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Hazardous Substances & Public Health

Healthy People in a Healthy Environment

This issue of *Hazardous Substances and Public Health* examines the relationship between diseases and the environment. Environmental factors can cause illness or make it worse. Therefore, it is important to examine and understand the links between the environment and human health so that we can lower our risk for illness or disease. In this issue, we look at asthma, multiple sclerosis, endocrine disruptors, chronic beryllium disease, and disease clusters, all of which have been linked to the environment.

Following is an overview of some of the articles.

Asthma and Multiple Sclerosis: Developing Epidemiologic Tools To Investigate Disease in Communities Impacted by Toxic Substances (page 2) addresses cooperative agreements between the Agency for Toxic Substances and Disease Registry (ATSDR) and several states. A companion article (page 5) discusses ATSDR's cooperative agreement program.

Environmental Triggers of Asthma (page 6) examines potential asthma triggers and how to control or avoid exposure to those triggers. Two sidebar articles discuss resources on asthma (page 9) and the new ATSDR *Case Studies in Environmental Medicine: Environmental Triggers of Asthma* (page 9), which offers continuing education credit.

Endocrine Disruption: Is There Cause for Concern? (page 10) discusses the hypothesis of environmentally mediated disruption of the endocrine system. Endocrine disruptors are environmental chemicals that may have an adverse effect on human and ecologic health by disrupting normal hormonal systems. The article includes background information on endocrine disruption and recommendations of the National Research Council's Committee on Hormonally Active Agents in the Environment. A sidebar article (page 11) discusses the controversy over appropriate terminology for endocrine disruption.

Beryllium Exposure and Chronic Beryllium Disease (page 12) discusses the health effects of exposure to compounds of beryllium. A companion article (page 13) examines the Elmore, Ohio, Brush Wellman Company plant site, the primary U.S. producer of beryllium powder. In October 2001, ATSDR issued a health consultation for the site, and in fall 2002 the agency will complete an exposure investigation.

New Director, ATSDR Division of Health Studies

Dr. G. David Williamson, a Department of Health and Human Services Distinguished Fellow, joined the Agency for Toxic Substances and Disease Registry (ATSDR) in summer 2001 after 14 years in the Epidemiology Program Office (EPO), Centers for Disease Control and Prevention (CDC). He is Adjunct Professor, Departments of Biostatistics and Epidemiology, Rollins School of Public Health, Emory University, and serves as Executive Director, CDC/ATSDR's Statistical Advisory Group (SAG). In the SAG role, he provides leadership for the

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development and coordination of statistical and analytic methods activities, including statistical consultation, communication, recruitment and retention, seminars and training courses, and symposia across both CDC and ATSDR.

Dr. Williamson is a member of the CDC/ATSDR Excellence in Science Committee as liaison to represent the statistical/analytic methods communities for the agencies. He is also a member of the U.S. Office of Management and Budget's Federal Committee on Statistical Methodology, the group that addresses and makes recommendations to the federal government on methodologic and statistical issues that affect the quality of federal data.

Dr. Williamson was born in Savannah, Georgia, and received his undergraduate degree in biology from the Georgia Institute of Technology. He received a master's degree in biology (with a focus in estuarine ecology) from Georgia Southern University, for which much of his work was performed at the Skidaway Institute of Oceanography. He received a master's degree in statistics from Virginia Polytechnic Institute and State University and his doctoral degree in biostatistics from Emory University. Before joining CDC, Dr. Williamson worked at the U.S. Environmental Protection Agency and at the Louisiana State University Medical Center.

Dr. Williamson is an active member of a number of professional societies, including the American Public Health Association, the American Statistical Association (ASA), and the International Biometrics Society. He was Program Chair for the 2000 Joint Statistical Meetings, with responsibility for assisting in determining the scientific agenda for the ASA and developing the agenda for the largest annual meeting of statisticians in the world. He has recently been named Vice Chair, Committee on Meetings, ASA, with responsibility for guiding ASA participation in all the association's sponsored meetings and conferences.

Asthma and Multiple Sclerosis

Developing Epidemiologic Tools To Investigate Disease in Communities Impacted by Toxic Substances

Sherri A. Berger-Frank, MSPH; Curtis W. Noonan, PhD; and Mary C. White, ScD

The Agency for Toxic Substances and Disease Registry (ATSDR) works closely with its partners at the state and local levels to respond to community concerns about environmental exposures and chronic diseases. Through a number of mechanisms, ATSDR provides both technical and financial assistance to state and local health departments to fill a critical need for applied epidemiologic research. ATSDR recently entered into cooperative agreements with several local and state health departments to explore the occurrence of asthma and multiple sclerosis (MS) near hazardous waste sites and other sources of environmental exposures. Exploratory epidemiologic research is an important step in better understanding the possible contribution of hazardous substances to the occurrence of these diseases.

