conduct a follow-up study of thyroid disease among a cohort of people potentially exposed to fallout—specifically iodine-131—from nuclear weapons testing at the Nevada Test Site. This cohort was initially identified and examined from 1965 through 1970 and included children aged 12 through 18 years who were enrolled in schools in Washington County, Utah; Lincoln County, Nevada; and Graham County, Arizona. The proposed study will be the third examination of this cohort within the last 35 years. A 1985 follow-up study identified a weak association between exposure to radioactive iodine in nuclear fallout and benign

thyroid neoplasms. The Utah Thyroid Disease Cohort Study received both Office of Management and Budget and Institutional Review Board approval this year, moving it one step closer to implementation. Currently, the National Academy of Sciences (NAS) is reviewing the scientific protocol. The study will move forward when recommendations from the NAS review are addressed and a sound scientific protocol is in place.

**Workshop Held on Thyroid Disease Screening** With support from CDC and the National Cancer Institute (NCI), the Advisory Committee on Energy-Related Epidemiologic Research (ACERER) sponsored a workshop entitled "Targeted Screening for Thyroid and Parathyroid Disease in a Higher-Risk Population Exposed to Iodine-131." The goal of this workshop was to provide ACERER membership with information and guidance so that they can make informed recommendations about such screening to the Secretary of Health and Human Services (HHS). CDC staff, with input from workshop participants and the Office of the Secretary, have prepared and transmitted a summary of the proceedings to all ACERER members and consultants and workshop participants, including officials from CDC, the Agency for Toxic Substances and Disease Registry, NCI, HHS, and the Department of Energy.

**CDC Completes Research in Fernald Community** One site at which CDC has researched the health effects of radioactive contaminants from Department of Energy nuclear production facilities is Fernald, Ohio. For



Silos 1 and 2 of Operable Unit 4 at Fernald, Ohio. CDC's assessment of health risk to the nearby communities found that radon from radium-containing wastes in these silos was the most significant source of radiologic exposure for the public.

several decades this site, which is the former Feed Materials Production Center, served as a uranium-processing facility for the U.S. nuclear weapons production complex. Since requested to do so by Congress in 1988, CDC has estimated off-site exposure to community members, conducted risk analyses of several types of cancer, and assessed the feasibility of conducting a scientifically sound epidemiologic study (subsequently determined not to be feasible). On the basis of the results of a dose reconstruction study, CDC determined that radioactive substances, including uranium, thorium, radium, and radon daughter products, migrated off site and exposed members of the surrounding communities. What was unexpected, though, was CDC's finding that radon released from radium-containing waste stored on site—not uranium—created the most significant radiologic exposure for the communities

surrounding the site. A CDC assessment of risk from these exposures concluded that the number of lung cancer deaths in the assessment population may increase by 1% to 12% as a result of exposure to radioactive material released from the site from 1951 through 1988.

CDC shared with community members information from risk analyses about potential health effects from off-site exposures. This information formed a basis for community seminars that the Agency for Toxic Substances and Disease Registry (ATSDR) developed. Although CDC has no future work planned in the Fernald community, CDC staff will continue to review research findings relating to health effects among community members and the possible links to the Fernald site. After consulting ATSDR, CDC discontinued its federally chartered advisory committee at the site this year.

### **Scientists Consider Public Health Consequences of Radioactive Fallout**

In collaboration with the National Cancer Institute, CDC scientists have prepared a report on the feasibility of conducting a study of the health consequences to the American people from radioactive fallout due to historic U.S. and global atmospheric nuclear weapons testing. For the first time, estimates have been made of preliminary doses and health risks from exposure to radioactive fallout from nuclear weapons tests conducted in the atmosphere from 1951 through 1962. This large two-volume report, which currently is undergoing department review, will





CDC's estimates of amounts of some hazardous materials released to air and water at the Savannah River Site (SRS), a U.S. Department of Energy site in close proximity to wetlands, agricultural land, and woodlands and underlain by an aquifer, are higher than those estimates previously provided by SRS.

undergo an extensive scientific peer review in fiscal year 2002. Congress and the Department of Health and Human Services will review the results of this feasibility study to determine whether the federal government should pursue a more comprehensive study of health consequences.

**International Radiation Data to Be Made Available to Researchers** A number of unintentional or operational releases of radioactive material to the environment have occurred at locations around the world. Radiation data compiled as a result of these events can be used in the development and testing of mathematical models that are used to assess the public health impact of radioactivity releases to the environment. With support from CDC, a number of international sets of data that can be used for this purpose have been identified and compiled. CDC will post these data sets on the Internet during calendar year 2002 so that

radiation health scientists can use them to develop and test methodologies for assessing the public health effect of various types of radionuclide releases into the environment.

**Public Receives Estimates of Toxic Materials Released at the Savannah River Site** CDC released to the public and posted on the Internet (<http://www.cdc.gov/nceh/radiation/savannah/default.htm>) a report describing estimates of the amounts of radionuclides and chemicals historically released into the environment by the Savannah River Site nuclear weapons facility. The release estimates provided in this report for radioactive iodine and plutonium are higher than the estimates previously provided by the Savannah River Site. CDC's ongoing Savannah River Site Environmental Dose Reconstruction Project will use these results to estimate the health risks to people of chemicals and radioactive materials previously released from the site.



**Agencies and Stakeholders Collaborate to Improve Advisory Committee Process** Public input is essential to CDC and the Agency for Toxic Substances and Disease Registry's (ATSDR's) research and public health activities involving communities and workers at nuclear weapons production facilities. Consequently, community-agency partnerships have been established through a system of site-specific citizen advisory subcommittees (referred to as health effects subcommittees). CDC recently completed an evaluation of this advisory process, the goal of which was to improve the effectiveness of the process. The evaluation addressed issues such as the effectiveness of the subcommittees in providing advice and the agencies' use of this advice, the effect of the advisory process on research credibility and trust, and the role of the subcommittees in outreach activities. Another issue that was addressed was the adequacy of resources. This evaluation used a participatory approach and included representatives from CDC, ATSDR, the subcommittees, and an independent evaluation contractor. The contractor compiled the key findings. On the basis of these findings, the contractor developed 17 recommendations for agency staff and subcommittee members to improve the subcommittee process. The endeavor was one of the first multisite evaluation projects guided by CDC's *Framework for Program Evaluation in Public Health*. CDC, ATSDR, and subcommittee members are continuing their collaboration in improving the subcommittee process as they review and implement the recommendations from this evaluation.

## Veterans' Health Activities

**R**esearch Programs Initiated to Improve Health Risk Communication CDC awarded \$337,693 to Rutgers University for the project "Improving Health Risk Communications to Prevent Unexplained Illnesses Related to Military Deployments." This project will assess knowledge, attitudes, and beliefs of healthy and ill Gulf War veterans and current active duty military personnel about chemical, biologic, and radiologic agents. The project will develop and evaluate risk communication materials about these agents as well. CDC also awarded \$461,177 to the Henry M. Jackson Foundation for the project "Health-e VOICE: Optimized Implementation of a Stepped Clinical Risk Communications Guideline." This project will develop and evaluate an interactive, Web-based distance-learning tool for improving communication between Department of Defense health care providers and veterans regarding deployment-related health concerns.

**Mortality Follow-Up Study of Vietnam Vets Initiated** This study will collect vital status data from the National Death Index Plus, the Veterans Administration Beneficiary Identification and Record Locator System, and the Social Security Administration Death Master File regarding the 18,313 veterans who were eligible to participate in CDC's Vietnam Experience Study. CDC developed a protocol and obtained Institutional Review Board approval in November 2001. Data collection began in December 2001. The purpose

of the study is to determine if Vietnam veterans are experiencing any excess mortality compared with their nondeployed peers. Back in the 1980s, CDC conducted the Vietnam Experience Study, which assessed both mortality and morbidity of a cohort of U.S. Army Vietnam veterans and a comparison group of U.S. Army personnel who served at the time of the Vietnam War but who were not deployed to Vietnam. The original mortality component assessed mortality through 1983. This study will conduct a follow-up to determine mortality through 1999. Results are expected by the end of 2002.

**Web Library to House Gulf War-Related Health Documents** CDC provided \$200,000 for the development of a Web-based research library of reports and articles about government-sponsored research on the health effects of military deployment during the Gulf War. The centralized library will be an easily accessible Internet tool designed to meet the needs of researchers, health care providers, veterans, and the general public. The library is being created through an interagency agreement between CDC and the Office of the Special Assistant to the Under Secretary of Defense (Personnel and Readiness) for Gulf War Illnesses, Medical Readiness, and Military Deployments. A workable Web site is expected to be completed in 2002.