Childhood Asthma and Hazardous Substances

In 1999, ATSDR entered a 3-year cooperative agreement with the Utah Department of Health and the Massachusetts Department of Public Health to conduct asthma research. Studies conducted under this cooperative agreement will examine patterns of asthma among children in relation to estimates of exposure to hazardous substances. The purposes of this program are threefold:

- to use available data sources on asthma to evaluate the contribution of environmental exposures to asthma among children,
- to provide generalizable scientific information about the association between hazardous substances and childhood asthma, and
- to develop a methodology that could be useful in responding to questions about the health impact of air releases of hazardous substances.

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Asthma is the most common chronic disease of childhood and a leading cause of disability among children in the United States. Since 1980, asthma incidence has increased dramatically in children. From 1980 to 1995, asthma incidence among persons aged 0–17 years increased approximately 5% each year (*1*).

Several agencies and institutes within the Department of Health and Human Services, including ATSDR, together developed a national strategic plan that outlines four priority areas for action against asthma (*2*). ATSDR research contributes to two of the plan's priority areas:

- to reduce the burden of asthma for people with the disease, and
- to eliminate the disproportionate health burden of asthma in minority populations and those living in poverty.

Analysis of Childhood Asthma and Hazardous Sites in Utah

Under this project, the Utah Department of Health will study variations in the risk for childhood asthma in four urban counties and determine whether rates of asthma increase in children living near hazardous waste sites or industrial emission sources. Data from almost 20 hospitals in four urban counties will be used to obtain data on asthma for children zero to 14 years of age. This project will use geographic information systems (GIS) to identify high-risk areas, which can lead to public health action. Analyses will identify areas with high incidences of childhood asthma and assess the cases of asthma alone and in relation to sources of potential hazardous substances.

Pediatric Asthma in the Merrimack Valley, Massachusetts

In a two-part study, the Massachusetts Department of Public Health aims to

- assess whether the pediatric asthma rate in each community in the Merrimack Valley is higher than the rate from a demographically similar comparison community and
- compare pediatric asthma rates in areas in the valley where the possibility is higher for exposure to incinerator emissions to areas where the possibility for exposure is lower.

The project will use school health records to identify students with asthma and will collect environmental data from the Massachusetts Department of Environmental Protection. GIS will be used to map the locations of the pediatric asthma cases and sources of exposure.

Prevalence of Multiple Sclerosis Near Hazardous Waste Sites

In cooperation with state and local public health partners, ATSDR is developing a capacity to

- respond to community concerns about MS and
- more fully understand the epidemiology of MS.

Under a grant funded by ATSDR, the Texas Department of Health recently completed an investigation of MS among members of a community living next to a metal smelter. The number of MS cases among this cohort was twofold higher than expected (*3*). ATSDR has also entered into cooperative agreements with the Ohio Department of Health; the Jackson County, Missouri, Health

Multiple sclerosis (MS) is a chronic disease of the central nervous system. MS is believed to be caused by a combination of environmental, genetic, and immunologic factors. The majority of persons with MS are 40–60 years old and suffer moderate to severe disability (*4*). MS is approximately twice as common in women than in men, and the number of women reporting MS as a cause of disability has doubled in recent years (*4*). Estimates of the number of people with MS in the United States have ranged from 125,000 to 350,000 (*4–6*). Residents of several communities living near hazardous waste sites have expressed concerns about perceived elevated rates of MS and the possible association with environmental contaminants. Because no registries for MS exist at the federal, regional, or state level, health agencies have found it difficult to respond to these concerns.

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Department; and the Texas Department of Health. Investigators will use neurologists' records to determine age-specific and sex-specific MS prevalence rates in the study areas of Lorain County, Ohio, Independence and Sugar Creek, Missouri, and a 19-county area around Lubbock, Texas. The three geographically and ethnically diverse study areas include more than 800,000 people. Researchers expect to gather information on 475 to 775 MS cases. The Texas study area also will allow for an estimation of prevalence among Hispanics, a population for which no reliable MS data exist.

In addition to establishing background MS prevalence estimates for three geographically and ethnically diverse areas, the three grantees will work with local MS support groups and other community groups to help identify individuals with MS and to communicate project findings. In collaboration with ATSDR, grantees will help to develop procedures and data collection instruments to be used for case ascertainment and case verification in other communities concerned about MS. These cooperative agreements will serve as a basis for future studies of MS and an investigation of potential environmental risk factors.

Conclusion

The epidemiology of chronic diseases possibly linked to conditions in the environment must be better understood. Through these collaborative projects, ATSDR will enhance the ability of state and local health departments to work with a variety of data sources and, when feasible, evaluate the contribution of environmental exposures to these conditions.

ATSDR will announce the availability of funding during fiscal year 2003 to support additional activities similar to those described previously. Please check the *Federal Register* notice for more information, or contact the project coordinators directly at 404-498-0104. These continued efforts are consistent with recommendations made by the Pew Environmental Health Commission in its September 2000 report, *America's Environmental Health Gap: Why the Country Needs a Nationwide Health Tracking Network* (*7*). The results of these projects will provide generalizable scientific information and allow the development of a methodology that other state and local health departments could use in responding to questions about the health impact of hazardous substances at specific sites.

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Next Issue

***Hazardous Substances and Public Health* becomes *Public Health and the Environment*. The inaugural issue focuses on children's environmental health.**

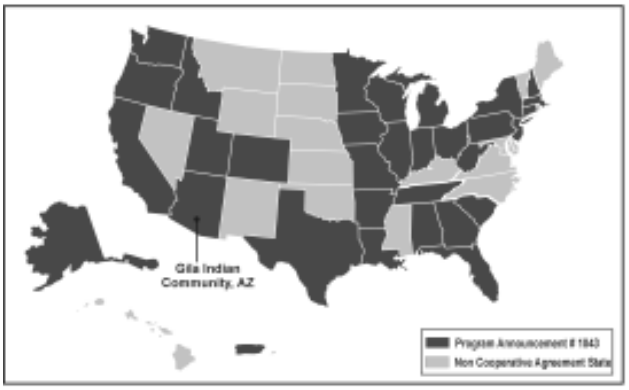
Co-Op Agreement Program Enables Partners To Tackle Sites of Concern

Paula S. Stephens

The Agency for Toxic Substances and Disease Registry (ATSDR) works with state health departments, state environmental agencies, local health departments, and the U.S. Environmental Protection Agency (EPA) to determine the possible public health effects of exposure to hazardous substances from sites on EPA's National Priorities List for Uncontrolled Hazardous Substances (NPL; known as Superfund sites). From its beginning in the 1980s, ATSDR sponsored cooperative agreements with states. Over the years, the work completed by ATSDR's state cooperative agreement partners has gone beyond sites on the NPL to include other sites of concern to local communities.

Recently, ATSDR completed two successful state cooperative agreement programs, known as Program Announcement (PA) 607 and PA98064. ATSDR is beginning a new cooperative agreement program, known as PA1043, which merges PA607 and PA98064 into a new unified program. Formally known as the "Program To Conduct and Coordinate Site-Specific Activities," PA1043 funds 31 state health departments, one commonwealth health department (Puerto Rico), and one tribal group (Gila River Indian Community). The 33 recipients were awarded a total of more than $11.1 million, says Sharon Conley, one of ATSDR's project officers for the cooperative agreement program. The positions funded under the cooperative agreement program include environmental health scientists, health educators, health assessors, epidemiologists, and others, depending on the needs of the partners.

ATSDR Cooperative Agreement Map



How the Program Works

To coordinate activities between ATSDR and the PA1043 recipients, Technical Project Team (TPT) members participate in monthly conference calls. TPTs include three ATSDR technical project officers, a regional office representative, and state-level staff. At the beginning of the fiscal year, TPTs agree on a workplan to guide site-specific activities for the year. The workplan is a fluid document and is modified by TPTs as new sites are added and priorities change.

> A site will be on a PA1043 recipient's workplan for a number of reasons, including requests from community members; from local, state, or federal elected officials; or from the state environmental agency. A site might be on the workplan at EPA's request. Activities at NPL sites are the priority. However, non-NPL sites are increasingly dominating a PA1043 recipient's workplan.

Once a site is listed on a workplan, a variety of activities occur. Working together, the team might conduct one or more public health assessments or health consultations. Simultaneously, the health educator conducts a needs assessment of community members and health professionals. Health education for community members and health professionals will be developed on the basis of the needs assessment. Finally, a variety of follow-up activities, including an exposure investigation, might be initiated if warranted.

As with site work performed by ATSDR headquarters staff, stakeholder involvement is critical to the success of activities funded by the partners cooperative agreement program.

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Measuring Success With STARS

An important improvement in the new cooperative agreement program is ATSDR interdivisional coordination, which played a role in the current pilot testing of a new reporting system known as STARS (Site Tracking and Reporting System). "Historically, we had multiple reporting documents," says Grant Baldwin, one of the technical project officers administering the cooperative agreement program. Each ATSDR division had its own programmatic reporting software the partners were required to use. Now, he states, "STARS mirrors the level of integration we'd like the partners to do." Previous state cooperative agreement program recipients requested this interdivisional coordination.

According to Linda Stacy, chair of the STARS Team, STARS is being tested by 20 states. Testing began with 12 states, but the project officers "were so pleased with the database that they've been bringing more states on board during the pilot testing," Stacy says. All 33 funding recipients should be in the system by the second quarter of FY 2002. Developed in Microsoft Access, STARS data can be uploaded into ATSDR's Hazardous Substance Release/Health Effects Database (HazDat). The new reporting system will replace the partner workplans that were entered into HazDat from a word-processing report. These workplans had incomplete data and data entry was time-consuming. STARS improves and streamlines the reporting mechanism and provides a better mechanism for reporting the public health benefit of activities and programs.

"We're excited about STARS because it not only tracks but also identifies the customer and evaluates the benefit of the activities," Stacy says. The STARS team has developed objectives that are linked to ATSDR's goals, which enables the agency to fulfill the mandates of GPRA (Government Performance and Results Act), she says. Another unifying feature is that STARS reports activities not as division activities but as agency activities.

The partners cooperative agreement program is a benchmark program for ATSDR. PA1043 and STARS will continue to build on this success.