## Asthma



# Success Stories

**CDC Reaches Out to Medically Underserved Children with Asthma**

CDC contracted with the Alliance of Community Health Plans to implement the National Cooperative Inner-City Asthma Study intervention in 23 clinics serving communities with medically underserved children who have moderate or severe persistent asthma. The primary purpose of the intervention is to translate asthma knowledge into skills and behavior changes that will reduce asthma severity and frequency of symptoms in children by encouraging them, together with their family members (or other caregivers), to assume direct responsibility for controlling symptoms. The severity and cause of each child's asthma varies, as does each family's capacity to take responsibility for managing the disease. This project is designed to work with these unique differences to achieve the greatest possible level of improvement for each child. The project goal is to work with 60 children the first year and 80 children yearly thereafter.

The El Rio Health Center in Tucson, Arizona, which is one of the Inner-City Asthma Intervention (ICAI) projects, was first funded in March 2001. CDC provided \$100,000 to the center for its first year of activities. As of November 2001, the center had enrolled more than 60 children and had a waiting list of children and families who want to be part of the program.

The key person in the intervention is the asthma counselor, who uses a standardized assessment tool to identify risk factors for the four problems

slated for intervention: access to primary care for asthma, adherence, behavior, and environment. The first 2 months of the intervention are semistructured, involving both group and individual sessions with child and family. Activities are then tailored to each family, focusing on environmental, medical, or special training, as needed. As the counselor tailors the intervention and learns of a family's specific circumstances, problems are often identified that can't be dealt with directly. The counselor refers these types of issues either back to the child's care provider or to another service that can address the problem. As the family begins participating in the tailored activities, the counselor maintains contact on a monthly basis throughout the intervention year, both by phone and in person. This contact enables the counselor to assess progress and provide continual reinforcement of key intervention concepts.

The asthma counselor at the El Rio Health Center worked with the University of Arizona Biomedical Center to create intervention tools in Spanish. Group and individual sessions are conducted in both English and Spanish. The project secured additional funding from nonfederal sources to purchase medications and to pay for pulmonologist visits, when indicated, for children with no insurance. To help the children and their families, the El Rio staff developed a notebook to record important telephone numbers and to keep track of medication refills and times to use the peak flow meter. The notebook also included instructions on how to determine whether a child with asthma symptoms should go to school.

The intervention was initially designed to include a role-playing component in the group training sessions. However, because the population served in this location was not comfortable engaging in role-playing, the counselor had helpers act out scenarios for the clients to watch. This enabled participating families to learn and discuss the role playing as a group and to benefit from this interaction without feeling pressured to participate. Children in the project are given awards for responsible behavior rather than for attendance at meetings. A \$20 gift certificate is awarded to children who take their medications and use their peak flow meters as prescribed by their individual asthma management plans. Parents report that their children have never been so good about taking their medications. Children participating in the project have learned so much and enjoyed the program to such an extent that the asthma counselor has set up an extra "reunion" session for the children to see their new friends and catch up on each other's progress.

The asthma counselor has worked with the schools and school nurses to allow children in the project to use albuterol and a peak flow meter and spacer at school when needed. The counselor also has provided school staff and nurses with asthma trigger information and copies of the children's asthma action plans.

The children and their parents have found the project to be both valuable and helpful. The key to this project's success has been the ability of the project staff to make the learning environment culturally sensitive, supportive, and interesting.



A CDC project identified two asthma intervention programs as science-based programs that are being successfully implemented at the community level to help children with asthma.



**From Science to Intervention: Determining What Works for Asthma** Across the country, people and organizations are searching for ways to prevent the rising rates of asthma in their communities. Asthma's impact is especially felt in the poorest inner-city areas. In 1999, CDC initiated action to identify science-based asthma interventions that could be replicated in a variety of community settings and to share this information at the state and local levels. CDC engaged the services of a contractor to (1) search the literature for research studies on asthma and (2) follow up with principal investigators to find out which studies actually had been implemented in hospital, clinic, school, or other community-based settings. The contractor discovered that despite the fact that many successful asthma research studies have been conducted over the past decade, only two have made a successful transition to an implemental intervention—Open Airways for Schools, prepared by the American Lung Association, and Asthma Care Training for Kids, a program from the Allergy and Asthma Foundation of America.

Finding out how few fully translated interventions were available was significant because it helped CDC better formulate its program activities for fiscal year (FY) 2001 and better understand the complexities of implementing successful asthma interventions at the community level. CDC used the knowledge it gained to contract for the translation of two more research study models in FY 2001. CDC also provided \$941,000 to fund seven local organizations, including hospitals and schools, to

implement Asthma Care Training for Kids and Open Airways for Schools. CDC shared the results of this effort with the National Asthma Education and Prevention Program, which is under the auspices of the National Heart, Lung, and Blood Institute and is the lead federal agency for coordinating efforts in asthma control. This year, CDC is updating its literature search, speaking to asthma experts across the country, and revising its inclusion criteria in an effort to identify more research models that may have been missed and to consider existing interventions which, although they may have not been based on research studies, warrant consideration on the basis of their strong evaluation results. The work is challenging and illustrative of the complexities of asthma—a disease that cannot yet be cured but can be controlled. CDC will continue its efforts to identify and fund successful interventions that can make a measurable difference in the lives of people with asthma.

## Biomonitoring

**DC's Report on Human Exposure to Environmental Chemicals Grabs National Spotlight** In March 2001, CDC issued its much anticipated *National Report on Human Exposure to Environmental Chemicals*, a rigorously scientific "state of the nation" examination of levels of 27 environmental chemicals measured in a representative sample of the U.S. civilian population. From the ubiquitous metal, lead, to certain everyday pesticides and a host of plasticizers called phthalates, Americans got a glimpse of what they're being exposed to in their

*The key to the success of the Inner-City Asthma Intervention project has been the ability of the project staff to make the learning environment culturally sensitive, supportive, and interesting.*

environment. But the critical point is that these chemicals were measured in *people*, not in air, water, soil, or food.

Some of the measurements told us that levels of certain chemicals, such as cotinine, a marker for exposure to tobacco smoke, had gone down by a dramatic 75% since they were last measured during the period from 1988 through 1991; however, 24 of the chemicals (metals, organophosphate pesticides, and phthalates) listed in the *Report* had never been measured before in the U.S. population. The *Report* also established reference ranges for these 24 chemicals, documented the continued decline of blood lead levels among children since levels were measured during the period from 1991 through 1994, provided a better assessment of children's and women's exposure to mercury than was previously available, and helped to set priorities for additional research on phthalates.

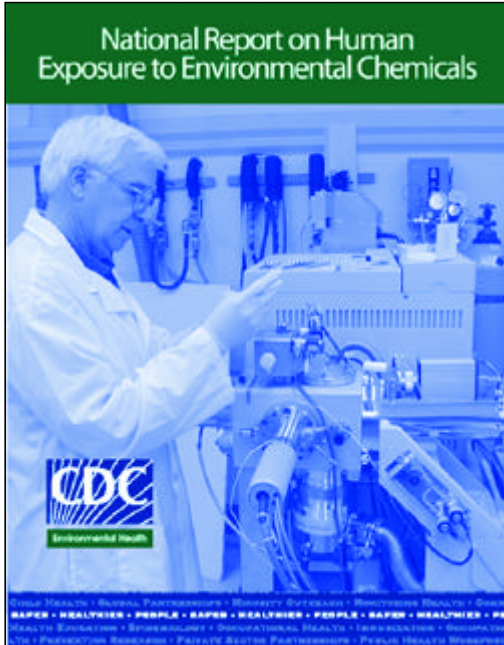
The *Report* provided information from the National Health and Nutrition Examination Survey (NHANES), CDC's ongoing national survey of the general U.S. population. NHANES is unique in its ability to examine public health issues that can best be addressed through physical and laboratory examinations of the U.S. population. This first *Report* was restricted to general population data from NHANES for 1999.

CDC scientists have been measuring chemicals in people for at least 25 years, both for national studies of population exposures and for studies

to examine exposures of specific populations. The work of these scientists has ranged from assessing exposures that resulted in acute disease or death to assessing those exposures that in the long term may cause cancer, birth defects, neurologic deficits, or other chronic diseases or conditions. CDC scientists also anticipated the need to measure levels in people exposed to unknown chemical agents that might be used by terrorists, and they have been working with state partners to increase the states' capacity to respond to these kinds of threats.