Environmental Triggers of Asthma

Lourdes Rosales-Guevara, MD

To achieve successful asthma control and effective long-term management, it is important to identify allergens, irritants, and pollutants that trigger asthma so asthma flare-ups can be prevented. Making changes in individual and family behavior and complying with treatment regimens also play important roles in the successful control of asthma. Resources on asthma can be found in the sidebar article.

Allergens

Allergens are substances capable of inducing an allergy or a specific hypersensitivity reaction. The most important step in controlling *allergen*-induced asthma is reducing exposure to the agents to which the patient might be sensitive. Reducing exposure will help prevent exacerbations of asthma.

For children, allergens might be encountered at home, in their classroom or day care center, on the playground, during family moves or house renovations, and during weather changes and seasonal variations.

Adults are affected by the same allergens that affect children. Adults can also be exposed to allergens in the workplace.

Cockroach Allergen: This allergen is more of a problem for people with asthma who live in low-income housing. The severity of asthma in these patients is directly proportional to the levels of cockroach allergen in their bedrooms.

Animal Allergens: All warm-blooded pets, including birds and small rodents, can cause allergic reactions in sensitive patients because of dander and body secretions (urine, feces, and saliva). Dander is small scales from the hair, skin, or feathers of animals.

House Dust Mites Allergen: The survival of mites depends on increased relative humidity and on human

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To help control exposure to **cockroach allergen**

- Discard food leftovers: exposed food or garbage residue can attract cockroaches.
- Limit eating areas to dining room and/or kitchen.
- Use traps instead of chemical agents for pest control. When chemical agents are applied, make sure that sensitive patients are kept out of the area. Ventilate the premises for several hours or until the chemical odor is gone.

To help control exposure to **animal allergens**

- Remove the pet from the house (preferred). If removal is not feasible, keep the pet out of the patient's bedroom and keep the door closed.
- Remove carpets and upholstered furniture from the patient's bedroom or family home or isolate the pet from these items.
- Wash the pet and change litter frequently (once a week) to decrease the amount of dander and/or body secretions from its hair or feathers.

To help control exposure to, and levels of, **house dust mites**

- Use allergen-impermeable mattress and pillow covers, and damp-wipe them clean once a week.
- Wash stuffed toys and bedclothes in hot water (temperature of 130°F [54°C]) to kill the mites.
- Use a damp wipe to clean the patient's bedroom furniture.
- Use a high-efficiency particulate air (HEPA) filter vacuum cleaner.

To help control **pollen allergy**

- Stay indoors with the windows closed during peak pollen seasons.
- Clean air filters frequently.
- Use antiallergic medical control.

To help control **indoor mold**

- Avoid using humidifiers. Maintain indoor humidity at <50%.
- Fix leaking faucets and eliminate standing water.
- Do not allow sensitive patients in problem areas such as the basement.

To help control exposure to **fumes from wood or gas stoves**

- Ensure proper functioning of stoves and fireplaces.
- Use kitchen vents when cooking.

To help control exposure to **environmental tobacco smoke**

- Parents who smoke should quit; if they are unable to quit, they should smoke outside—never in the home or in the family car.
- If children attend day care, ensure that day care staff do not smoke indoors.

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dander. Increased concentrations of mites are in all bedclothes (dust covers, pillows, and mattresses), upholstered furniture, carpets, clothes, and stuffed toys.

Pollens: Pollen from trees, grass, or weeds can be a problem, especially during spring and fall seasons.

Indoor Mold: Indoor mold can be found where humidity levels are high, such as in bathrooms (especially bathrooms without windows and bathrooms with leaking faucets) or basements, and in homes where dampness is a problem. Inspecting rooms for molds, such as looking under old carpets, might reveal areas covered with mold.

Irritants

Fumes From Wood or Gas Stoves: Malfunctioning stoves (gas, oil, kerosene, or wood), fireplaces, or strong odors can irritate the lungs, precipitating asthma symptoms.

Environmental Tobacco Smoke (ETS): ETS is a major precipitant of asthma symptoms and the most important and preventable indoor environmental irritant. ETS exposure is associated with early onset of asthma symptoms, increases in asthma exacerbations, consequent increased use of medication, and lengthened recovery periods. Prenatal exposure to ETS can adversely impact a child. Maternal smoking during pregnancy (as few as 10 cigarettes per day) has been associated with an increased risk of the child developing asthma later in life.

Outdoor Pollutants

Nitrogen Dioxide (NO_2): In contrast to the other pollutants in this section, NO_2 is both an **indoor and outdoor** air pollutant. Sources of indoor NO_2 include malfunctioning gas stoves, furnaces, fireplaces, and kerosene space heaters. The effects of NO_2 are thought to be due to long-term, low-level exposure. NO_2 exposure that occurs when the patient is exercising or running might be more irritating to airways than exposure that occurs when the patient is not exercising.

Particulate matter (PM_{10} and $PM_{2.5}$): Particulate matter is a mixture of solid particles and liquid droplets. The sources and potential health effects of particulate matter are different for the two sizes.

- **PM_{10}**, particulate matter ≤10 micrometers (µm) in aerodynamic diameter, is associated with exacerbation of existing asthma. Sources of PM_{10} include dust and street sand from crushing or grinding (i.e., construction work), vehicle exhaust, and smoke from burning wood.
- **$PM_{2.5}$**, particulate matter ≤2.5 µm in aerodynamic diameter, penetrates deeper into the lung, thus producing greater health effects. $PM_{2.5}$ can precipitate asthma symptoms. Sources of $PM_{2.5}$ include industrial and residential combustion, vehicle exhaust, and atmospheric reactions between gases (SO_2 and NO_2) and volatile organic compounds (VOCs).

Ozone (O_3): O_3 is the most potent irritant of the outdoor air pollutants. Its effect is immediate. O_3 is suspected to induce or enhance the inflammatory response of the respiratory system. In the United States, a large fraction of ambient O_3 is the product of photochemical reactions between various nitrogen oxides (NO_x) and VOCs emitted from vehicles.

Sulfur Dioxide (SO_2): SO_2 is highly soluble. The nasal mucosa can fail to remove SO_2, leading to upper airway irritation and subsequent penetration into the lung tissue. Greater exposure to SO_2 might occur in persons who have asthma and who exercise. SO_2 levels have been decreasing over the last 15 years, so it is unlikely that SO_2 alone is responsible for the recent increases in the prevalence of asthma.

Outdoor mold: Outdoor mold can be found in shady, damp areas or places where leaves or other vegetation are decomposing. In warmer states, mold spores begin to show early in spring; levels of spores peak in July. In colder states, the peak for mold spores occurs during the fall. Children playing outside or adults raking leaves might be exposed to those spores. Molds can be found year-round outdoors in the South and on the West Coast.

Conclusion

Various environmental factors can trigger exacerbations of asthma. Interventions are available to mitigate these factors. Identifying possible asthma triggers and taking preventive action to reduce those triggers are imperative to achieving successful asthma control and effective long-term management.

Resources on Asthma

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Case Studies in Environmental Medicine: Environmental Triggers of Asthma

ATSDR's new *Case Studies in Environmental Medicine: Environmental Triggers of Asthma* is available on the Internet in August at www.atsdr.cdc.gov/HEC/CSEM/.

The case studies series is a key part of the agency's health professional environmental education strategy. The case studies are available free of charge to educate health professionals about hazardous substances. The case studies are accredited and offer continuing education credits for doctors and nurses. A brief introduction to the case study follows.

Case Study

A 12-year-old girl arrives at your office with her mother for an evaluation of her cough. The mother reports that her daughter has had a nocturnal nonproductive cough two to three times per month for the past 3 months associated with increasing episodes of shortness of breath that resolve spontaneously. During soccer games, the girl has recurrent episodes, which are only relieved when she uses a friend's albuterol inhaler.

Past medical history reveals that the patient has had recurrent upper respiratory infections and had bronchitis 2 years ago. The patient has had no hospitalizations or emergency department visits.

The objectives of this case study are to help you

- identify various environmental factors that trigger asthma exacerbations,
- describe interventions available to mitigate environmental factors in triggering asthma,
- identify sources of information on the impact of environmental factors on patients with asthma, and
- identify sources of information on asthma management.

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Current medications include diphenhydramine for her intermittent runny nose and an occasional puff from her friend's inhaler during soccer games.

Family history reveals that the girl lives with her mother, father, and older sister in a house on the outskirts of the community. The father had a history of seasonal hay fever as a child. Both parents are smokers, and the mother reports that her husband has had some difficulties with episodic cough and shortness of breath, but has not seen a physician.

Endocrine Disruption: Is There Cause for Concern?

Stephanie Miles-Richardson, DVM, PhD

For nearly two decades, scientists have been concerned about the potentially serious effects of several categories of chemicals in the human endocrine system. Endocrine disruptors are thought to

- mimic natural body hormones;
- inhibit the actions of natural body hormones; or
- alter the normal regulatory function of the immune, nervous, and endocrine systems (*1*).

Many persistent organic chemicals have been implicated in endocrine disruption—including pesticides, dioxin, polychlorinated biphenyls (PCBs), and DDT. Much of the evidence for endocrine disruption is gleaned from observations in birds, fish, and wildlife. Some adverse health effects include

- abnormal thyroid function and development in fish and birds;
- decreased fertility in shellfish, fish, birds, and mammals;
- decreased survival of offspring; and
- alteration of the immune and behavioral function in birds and mammals (*1*).

Many suspected endocrine-disrupting chemicals are environmentally persistent and lipophilic. The effects of mixtures of chemicals that might affect endocrine function must also be considered. Finally, and perhaps most importantly, we must consider the fact that susceptible populations, such as young children and persons who live near hazardous waste sites and who might be exposed via contaminated soil and water, might be at greater risk for adverse health effects of endocrine-disrupting chemicals. Results of research from the Agency for Toxic Substances and Disease Registry's (ATSDR) Great Lakes Human Health Effects Research Program have demonstrated

elevated exposures and intrinsic physiologic susceptibility in sensitive populations such as subsistence anglers, American Indians, pregnant women, young children, men and women of reproductive age, the elderly, and the urban poor (*2*).