The success of the first *Report* is a direct result of the exceptional dedication, scientific acumen, and visionary work of hundreds of people in the laboratory doing their "ordinary" jobs to protect public health every day—around the clock, if needed. These scientists have a keen and abiding interest in discovery and innovation and a determination and sense of urgency to persevere until they "get it right." And they did.

Launched simultaneously through the National Center for Environmental Health's Web site and at a Washington, D.C., meeting with CDC's partners, the *Report* received close scrutiny by public health advocates and industry and widespread coverage and requests for interviews by national print and broadcast media. This coverage generated hundreds of requests for information from health care professionals and lay audiences worldwide.



The *National Report on Human Exposure to Environmental Chemicals* revealed levels of 27 chemicals measured in a sample of people in the United States.

## Public Health Emergency Response

**I**nvestment in the National Pharmaceutical Stockpile Program Proves Invaluable After Terrorist Attacks Established by CDC 2 years ago, the National Pharmaceutical Stockpile (NPS) Program evolved from CDC's recognition of the need for America to establish a lifesaving, highly mobile resource to respond to a national terrorist attack. CDC's investment in this resource proved to be invaluable on September 11, 2001. While America was just beginning to comprehend the full repercussions of the attacks in New York City



National Pharmaceutical Stockpile Program staff loading cargo into wide-body aircraft to respond to the terrorist attacks.

and Washington, D.C., and while all other commercial aircraft were grounded, CDC's NPS Program staff were reporting to their emergency operations center (EOC) to arrange for air transportation for Technical Assistance Response Unit (TARU) members and other CDC emergency personnel. Next, they immediately began operations to deploy to New York City the first

12-hour push package, a portable, fully stocked repository of drugs, antidotes, and medical/surgical supplies designed to resupply state and local public health agencies during a terrorism incident.

CDC had trained TARU members to accompany push packages and to be prepared to start, operate, and repair the packages' counting/packaging machinery as well as provide detailed consultation and technical assistance to local health and emergency personnel. CDC also had secured specialized cargo containers for the push packages and had updated methods used for repackaging and distribution. These measures were soon to pay off for the American people.

The EOC was fully staffed and functional at 9:00 AM, within 15 minutes after the report of the first plane crash into the World Trade Center; the request from New York State and local officials for a push package came in at 2:43 PM. By that time, NPS Program staff had contacted all their commercial and government partners and had coordinated the logistics for moving the push package from its undisclosed location. Within 30 minutes, a push package was deployed for the first time in history. The push package, which can be transported by either air or ground, was transported by ground on September 11 and had taken only 7 hours from the time of the request to reach its destination, exceeding expectations for response time.

By 6:30 PM, members of TARU were on the ground in New York City, providing assistance to

the mayor's office. When the push package arrived at 10:00 PM, members of TARU met it and helped public health and emergency personnel rapidly procure, transport, and stage NPS assets. NPS Program staff also arranged for rapid delivery of more than 60 loads of vendor-managed inventory (VMI) to New York City. VMI packages, which contain drugs and medical supplies like push packages but which can be tailored to a specific situation, began arriving in New York City within 12 hours of the official request.

During the crisis, the NPS Program was responsible for the delivery of thousands of pounds of drugs, supplies, and protective equipment for victims and rescue workers. Only 2 years old, the NPS Program had been tested in a real-life terrorist attack. By all accounts, it passed with flying colors.

## Childhood Lead Poisoning Prevention

**H**igh-Intensity Targeted Screening Exemplifies Effective Collaboration Between CDC, Communities, and Key Organizations CDC has made a commitment to eliminate childhood lead poisoning in the United States by 2010. Reducing blood lead levels (BLLs) to less than 10 µg/dL of blood is a tall order, requiring CDC to rapidly identify and follow up on large numbers of high-risk children. How can such a feat be accomplished? One way is by teaching states how to conduct high-

intensity targeted screening (HITS) on a door-to-door basis. CDC's Lead Poisoning Prevention Branch completed the first HITS project in two inner-city communities in Chicago in November



One of the 581 inner-city Chicago children whose blood lead levels were measured in CDC's High-Intensity Targeted Screening project. The project was a collaborative effort among CDC and other federal, state, and local agencies.

2001. CDC's environmental health laboratory trained 20 teams (comprising 100 Chicago Department of Public Health staff members who worked in lead poisoning prevention) in the proper way to collect and analyze blood lead samples. CDC also assembled sample kits for each of the 20 teams and provided technical assistance and advice in the field. This first HITS project was a collaborative effort among CDC, the Chicago Department of Public Health, the Illinois Department of Public Health, the Department of Housing and Urban Development, the U.S.

*Established by CDC 2 years ago, the National Pharmaceutical Stockpile evolved from the need for America to establish a lifesaving, highly mobile resource to respond to a national terrorist attack.*



Environmental Protection Agency, and the Centers for Medicare and Medicaid Services.

CDC selected the two communities—Austin and Englewood—for two reasons: (1) their rates of elevated BLLs were among the highest in the nation and (2) the Chicago Lead Poisoning Prevention Program (CLPPP) wanted to determine whether it was identifying and screening all high-risk children.

During the 3-week project, CDC assisted with study design, provided laboratory support, and collected and analyzed data. Americorp workers, community members, staff from the Chicago Department of Public Health, and graduate students from Emory University's Rollins School of Public Health conducted door-to-door screening. The Westside Health Authority and the Englewood Neighborhood Health Center provided the base of operations from which project participants worked.

Blood samples were collected from 581 children 12 to 71 months of age. The families of the tested children received educational materials, and when children were identified with elevated BLLs, the families were offered appropriate medical management and a home investigation to identify all possible sources of lead exposure.

The director for CLPPP declared that the Chicago HITS project was a success because it had forged partnerships and stimulated community interest in eliminating lead poisoning among children. CLPPP plans to use HITS data to improve screening plans, better direct resources, and

monitor progress toward eliminating childhood lead poisoning. At least two more HITS projects are planned elsewhere in the nation in 2002. The methods developed by the Chicago HITS project can be replicated by other communities that want to collect representative baseline data in their efforts to eliminate childhood lead poisoning.

## Environmental Health Services

**P***rotocol for Assessing Community Excellence in Environmental Health Goes International* With a precedent-setting project in South America, CDC debuted in an international setting the successful *Protocol for Assessing Community Excellence in Environmental Health* (PACE-EH). PACE-EH was developed by the National Association of County and City Health Officials with funding from CDC. Through the CARE-CDC Health Initiative, both agencies helped build local capacity in public and private sectors to conduct community-based environmental health assessments in two Peruvian communities. The project collaborators used PACE-EH in planning and conducting the environmental health assessment activities, making the project the first implementation of PACE-EH outside the United States. Because of the success of the project and the development of a community health assessment capability, the U.S. Agency for International Development decided to fund the \$2.5-million, 3-year project for CARE Peru to establish environmental health capacity in three additional communities. CDC is now assisting these communities in (1) characterizing and



CDC and CARE are teaching communities in Peru to use the *Protocol for Assessing Community Excellence in Environmental Health* to address public health issues such as drinking water supply. Here, children draw water from a public well while staffers discuss the issues.

evaluating local health conditions and concerns, (2) identifying their environmental health risks and hazards, (3) collecting meaningful environmental data to establish a monitoring system for environmental health-related issues, and (4) setting priorities for actions to address environmental health problems and prepare effective interventions. CDC determined that including community residents throughout the assessment process aided their understanding of complex environmental health issues. This increased understanding has enabled the communities to develop practical solutions to improve their environmental health conditions.

## Genomics

### **I**nformed Consent Document Is Developed for Participants in Population-Based Studies

Research involving genetics must be conducted ethically and must include the informed consent of study participants. However, little guidance has been available for population-based studies of common gene variants with low to moderate individual disease risks. Recommendations developed for family-based research are not well suited for most population-based studies because the recommendations generally do not distinguish clinically relevant information from epidemiologic data, which are meaningful only at the population level and

involve few physical, psychological, or social risks for individual participants. In response to this dilemma, CDC worked with a multidisciplinary group of experts and developed content and process guidelines for informed consent for population-based genetic research studies. The guidelines address several important issues. The consent document must include information that outlines why the study is being done, what is involved in the study, how information collected about research subjects will be kept confidential, and what the risks and benefits might be for study participants. The consent document must clearly state what is to be done with any remaining biologic samples when the study is completed. In addition, some genetic studies may have the potential to result in a product with commercial value. When this possibility exists, it should be disclosed along with a statement about whether participants would share in any profits.