Scientists continue to debate various issues surrounding endocrine disruption, including the name itself (see sidebar article). To fully assess the public health implications of endocrine disruption, many unanswered questions must be addressed. A report by the National Research Council (NRC) Committee on Hormonally Active Agents in the Environment evaluated mechanisms of action, health effects, exposure, dosimetry, and screening and monitoring (*3*). The committee made several recommendations including the following:

- Further research to better elucidate underlying mechanisms of action of hormonally active agents.
- Continued monitoring for abnormal development and reproduction in wildlife and human populations.
- Longitudinal tests of developmental milestones from conception through adulthood and a standardized test to study neurobiologic and social development.
- Studies of the prevalence of autoimmune problems.
- Studies of possible associations between exposure and various cancers, including the development of animal models.
- Long-term studies of exposed populations.
- Better monitoring of contaminated media to determine environmental concentrations, as well as

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background concentrations of hormonally active agents in humans.

Addressing the committee recommendations will enable scientists to obtain a clearer picture of the human health and ecologic effects of endocrine-disrupting chemicals and allow appropriate public health policies to be set. Both the EPA Endocrine Disruptor Screening and Testing Advisory Committee report (*4*) and the NRC (*3*) committee report recommended that chemicals be screened and monitored for endocrine-disrupting potential. Following the recommendations of its committee, EPA implemented a screening and testing program that will determine what, if any, endocrine-mediated adverse effects occur as a result of exposure to chemicals. ATSDR included endocrine disruption as a part of one of its focus areas in the agency's *Agenda for Public Health Environmental Research* [APHER] *2002–2010* (*5*). APHER includes several areas of concern that, like endocrine disruption, have critical data and information gaps. Research results will be used to improve ATSDR's public health activities and interventions for communities exposed to hazardous waste substances through contaminated water, soil, air, or food (*5*).

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Chronology of Terminology

Appropriate terminology to describe endocrine-disrupting effects remains controversial:

- Initially, during the mid to late 1980s, scientists were focused on so-called *environmental estrogens*.
- More recently, the terminology *endocrine disruption* has been used to convey the fact that the alterations can occur at any of several target organ sites throughout the endocrine system.
- The terminology *endocrine disruptors*, initially used by Colborn and Clements (*1*), was also used in 1996 when Congress mandated the U.S. Environmental Protection Agency (EPA) to develop a screening program for "...certain substances [which] may have an effect produced by a naturally occurring estrogen, or other such endocrine effect[s]..." (*2–4*). To meet this mandate, EPA convened a panel called the Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), which in 1998 completed its deliberations and made recommendations to EPA concerning *endocrine disruptors* (*4*).
- In 1999, the National Research Council (NRC) released a report that referred to these same types of chemicals as *hormonally active agents* (*5*).
- The terminology *endocrine modulators* has also been used to convey the fact that effects caused by such chemicals might not necessarily be adverse.

References

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5. Committee on Hormonally Active Agents in the Environment, National Research Council. Hormonally active agents in the environment. Washington (DC): National Academy Press; 1999. p. 1–9.

Beryllium Exposure and Chronic Beryllium Disease

With the exception of the naturally occurring ore, beryl, all compounds of the metal beryllium are potentially harmful, particularly if inhaled. Soluble beryllium compounds produce both acute and chronic toxicity. Insoluble forms, such as beryllium alloys, intermetallics, beryllium oxide, and beryllium ores, generally induce effects only after prolonged exposures.

Beryllium and its compounds can be highly toxic, and exposure can lead to adverse health effects. The metal can be absorbed through the lungs or the skin, particularly if the skin is not whole. In contrast, beryllium usually is not hazardous if ingested (*1*,*2*). Beryllium exposure might have local effects; however, the systemic changes are usually more significant. Once absorbed through the lungs or skin, beryllium can be deposited in the spleen, liver, and bones (*1*). The rate of excretion of beryllium in the urine depends on how rapidly and in what form the metal has been absorbed. Beryllium can persist in the liver and bones after it has been excreted by the lung.

Most acute health effects result from relatively high exposure—sometimes from only a one-time exposure. Most chronic health effects result from repeated exposures, sometimes at levels not high enough to make a person immediately sick.

Beryllium can be tested in the urine; however, beryllium in the urine only indicates that exposure has occurred: the level does not correlate with severity of exposure or clinical findings (*2*). Specific tests for beryllium in lung and skin tissue are also available (*2*). Other types of lung disease, particularly sarcoidosis, must be ruled out. The skin can also be affected by chronic beryllium exposure (*1*). Contact with the broken skin can cause itchy ulcers and lumps or nodules to develop on the exposed part of the body after an incubation period of about 2 weeks. Accidental implantation of beryllium metal in the skin might produce a "beryllium ulcer" or granuloma. These ulcers can be chronic.