An article about these guidelines for informed consent for population-based genetics research was published in the November 14, 2001, issue of *JAMA*. This new informed consent document and supplemental brochure are intended to help people make informed decisions about participating in genetic studies and, in turn, to help bridge the gap between gene discovery and the ability to use genetic information to improve health and prevent disease.



Information provided to participants in genetics studies must include information about (1) the study, (2) the measures being taken to protect participants' privacy, and (3) the risks and benefits.



# Asthma

**Asthma Death Rates Increase Among Elderly White Females** Although death rates for asthma increased between 1979 and 1997, analyses to determine the demographic subgroups most affected by the increase have not been conducted. In response to this need, CDC used Underlying Cause of Death files for 1979 through 1995 to calculate annual and age-, sex-, and race-specific death rates. The results showed that deaths from asthma increased from 2,603 in 1979 to 5,645 in 1995. In the single variable analysis, rates of asthma mortality increased more in people older than 65 years of age than in younger people, in women more than in men, and in African-American women more than in white women. When considering age, sex, and race simultaneously, the single subgroup that accounted most for the increase in asthma mortality was white women aged 65 years and older. Subgroup characteristics are important considerations when interventions are planned and outcomes are assessed.

Moorman JE, Mannino DM. Increasing U.S. asthma mortality rates: who is really dying? *J Asthma* 2001;38(1):65-71.



**Olympic Games Provide Insight on Traffic, Air Quality, and Asthma Control**

Although ozone and particulate pollution are associated with transient increases in asthma morbidity, the impact of citywide transportation changes on air quality and childhood asthma has not been studied. The alternative transportation strategy implemented in Atlanta during the 1996 Olympic games provided an opportunity to conduct such a study. In this study, CDC compared the 17 days during which the Olympics took place with the 4 weeks preceding and following the games. During the Olympics, numbers of acute care visits for asthma decreased 44% and numbers of emergency room visits decreased 11%; however, numbers of nonasthma-related acute medical visits did not change. Ozone, particulates, and carbon monoxide levels dropped 28%, 16%, and 18.5%, respectively. One-hour peak AM weekday traffic counts dropped 22.5%. Traffic counts were significantly correlated with peak ozone levels. These findings suggest that decreasing automobile congestion, especially during the critical morning rush-hour period, can improve air quality and have a substantial impact on the burden of asthma among our cities' children. Thus, the study provided important experimental evidence that traffic patterns, air quality, and respiratory health are causally linked.

Friedman MS, Powell KE, Hutwagner L, Graham LM, Teague WG. Impact of changes in transportation and commuting behaviors during the 1996 summer Olympic games in Atlanta on air quality and childhood asthma. *JAMA* 2001;285:897-905.

**Medical Examiners' Investigation Sheds Light on Elevated Asthma Mortality Rate**

The asthma death rate for New York City is twice the rate for the entire country. To better understand the circumstances surrounding the asthma deaths, CDC abstracted medical examiner (ME) files for asthma-related deaths in New York City for 1995 through 1997. Investigators' field reports were available for 96% of the ME cases, as were pathology reports for 63% of the cases, toxicology reports for 68% of the cases, and microscopic examination reports for 56% of the cases. Forty-four percent of deaths occurred without medical attention. Pathology findings were consistent with death caused by acute asthma. Drugs with abuse potential were detected in 38% of people for whom toxicology reports were available. These detailed analyses of ME cases show that a substantial number of asthma-related deaths occurred without medical attention and that use of drugs with abuse potential may be a risk factor for asthma-related death in New York City. CDC will conduct more detailed analysis of the study's data to identify aspects of severe asthma exacerbations that have intervention potential and that may be used to prevent deaths from asthma in the future.

Moorman JE, Mannino DM, Redd SC, Matte T, Garg R, Leighton J, et al. Asthma mortality in New York City: medical examiner's data. American Thoracic Society meeting, San Francisco, May 2001.



A CDC study of New York City medical examiner files showed that 44% percent of asthma deaths occurred without medical attention. Another CDC study of asthma deaths revealed that asthma death rates increased more in elderly white women from 1979 through 1995 than in any other group.



**Asthma Hospitalizations More Prevalent in Northeast United States** Hospitalization rates for asthma in the Northeast have been higher than in other regions for the past 20 years. To assess whether these higher rates in the Northeast reflect differences in asthma presentation or severity or general differences in hospitalization practices, CDC examined regional differences in asthma hospitalizations from 1988 through 1996 using data from the National Hospital Discharge Survey. From 1988 through 1996, the age-adjusted rate of hospitalizations for asthma as the first-listed diagnosis increased in the Northeast but declined in other regions; however, the age-adjusted rate for all hospitalizations declined in all regions. These results indicate that the higher rates of hospitalization for asthma observed for the Northeast are not related to general hospitalization patterns and thus suggest that asthma in that region may present more severely. Further studies are needed to verify whether asthma indeed does present more severely in the Northeast, and if so, why.

Homa DM, Mannino DM, Redd SC. Regional differences in hospitalizations for asthma in the United States, 1988–1996. *J Asthma*. In press 2002.

**Asthma Types Can Be Determined from NHANES Data** CDC used NHANES III data to categorize children aged 6 through 16 years ( $n = 5,683$ ) into three distinct *a priori*-defined asthma types: “allergic,” representing children with asthma who have a positive skin test result to one or more of 10 allergens; “nonallergic,” representing children who have a negative skin

test result to all 10 allergens; and “resolved,” representing children who have a history of asthma but no current symptoms. Among all surveyed children aged 6 through 16 years, 6.5% had allergic asthma, 1.5% had nonallergic asthma, and 3.4% had resolved asthma. Lung function was measured as the ratio of forced expiratory volume over 1 second to forced vital capacity (FEV1/FVC); people with an FEV1/FVC ratio less than 80% were considered to have diminished lung function. A greater proportion of children with nonallergic asthma had diminished lung function (48% compared with 35% for children with allergic asthma); 39% of children with resolved asthma had an FEV1/FVC ratio less than 80%. Children with allergic asthma and children with resolved asthma had similar lung function results. This analysis, which demonstrates that distinct asthma types can be identified from epidemiologic data, may help researchers better understand the disease.

Homa DM, Mannino DM, Redd SC. Characterization of asthma types for children aged 6-16 years from NHANES III. Abstract submitted for the American Thoracic Society International Meeting, May 17–22, 2002, Atlanta, GA.

## Biomonitoring

**R**elation Examined Between Premature Births and Exposure to Chlorinated Pesticides In 1999, 11.8% of all babies in the United States were born prematurely. To examine the relation between premature birth



Health effects of exposure to pesticides were examined in three CDC studies: one on premature births and pesticide metabolites, one on pesticide metabolites found in children's bodies, and one on pesticide metabolites found in the meconium of newborns.

and exposure to chlorinated pesticides, particularly to DDT and its metabolite DDE, CDC collaborated with the National Institute of Environmental Health Sciences (NIEHS) to conduct this study. Laboratory scientists measured concentrations of DDE in stored serum collected from pregnant women who gave birth during the period 1959 through 1966, when DDT was heavily used in the United States. Of the 2,380 babies born to these women, 361 were born prematurely. Statistical analyses revealed that the greater the level of DDE in a mother's blood, the greater the risk for a preterm delivery (i.e., less than 37 weeks' gestation). DDT is no longer used in the United States; however, in the 25 countries where it is used to control the mosquitoes that cause malaria, DDE serum levels can greatly exceed those found in the NIEHS/CDC study.

Longnecker MP, Klebanoff MA, Zhou H, Brock JW. Association between maternal serum concentration of the DDT metabolite DDE and preterm and small-for-gestational age babies at birth. *Lancet* 2001;358:110-4.