Discovered in 1797, beryllium is a rare element (*1*). Colorado, New Mexico, and Utah have beryllium deposits (*1*). Beryllium is used in hardening alloys in combination with steel, aluminum, and copper. Because it is nonmagnetic and transmits x-rays easily, beryllium is used extensively in x-ray tube manufacture. In the past, beryllium was also used in the manufacture of fluorescent lighting tubes; however, the recognition of chronic beryllium disease led to beryllium's replacement by other, less toxic compounds. Today, beryllium's main uses are in nuclear physics, in the space program, in production of fatigue-resistant alloys and heat-resistant ceramics, and as a "window" in x-ray tubes (*1*). Beryllium is also found in cigarettes (*2*).

Treatment of chronic beryllium disease, or berylliosis, is dependent on severity of the symptoms, and should include removing the person from exposure. Corticosteroids can be a useful adjunct for controlling symptoms of shortness of breath and for delaying onset of heart failure (*2*). Chronic skin granulomas can be surgically removed.

Whether beryllium compounds are carcinogenic in humans remains controversial (*2*). Some evidence shows that beryllium causes lung cancer in humans, and beryllium has been shown to cause lung and bone cancer in experimental animals (*2*,*3*). Insufficient information is available to classify beryllium as a reproductive hazard (*2*). Individual sensitization and hypersensitivity reactions to beryllium compounds, particularly beryllium fluoride, beryllium chloride, and sulfate, also occur with exposure (*1*,*2*).

Conclusion

Medical tests that look for damage already caused are not a substitute for controlling exposure. All unnecessary beryllium exposure must be avoided. Unless a less toxic chemical can be substituted for beryllium, engineering controls are the most effective way of reducing beryllium exposure. Because

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dust control is of paramount importance, the best protection is to enclose operations and provide local exhaust ventilation at the site of chemical release. Wet, self-contained processes should be used. Beryllium preparations should be transported as liquids rather than powders. Respirators, masks, protective eyewear, clothing, and gloves are less effective than the controls already mentioned, but are sometimes necessary to prevent exposure. Even with optimal care, the concentration of beryllium in the air might be sufficient to induce hypersensitivity in some individuals (*1*). The Occupational Safety and Health Administration, which adopts and enforces health and safety standards, requires employers to determine the appropriate personal protective equipment for each hazard, including exposure to beryllium and beryllium compounds, and to train employees on how and when to use protective equipment.

References

1. Morgan WK, Seaton A. Occupational lung disease. 2nd ed. Philadelphia: W.B. Saunders Company; 1984. p. 458–68.
2. MEDITEXT medical management: beryllium compounds. In: Heitland G, Hurlbut KM, editors. TOMES system. Englewood (CO): Micromedex; 1998 Dec.
3. New Jersey Department of Health and Senior Services. Beryllium: hazardous substance fact sheet. Trenton (NJ): New Jersey Department of Health and Senior Services; 1998.

Investigating Community Exposure to Beryllium in Elmore, Ohio

Peter J. Kowalski, MPH, CIH

U.S. Senator Mike DeWine (R-OH) asked the Agency for Toxic Substances and Disease Registry (ATSDR) to determine whether beryllium air emissions from the Brush Wellman plant in Elmore, Ohio, and the possible off-site transport of beryllium dust on workers' clothing present a health hazard to the Elmore community.

On October 10, 2001, ATSDR issued a health consultation for the Brush Wellman Elmore plant. This health consultation identified two gaps that limit ATSDR's evaluation of these exposure pathways. The data gaps include insufficient information about (a) the levels of beryllium dust in homes and personal vehicles of both Brush Wellman workers and other members of the community and (b) the levels of beryllium in ambient air during short-term incidents (e.g., air pollution control system failures).

> Beryllium is a rigid, low-density metal that has excellent thermal and physical properties. Because of these properties, beryllium is used in a number of commercial products. The Brush Wellman Company's plant in Elmore, Ohio, is the primary U.S. producer of beryllium powder, beryllium oxide, and beryllium alloys. The Elmore plant has operated since 1953 and employs approximately 600 workers.

In follow-up, ATSDR will collect environmental samples in the Elmore community to determine whether the public might be exposed to beryllium from (a) local beryllium workers who might have carried beryllium dust home on their clothing or (b) deposition of beryllium from facility air emissions. Investigators will collect soil, surface (i.e., wipe or vacuum), and air samples for beryllium from selected homes in the Elmore area, including those of current and former beryllium workers.

The results of this investigation will assist ATSDR in evaluating these exposure pathways and determining appropriate follow-up actions. ATSDR has also recommended community involvement and health education activities so that the community has a better understanding of chronic beryllium disease.

Calendar

August 6–10, 2002
North American Association for Environmental Education (NAAEE) 31st Annual Conference: The Boston TEE (Total Environmental Education) Party. Contact: NAAEE, 410 Tarvin Road, Rock Spring, GA 30739; telephone: 706-764-2926; fax 706-764-2094; e-mail: email@naaee.org.

September 4–6, 2002
Georgia Public Health Association Annual Meeting and Conference, Atlanta, Georgia: Partnerships in Action: Connecting Globally, Responding Locally. More information is available at www.gapha.org.