**Children Are at Greater Risk for Exposure to Organophosphate Pesticides** Protecting children from exposure to pesticides is a key environmental health concern. CDC collaborated on two important studies assessing exposure to organophosphate (OP) pesticides. One study, done in collaboration with the University of Washington Children's Environmental Health Center, was conducted in an agricultural community in the state of Washington. Investigators measured levels of chlorpyrifos and parathion among children aged 6 years or younger. Levels

of these neurotoxic agents were measured in house dust and surface-wipe samples, and their metabolites were measured in the children's urine. Study results showed that house dust in the homes of people who worked in agriculture or who lived near pesticide-treated farmland had higher levels of these pesticides than did the house dust in other homes in the same community but that most study children had very low or nondetectable levels of the metabolites of the parent compound in their urine.

In the second study, done in collaboration with the Columbia University Center for Children's Environmental Health, CDC scientists determined background levels, detection limits, and stability of six OP pesticide metabolites in the meconium of newborns. Scientists think that measuring pesticides in meconium may yield information about long-term exposure to these pesticides; existing biomarkers reflect only short-term exposure. All but two of the metabolites were detected in the meconium samples. Preliminary results thus indicate that, in general, pesticides do cross the placental barrier. More research is needed to evaluate the dose-response relation and to determine the time frame of exposure represented by the presence of the metabolites in meconium.

The work represented by these studies is particularly relevant to the 1996 Food Quality Protection Act, which requires the federal government to take special steps to protect children by increasing its scrutiny of children's exposure to pesticides. Two key provisions of the Act are the requirements that an additional

tenfold margin of safety be applied in setting tolerances for pesticide use and that aggregate and cumulative exposures be considered to ensure that infants and children are adequately protected from exposure through chemical residues or other sources.

Fenske RA, Lu C, Barr DB, Needham LL. Children's exposure to chlorpyrifos and parathion in an agricultural community in central Washington state. *Environ Health Perspect* 2002. In press.

Whyatt RM, Barr DB. Measurement of organophosphate metabolites in postpartum meconium as a potential biomarker of prenatal exposure: a validation study. *Environ Health Perspect* 2001;109:417–20.

**Additional Health Consequences of Exposure to Dioxin Found** During fiscal year 2001, CDC scientists continued their efforts to link exposure to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin to adverse health effects in people. Studies completed in 2001 show a statistically significant association between levels of dioxin and breast cancer among women who were exposed to dioxin after a major explosion in a chemical plant in Seveso, Italy, in 1976. Dioxin persists for a long time in the body, and CDC's environmental health laboratory has the ability to measure dioxin exposure in human samples many years after that exposure has occurred. In another study, CDC, in collaboration with the Department of Veterans Affairs, measured dioxin concentrations in veterans who served in Vietnam in the U.S. Army's Chemical Corps and sprayed Agent Orange, a dioxin-containing defoliant, from

backpacks. CDC determined that the dioxin concentrations found in recently collected serum from veterans who served in Vietnam more than 30 years ago can be used to identify exposure variables for a health survey of exposure to phenoxyherbicides, which contain dioxin. The Department of Veterans Affairs will now determine whether to conduct the health survey.

Warner M, Mocarelli P, Eskenazi B, Samuels S, Gerthoux PM, Needham LL, et al. Serum dioxin concentrations and breast cancer risk in the Seveso Women's Health Study. *Environ Health Perspect*. In press 2002.

Kang HK, Dalager NA, Needham LL, Patterson Jr DG, Matanoski GM, Kanchanaraksa S, et al. U.S. Army Chemical Corps Vietnam veterans' health study: preliminary results. *Chemosphere* 2001;43:943–9.

**CDC Collaborates with Denmark to Study *In Utero* Exposure to Polychlorinated Biphenyls and Mercury** Several environmental pollutants are neurotoxic and may cause adverse developmental effects after *in utero* exposure. In the early 1990s, children born in the Faroe Islands of Denmark were thought to have been excessively exposed to polychlorinated biphenyls (PCBs). CDC, working with Danish investigators, analyzed PCBs and chlorinated hydrocarbon pesticides in the umbilical cords of these children. As part of this continuing collaboration, CDC is now assessing fetal exposures to PCBs and mercury and their relation to 17 neuropsychological outcomes that are determined when children reach 7 years of age. One recent finding was that



A soldier sprays Agent Orange, a dioxin-containing defoliant, in Vietnam. In 2001, CDC (1) measured dioxin concentrations in serum collected recently from Vietnam veterans who sprayed Agent Orange from backpacks and (2) studied women who were exposed to dioxin after a chemical plant explosion in Italy.

PCB exposure alone did not account for adverse health effects seen during the extensive neurobehavioral and cognitive testing of these children. However, PCB-associated deficits were found in those children with the highest levels of exposure to mercury. Additional studies are ongoing to help resolve this important issue.

Grandjean P, Wiehe P, Burse VW, Needham LL, Storr-Hansen E, Heinzow B, et al. Neurobehavioral deficits associated with PCBs in 7-year-old children prenatally exposed to seafood neurotoxicants. *Neurotoxicol Teratol* 2001;23:305–17.

### Personal Activities Identified that Lead to Exposure to Volatile Organic Compounds In

collaboration with the Agency for Toxic Substances and Disease Registry, CDC studied blood levels of volatile organic compounds (VOCs) and questionnaire responses of participants in the National Health and Nutrition Examination Survey (NHANES) III (1988–1994) to determine whether certain activities were associated with increased VOC levels. VOCs have been linked to cancer and neurological and other health effects in animals and people.

This study showed statistically significant relations between lifetime pack-years of cigarettes smoked and internal-dose levels of benzene, toluene, and styrene. In addition, blood levels of acetone and 2-butanone increased with alcohol consumption. The study also found that using a well as a water source resulted in a statistically significant lower likelihood of having elevated levels of blood bromodichloromethane

(a disinfection by-product). Study results indicate the need for further investigation of activities that expose people to VOCs and how to minimize this exposure.

Churchill JE, Ashley DL, Kaye WE. Recent chemical exposures and blood volatile organic compound levels in a large population-based sample. *Arch Environ Health* 2001;56(2):157–66.

## Childhood Lead Poisoning Prevention

### Blood Lead Levels in Children Decline Nationally, but Problems Persist Locally

Lead poisoning can cause learning disabilities; behavioral problems; and at very high levels, seizures, coma, and even death. Blood lead levels (BLLs) equal to or greater than 10 µg/dL are considered elevated and warrant action to reduce exposure to lead. CDC responded to this call for action by analyzing data from the National Health and Nutrition Examination Survey (NHANES) 1999, NHANES III Phase 2, and the Childhood Blood Lead Surveillance (CBLs) program. The purpose of this endeavor was to determine childhood BLLs on the national, state, and local levels from 1996 to 1999.

NHANES, a continuous survey of the health and nutritional status of the U.S. civilian, noninstitutionalized population aged 6 months and older, provided data on average BLLs and percentiles but not on the prevalence of elevated BLLs. CDC analyzed CBLs data, which consisted of



CDC's study of blood levels of volatile organic compounds (VOCs) indicated that exposure to VOCs can be increased by personal habits such as smoking or drinking alcohol or decreased by ordinary activities such as using a well for a water source instead of tap water.



data that 19 states had reported to CDC, to identify the proportion of children with elevated BLLs among those tested from 1996 to 1999.

Children aged 1 through 5 years who had blood lead tests in NHANES in 1999 had lower lead levels than children tested in NHANES III Phase 2 (1991 through 1994). The geometric mean (the antilog of the mean of the logs) BLL, which is used for more rigorous population samples such as NHANES, decreased from 2.7  $\mu\text{g}/\text{dL}$  in NHANES III Phase 2 to 2.0  $\mu\text{g}/\text{dL}$  in NHANES 1999. CBLS data showed that the proportion of children tested with BLLs  $\geq 10 \mu\text{g}/\text{dL}$  decreased from 10.5% in 1996 to 7.6% in 1998 in the 19 states providing data. Within states, the proportion of children with elevated BLLs in counties with at least 200 children tested also varied considerably. Across all 19 states, the county-specific proportions of children with elevated BLLs ranged from 0.5% to 27.3%, indicating a concentrated proportion of elevated BLLs in specific populations or geographic areas.

The findings indicate that, despite the decreases in geometric mean BLL among children, the problem remains concentrated on a local level. These findings indicate the need for surveillance efforts to target screening activities to communities at highest risk.

CDC. Blood lead levels in young children—United States and selected states, 1996–1999. *MMWR* 2000;49(50):1133–7.

### Geographic Information System Data Used to Guide Lead Screening Strategies

Children living in older houses, which may contain leaded paint, are at greatest risk for lead poisoning; consequently, CDC recommends screening these children for lead. Geographic information system (GIS) technology, which has the capability to map areas with older housing, has helped state and local health departments, including Jefferson County's well-established Kentucky Childhood Lead Poisoning Prevention Program, assess and improve their screening efforts. This evaluation study focused on children aged 6 to 35 months and defined children at risk as those living in a home built before 1950 or in an area where at least 27% of the homes were built before 1950. The program combined birth record data, lead screening data, and tax assessor data to identify children at risk for lead poisoning and to determine the proportion of at-risk children who were being screened.

Findings showed that 50% of the children living in housing built before 1950 were screened for lead exposure in 1996 and 1997. Seventy-nine housing units were identified as posing an extraordinary risk to child residents, as evidenced by the fact that these units accounted for 35% of the instances in which more than one child resident had an elevated BLL equal to or greater than 20  $\mu\text{g}/\text{dL}$ . The GIS data analysis revealed that substantial numbers of at-risk children throughout Jefferson County, including those living in targeted screening areas, were not being tested for lead exposure. This study demonstrated how GIS can be useful to health



Elevated blood levels are found more often in children who live in housing built before 1950, when lead-based paint was still being used.

departments in planning lead exposure screening strategies and in measuring program performance.

Reissman DB, Staley F, Curtis GB, Kaufmann RB. Use of geographic information system technology to aid health department decision making about childhood lead poisoning prevention activities. *Environ Health Perspect* 2001;109(1):89–94.

**CDC Develops Recommendations to Ensure that Children Enrolled in Medicaid Undergo Blood Lead Screening** Because children who live in low-income families are at higher risk for lead poisoning than other children, federal law requires states to screen children who are enrolled in Medicaid for elevated BLLs through the Early and Periodic Screening, Diagnosis, and Treatment Program. However, national data collected from NHANES III (1991 through 1994) show that only 19% of children aged 1 to 5 years and 21% of children aged 1 through 2 years who were enrolled in Medicaid had received a blood lead test. In addition, the study showed that most (83%) of the U.S. children aged 1 to 5 years who had BLLs  $\geq 20$   $\mu\text{g}/\text{dL}$  were enrolled in Medicaid. The low screening and high prevalence rates among children enrolled in Medicaid prompted the Advisory Committee on Childhood Lead Poisoning Prevention to develop recommendations to ensure blood lead screening and follow-up care for young children enrolled in Medicaid. In December 2000, CDC published recommendations to health care providers, states, and other agencies that administer Medicaid programs. These

recommendations, if adopted by states, will help improve the delivery of lead-related services to young children.

CDC. Recommendations for blood lead screening of young children enrolled in Medicaid: targeting a group at high risk. *MMWR* 2000;49 (RR-14).

**Scientists Assess Blood Lead Levels of Children in Torreón, Mexico** In March 2001, Mexico's Environmental Protection Agency asked CDC to conduct an investigation to determine whether the children of Torreón were being exposed to hazardous levels of lead. This small town is home to a metal-processing plant (lead smelter) that is the largest in Latin America and the fourth largest in the world. Scientists from CDC's lead program and environmental health laboratory collaborated on the study. They measured the blood lead levels (BLLs) of children 1 to 6 years of age living in Torreón, particularly those children living in the area around the smelter, and assessed risk factors for lead exposure among these children. The strongest predictor of elevated BLLs was proximity to the smelter. Dust and soil lead levels were also highest closer to the smelter.

The geometric mean BLL of children in this study was 8.3 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ) for the smelter area and 5.5  $\mu\text{g}/\text{dL}$  for the cluster-survey area. (CDC has defined an elevated BLL as  $\geq 10$   $\mu\text{g}/\text{dL}$ .) The percentage of children with BLLs  $\geq 10$   $\mu\text{g}/\text{dL}$  was 33.0% for the smelter area and 16.7% for the cluster-survey area. These values



Children living near a metal-processing plant in Torreón, Mexico, were studied by CDC to determine their blood lead levels. Blood lead levels in these children were higher than in U.S. children but lower than in children studied in other communities where smelting operations had not yet been remediated.

are considerably higher than the geometric mean found among U.S. children, which in the early 1990s was 2.7  $\mu\text{g}/\text{dL}$  for children 1 through 5 years of age. The percentage of children in the U.S. population with BLLs  $\geq 10 \mu\text{g}/\text{dL}$  is 4.4%. A noteworthy point is that although mean BLLs and the percentage of children with elevated BLLs found in this study were higher than those levels observed in the United States, they were lower than those observed in previous studies of children in other communities (such as in British Columbia and Quebec, Canada) where smelting operations had yet to undergo remediation.

Letters were sent to households to inform parents of the results of their children's tests and of the environmental sampling. In these letters, parents whose children had BLLs  $\geq 20 \mu\text{g}/\text{dL}$

were encouraged to seek confirmatory blood tests; parents of children with levels  $\geq 45 \mu\text{g}/\text{dL}$  were asked to take their children to their health care provider for immediate follow-up. The costs of any needed medical treatment are to be covered by a trust set up by the metal-processing company.

CDC recommended that the community not only continue to monitor lead emissions and dust and soil levels in the areas around the processing plant but also target educational interventions to reduce lead exposure in Torreón children.

CDC. Blood lead levels and risk factors for lead poisoning among children in Torreón, Coahuila, Mexico. Final report. Atlanta (GA): Dept. of Health and Human Services (US), Centers for Disease Control and Prevention; 2001.

## Genomics

### CDC Publishes First-Ever Nationally Representative Prevalence Data for Hemochromatosis Genes

Scientists have taken a big step forward in helping to answer questions about hereditary hemochromatosis, the most common genetic disease in the United States. This genetic disease causes people to absorb excess amounts of iron from their diet that then accumulates in organs such as the heart, liver, and kidneys. This "iron overload" causes diseases such as cirrhosis and heart failure and in some cases, death. However, hemochromatosis can be prevented if detected early.



Hemochromatosis, an inherited disorder that causes people to absorb too much iron from their diet, is the most common genetic disease in the United States. CDC studied the prevalence in the white U.S. population of two gene mutations that, if inherited together, predispose a person to hemochromatosis.



CDC published the first population-based estimates of gene variants that are associated with hereditary hemochromatosis in the white U.S. population. These rare gene variants that predispose people to hereditary hemochromatosis are called *C28Y* and *H63D*. People in the white population who inherit two copies of one of these variants, or one of each of the variants rather than the normal form of the gene, will be susceptible to iron overload. In the United States, 5.4% of the population has at least one copy of the *C28Y* variant, and 13.5 % has at least one copy of the *H63D* variant.



In collaboration with the Council of State and Territorial Epidemiologists, CDC's Office of Genetics and Disease Prevention surveyed state public health officials about their concerns and projects related to genetics.

This study revealed that other gene variants must be found to account for the disease among African-American and Hispanic populations. Information about the prevalence of gene variants associated with the disease and the penetrance of these variants is critical for making public health decisions about genetic screening for this disease.

Steinberg KK, Cogswell ME, Chang JC, Caudill SP, McQuillan GM, Bowman BA, et al. The prevalence of *C28Y* and *H63D* mutations to the hemochromatosis (HFE) gene in the United States. *JAMA* 2001;285(17):2216–22.

**Public Health Agencies Recognize Need to Incorporate Genetic Discoveries into Core Activities** Genetic predisposition influences the onset and severity of most diseases of public health importance. Fortunately, as technology advances, so does our ability to assess human genetic predisposition for many diseases. Therefore, state public health agencies need to

incorporate new developments in genetics and disease prevention into their core activities of assessment, policy development, and assurance. To assess this process of incorporating new developments in genetics and disease prevention, CDC's Office of Genetics and Disease Prevention collaborated with the Council of State and Territorial Epidemiologists to survey states about projects and concerns pertaining to genetics and public health activities. State respondents were the health officer, the maternal and child health/genetics program director, the chronic disease program director, and the laboratory director.

Thirty-eight (76%) state health departments responded to the survey. According to the responses, ongoing genetics activities in the states and corresponding percentages were assurance (82%), assessment (17%), and policy development (2%). However, state health officers indicated that future genetics activities would be distributed differently: assurance, 41%; assessment, 36%; and policy development, 23%. Plans are for future assurance activities to be largely educational. Respondents reported that topics of interest and recently initiated activities in genetics were primarily assessment functions. Funding was the respondents' greatest concern, followed by lack of proven disease prevention measures and outcomes data.