September 10–13, 2002
Association of State and Territorial Health Officials (ASTHO) 2002 Annual Meeting: Public Health: The Challenge Continues, Nashville, Tennessee. For more information, contact ASTHO by telephone at 202-371-9090 or e-mail at kkrolak@astho.org.

September 12, 2002, 1:00–3:30 PM ET
Working with Communities for Environmental Health. An Agency for Toxic Substances and Disease Registry and Public Health Training Network Satellite Broadcast and Webcast. Contact Diane Drew at ddrew@cdc.gov; more information about the braodcast is available at www.phppo.cdc.gov/phtn/envedu/.

September 17–19, 2002
Charting the Course: First Conference of the National Center on Birth Defects and Developmental Disabilities. More information is available at www.cdc.gov/ncbddd or by calling the center at 770-488-7150.

September 21, 2002
First Mid-Atlantic Conference on Children's Health and the Environment, Washington, DC: Clinically Important Issues in Children's Health and the Environment. Sponsored by the Mid-Atlantic Center for Children's Health and the Environment. Contact: Mid-Atlantic Center for Children's Health and the Environment at 202-994-1166; Web: http://www.health-e-kids.org.

October 17–19, 2002
Environmental Hormone 2002 Conference, New Orleans, Louisiana. Contact: www.e.hormone.tulane.edu.

October 23-25, 2002
Third National Centers for Disease Control and Prevention Conference on Asthma: 2002 National Asthma Meeting: Living Well with Asthma, Atlanta. More information is available at www.cdc.gov/nceh/airpollution/asthma/2002mtg.htm.

November 8–9, 2002
Society for Public Health Education (SOPHE) 53rd Annual Meeting, Philadelphia, PA: Declaring Our Interdependence: United for Health Education. Contact: Society for Public Health Education, 750 First Street NE, Suite 910, Washington, DC 20002-4242; telephone: 202-408-9804; e-mail: info@sophe.org; Web: www.sophe.org.

November 9–13, 2002
American Public Health Association 130th Annual Meeting, Philadelphia, PA: Putting the Public Back into Public Health. Contact: APHA Meeting Coordinator Edward Shipley, telephone: 202-777-2478; fax: 202-777-2530; e-mail: edward.shipley@apha.org; Web: www.apha.org/meetings.

November 13–15, 2002
Brownfields 2002: Investing in the Future, Charlotte, NC. More information is available by e-mail: brownfields2002@dyncorp.com or by telephone: 1-877-343-5374.

November 19–21, 2002
2002 Conference on Tobacco or Health, San Francisco. For more information, contact the National Conference on Tobacco or Health by telephone: 301-294-5664, e-mail: registrar@feddata.com, or Web site: www.tobaccocontrolconference.org.

Courses

Deep South Center for Occupational Health and Safety

Contact: Melinda L. Sledge, Deep South Center for Occupational Health and Safety, University of Alabama at Birmingham, School of Public Health, Birmingham, AL 35294-0022; telephone: 205-934-7178; e-mail: dsc@uab.edu; Web: www.uab.edu/dsc.

10-Hour Occupational Safety and Health Administration (OSHA) General Industry. Upcoming course dates: July 18–19.

Spirometry Workshop. Upcoming course dates: August 5–6.

Audiometric Testing and Hearing Conservation. Upcoming course dates: August 7–9.

North Carolina Occupational Safety and Health Education and Research Center

Occupational Safety and Health Education and Research Center, University of North Carolina, 3300 Highway 54 West, Chapel Hill, NC 27516-8264; telephone: 919-962-2101 or toll-free 1-888-235-3320; fax: 919-966-7579; e-mail: oshercww@sph.unc.edu; Web: www.sph.unc.edu/osherc/.

Supervising Lead Abatement Programs. Upcoming course dates: August 27–30; refresher course date: July 11.

Domestic Preparedness: Awareness Level. Upcoming course date: July 18.

Domestic Preparedness: Operations Level. Upcoming course date: July 18.

Domestic Preparedness: Technician Level. Upcoming course dates: July 18–19.

25th Annual Occupational Safety and Health Summer Institute, Norfolk, Virginia. Upcoming dates: August 5–9.

Lead Inspector. Upcoming course dates: August 19–21; refresher course date: August 26.

Lead Risk Assessor. Upcoming course dates: August 22–23; refresher course date: August 27.

19th Workers' Compensation Conference. Upcoming date: August 30.

Books

Measuring and Raising Community Awareness of Environmental Health Services: A How-To Manual. Published by the National Environmental Health Association (NEHA) Association Research Center (ARC)

This publication is ARC's second reference specifically designed to be of value for the environmental health professional.

The manual

- provides the reader with a detailed description (including a case study) of how to measure levels of awareness of environmental health in a community;
- explains how to accurately interpret and report survey results;
- describes strategic planning principles and initiatives that were implemented in the case study community; and
- supplies the reader with actual tools and resources that can be used by any local environmental health program.

Special introductory prices until June 30, 2002: $69.99 (NEHA members), $99.99 (nonmembers). Save $10.00 each on additional copies ordered at the same time. 176 pages. ISBN: 0-944111-02-5.

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