Survey results show that state health departments recognize a need to realign their activities to meet future developments in genetics. Potential barriers are lack of adequate resources, proven disease prevention measures,



and outcomes data. Public health agencies need strategic planning to take advantage of the opportunities associated with the development and implementation of genetic tests and procedures.

Piper MA, Lindenmayer JM, Lengerich EJ, Pass KA, Brown WG, Crowder WB, et al. The role of state public health agencies in genetics and disease prevention: results of a national survey. *Public Health Rep* 2001;116:22–31.

## International Health

**M** **easles Is a Significant Contributor to Mortality in Ethiopian Famine** While assisting the United Nations Children’s Fund (UNICEF) with coordinating a famine relief effort in Ethiopia, CDC staff and the United States Agency for International Development’s Office of Foreign Disaster Assistance jointly assessed famine-affected areas. A survey was designed and conducted to enable determinations to be made about nutrition and retrospective mortality in the Gode district, the epicenter of the famine. In addition, a database was designed that collated information from nutrition surveys conducted by all UN agencies and nongovernmental organizations (NGOs) in famine-affected areas of Ethiopia. CDC’s activities helped standardize survey methods and improve the standards of feeding programs operated by UN agencies and NGOs. The Gode survey highlighted the region’s ongoing nutritional crisis and the fact that measles contributed to mortality. The findings illustrated the need to extend measles

vaccination coverage to children between 5 and 14 years of age. The CDC article published in the *Journal of the American Medical Association* as a result of this research was one of the first to demonstrate epidemiologically the potential negative effects of a humanitarian response that is not based on sound knowledge of public health principles. The article received widespread coverage among the media and led several UN agencies to review their policies and practices. UNICEF has since asked CDC to collaborate with Columbia and Tufts universities to establish worldwide training for UNICEF staff in emergency response. Furthermore, UNICEF is prioritizing measles vaccination as a major activity. As a result of the CDC article, the target age group for measles vaccination is now widely accepted as being up to 15 years.

Salama P, Assefa F, Talley L, Spiegel P, van der Veen A, Gotway CA. Malnutrition, measles, mortality, and the humanitarian response during a famine in Ethiopia. *JAMA* 2001;286:563–71.

### **Surveillance for Human Immunodeficiency Virus Lacking in Complex Emergencies**

Research by CDC has shown that despite recent success in preventing human immunodeficiency virus (HIV) infection in stable populations in selected developing countries, internally displaced persons and refugees have not been systematically included in HIV surveillance systems or consequently in prevention activities. Standard surveillance systems that rely on functioning health services may not provide useful data in many complex emergency settings. However, second-generation surveillance

methods—such as cross-sectional, population-based surveys—can provide rapid information on HIV, sexually transmitted infections (STIs), and sexual behavior, though the risks of stigmatization and breaches of confidentiality presented by second-generation methods must be recognized. On the basis of CDC’s research, which was published in the journal *AIDS*, surveillance is required to define the high-risk groups and to target interventions. Such surveillance will ultimately decrease HIV and STI transmission within countries facing complex emergencies as well as facilitate regional control of HIV epidemics.

Salama P, Dondero T. HIV surveillance in complex emergencies. *AIDS* 2001;15 Suppl 3:S4–S12.

## Improving the Diagnosis, Treatment, and Prevention of Chronic Diseases

### *Tobacco-Related Issues*

**Latino Tobacco Workers’ Risk of Getting Green Tobacco Sickness Studied** Dermal exposure to nicotine by tobacco workers is known to be associated with a form of nicotine poisoning called green tobacco sickness (GTS). In recent years, tobacco work has been performed mainly by migrant workers, almost all Latino, who have little experience with tobacco production and are often unaware of their risk of developing GTS. This study examined a cohort of 182 workers in North Carolina during the summer of 1999.

Repeated salivary cotinine measurements obtained over the course of the season demonstrated that these workers experienced substantial work-related exposure to nicotine. The analyses indicated that exposures varied greatly by activities, with “priming” or harvesting of tobacco associated with the greatest exposure risk. The analyses also helped identify work behaviors that might mediate the risk for exposure.

These results are being used to develop educational materials for workers to help them avoid exposure and thus decrease their risk of developing GTS. In addition, a follow-up case-control study is in progress of workers who did and who did not develop GTS.

Quandt SA, Arcury TA, Preisser JS, Bernert JT, Norton D. Environmental and behavioral predictors of salivary cotinine in Latino tobacco workers. *J Occup Environ Med* 2001;43:844–52.

## Newborn Screening

**E**rrors Prevented in Assaying Blood-Spot Specimens Substances known as acylcarnitines are organic- and fatty-acid metabolites, and five of these metabolites are key to diagnosing several disorders of fatty- and organic-acid metabolism during newborn screening using routine blood-spot specimens. Preliminary results with blood spots demonstrate excellent linearity for each of the five acylcarnitines. However, during proficiency testing (PT) conducted on assays performed by



Handling tobacco—like smoking it—can make you sick, as CDC found in a study of Latino tobacco workers.

laboratories that participate in CDC's PT program, CDC scientists observed an extremely unusual result for the metabolite octanoylcarnitine: the recovery was significantly lower than that for other acylcarnitines. To account for this discrepancy and prevent it from recurring, CDC scientists designed experiments to clarify and confirm the loss of D, L-octanoylcarnitine and found that using a racemic (equimolar) mixture of D, L-octanoylcarnitine to calibrate assays results in overestimating the concentration of octanoylcarnitine in routine blood-spot specimens because of differences in stability. This serious problem could cause measurement errors, such as false-positive test results. Thus, CDC recommended that laboratories performing this assay use only L-octanoylcarnitine to produce assay calibrators. The results of this study demonstrate the importance of assay standardization and the validation required for clinical screening.

Chace DH, DiPerna JC, Adam BW, Hannon WH. Errors caused by the use of D, L-octanoylcarnitine for blood-spot calibrators. *Clin Chem* 2001;47(4):758–60.

**Developing a Fluorescence Intensity Standard Signals a Bright Spot for the Future** Assays based on the measurement of fluorescence intensity (FI) have become the most common method of measurement in the biomedical laboratory. Assays based on FI have higher sensitivity than other methods, and the measurements can be made easily and rapidly. However, no reference materials to ensure the accuracy of FI measurements have been

available. Accurate FI readings are especially important for genetic testing and population screening. Ongoing research at CDC, the National Institute of Standards and Technology, and the U.S. Food and Drug Administration has established the criteria for accurate FI standards based on the equivalent number of soluble fluorochrome molecules (MESF). This research shows that flow and scanning cytometers can accurately measure as little as 100 MESF on stained particles with a linear dynamic range of up to 4 decades. These FI standards will allow accurate measurements on normal and malignant cells as well as on genes and gene products, leading to better data for making public health decisions.

Gaigalas K, Li L, Henderson O, Vogt R, Barr J, Marti G, et al. Development of fluorescence intensity standards. *J Res Natl Inst Stand Technol* 2001; 106(2):381–9.

## Environmental Health Studies

### Noise-Induced Hearing Loss May Affect More Children Than Previously Thought

Exposure to environmental noise can damage the inner ear's cilia (tiny hair-like structures) and cause a hearing loss that may be temporary or permanent. Historically, noise has not been considered a common cause of childhood hearing problems. More recently, however, researchers have discovered that noise-induced threshold shifts actually can contribute to childhood hearing problems, especially when children are continually exposed to excessive noise. Such exposure can lead



On the basis of reviews of audiograms, CDC researchers estimate that 5.2 million U.S. children between the ages of 6 and 19 have noise-induced hearing loss, which can be caused by everyday activities such as listening to loud music through headphones.

to high-frequency sound discrimination difficulties. The hearing loss may be subtle but can contribute to problems with classroom learning. This kind of hearing loss is characterized by specific threshold shifts that can be observed during an audiogram. To determine the extent of this problem among U.S. children, CDC analyzed audiograms that had been performed as part of the National Health and Nutrition Examination Survey (NHANES) III, conducted from 1988 through 1994. A total of 5,249 children aged 6 to 19 years completed both audiometry and compliance testing for both ears as part of NHANES III. The criteria used to assess noise-induced threshold shifts included observation of a distinct audiometric pattern called a noise notch in at least one ear. Survey results indicated that of those children aged 6 to 19 years, 12.5% (approximately 5.2 million) are estimated to have noise-induced hearing loss in one or both ears. These findings suggest that children are being exposed to excessive amounts of hazardous levels of noise, and children's hearing is susceptible to damage from these exposures. Results indicate the need for research on appropriate hearing conservation methods and for audiometric screening programs among school-aged children.

Niskar AS, Kieszak SM, Holmes A, Esteban E, Rubin C, Brody DJ. Estimated prevalence of noise-induced hearing threshold shifts among children 6-19 years of age: the third National Health and Nutrition Examination Survey, 1988-94—United States. *Pediatrics* 2001;108:40-3.



Mothers who had recently given birth were studied by CDC in Georgia and Texas to determine levels of water disinfection by-products in their blood before and after they took a shower.

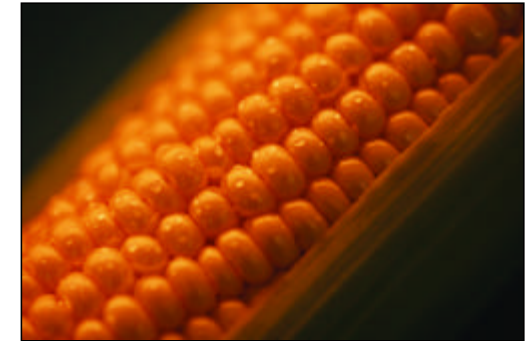
**Disinfection By-Products in Tap Water Are Cause for Concern** Recent epidemiologic studies of disinfection by-products (DBPs) have suggested an association between DBPs (generally trihalomethanes [THMs]) in tap water and adverse reproductive outcomes, including spontaneous abortion, birth defects, and intrauterine growth retardation. Although most studies of human reproductive outcome and exposure to THMs have focused on total THMs, recent epidemiologic studies that evaluated exposure to individual THM species found an increased risk of spontaneous abortion associated with exposure to increased levels of bromodichloromethane levels in drinking water. Both chlorinated and brominated THM species (including chloroform, bromodichloromethane, and bromoform) cause reproductive and developmental toxicity in laboratory animals; however, studies are not clear on which THM species pose the greatest potential health risk. CDC staff conducted a field study in 1999 in Corpus Christi, Texas, and Cobb County, Georgia, to evaluate exposure measures for DBPs, with a special emphasis on THMs. Participants were mothers living in either geographic area who gave birth to healthy infants from June 1998 through May 1999. The study assessed exposure by sampling blood and water and by obtaining information about water use habits and tap water characteristics. Because inhalation of aerosolized THMs while showering is considered to be one of the most important and significant routes of exposure, CDC staff collected two 10-mL whole blood samples from each participant before and immediately after her shower. Levels of individual THM species



(chloroform, bromodichloromethane, dibromochloromethane, and bromoform) were measured in whole blood (parts per trillion [pptr]) and in water samples (parts per billion [ppb]). In the Corpus Christi water samples, brominated compounds accounted for 71% of the total THM concentration by weight; in Cobb County, chloroform accounted for 88%. Using sophisticated analytic techniques, CDC staff were able to quantify blood levels of individual THM compounds at extremely low concentrations (pptr), enabling them to discern elevated blood THM levels among study participants. Significant differences in blood THM levels were observed between study locations. For example, the median baseline blood level of bromoform was 0.3 pptr for Cobb County participants and 3.5 pptr for Corpus Christi participants ( $p = 0.0001$ ). Differences were most striking in blood obtained from the mothers after they showered. For bromoform, the median blood levels were 0.5 pptr for Cobb County participants and 17 pptr for Corpus Christi participants ( $p = 0.0001$ ). These results demonstrate that blood levels of THM species vary substantially across populations, depending on both water quality characteristics and water use activities. Such variation has important implications for epidemiologic studies of the potential health effects of DBPs. This is the first study that (1) documents elevated background levels of individual THMs in human tissue, (2) demonstrates substantial differences in speciation and blood levels of THMs between populations served by different water supply systems, and (3) indicates that THM speciation and levels in blood mirror the THM speciation and levels found in an individual's water supply.

Lynberg M, Nuckols JR, Langlois P, Ashley D, Singer P, Mendola P, et al. Assessing exposure to disinfection by-products in women of reproductive age living in Corpus Christi, Texas, and Cobb County, Georgia: descriptive results and methods, 2001. *Environ Health Perspect* 2001;109(6):597–604.

**Genetically Engineered Corn Scrutinized** On October 25, 2000, the U.S. Food and Drug Administration requested technical assistance from CDC in investigating reports of human illnesses potentially associated with consumption of genetically modified corn products. Prior to these reports, a protein named Cry9c had been inserted into genetically modified StarLink™ corn and subsequently and inadvertently introduced into the human food supply. CDC conducted an investigation and concluded that (1) the adverse health events were consistent with allergic reactions to consumption of StarLink™ corn products, (2) a temporal association existed between product consumption and symptom onset, and (3) neither causation nor exposure could be verified. Sufficient evidence suggested the need for further laboratory assessment of the relation between the allergic reactions and the Cry9c protein present in StarLink™ corn. The findings did not provide any evidence that the allergic reactions were associated with hypersensitivity to the Cry9c protein. CDC strongly recommended that participants work with their health care providers to further investigate their allergy symptoms. The report is available online at <http://www.cdc.gov/nceh/ehhe/Cry9cReport>.



The U.S. Food and Drug Administration asked CDC to assist in an investigation of whether people had become sick from eating genetically modified corn that had inadvertently gotten into the food supply.

Investigation of human health effects associated with potential exposure to genetically modified corn. Final report. Atlanta (GA): Dept. of Health and Human Services (US), Centers for Disease Control and Prevention; 2001.

**Research Continues on the Possible Health Effect of *Pfiesteria piscicida*** Since 1996, the public health effect of the presence of the dinoflagellate *Pfiesteria piscicida* in East Coast estuaries has been the subject of considerable research activity and controversy. CDC is supporting a number of efforts to determine what effect, if any, *P. piscicida* has on human health. First, CDC has supported the development of surveillance for possible estuary-associated

syndrome (PEAS) in six East Coast states (Delaware, Florida, Maryland, North Carolina, South Carolina, and Virginia). From June 1998 through June 2001, the PEAS surveillance system received 3,859 calls to request information about *P. piscicida* and similar organisms or to report health effects. Almost all (97.6%) of the calls were requests for information; however, 91 calls concerned symptomatic people. Five of these people have been identified as meeting PEAS health-related criteria; however, the environmental data did not conclusively demonstrate exposure to water containing *P. piscicida* or toxins. Second, CDC is supporting occupational cohort studies in three states (Maryland, North Carolina, and Virginia) to examine the potential acute and chronic health effects that might result from exposure to *P. piscicida* or any toxins it may produce. These studies are still in the final data collection stage. Third, in October 2000, CDC sponsored a national conference on *P. piscicida* entitled "From Biology to Public Health." CDC convened a panel of experts to review the existing scientific literature and provide CDC with feedback about the future direction of *P. piscicida* research. The panel concluded that, although a considerable amount of research had been done on *P. piscicida*, a number of research gaps need to be addressed. The panel's summary of future research areas included the following topics: the ecophysiology of *P. piscicida*, the effects of *P. piscicida* on fish and other aquatic organisms, methods to detect *P. piscicida*'s toxins, and epidemiologic and clinical studies.



*Pfiesteria piscicida*, a microorganism that lives in estuaries in some areas along the East Coast, is being studied by CDC to determine what effects it may have on human health.



Global climate change—which could cause natural disasters such as floods, droughts, and heat waves—was the topic of a literature review that CDC conducted to determine the potential effects on human health.

McGeehin MA, Rubin CH. *Pfiesteria*: from biology to public health. *Environ Health Perspect* 2001;109 Suppl 5:633–808.

### **Potential Impacts of Climate Change and Variability on Human Health Call for Preventive Measures and Additional Research**

CDC reviewed the literature regarding the potential impacts of climate change and variability on human health. Findings included the following: (1) heat and heat waves are predicted to increase in severity and frequency with increasing global mean temperatures; (2) overall death rates are higher in winter than in summer, although the relation between winter weather and mortality is difficult to interpret; and (3) physiologic and behavioral adaptations,

warning systems, and illness management plans may reduce morbidity and mortality from heat or cold. Additional research is needed to do the following: (1) identify critical weather parameters, (2) determine whether any association exists between heat and nonfatal illness, (3) evaluate the implementation of heat response plans, and (4) determine the effectiveness of urban design in reducing heat retention.

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