

NIEHS Responds to Katrina

NIEHS director David Schwartz knows firsthand what the country's worst natural disaster looks like. Within days of Hurricane Katrina's winds and waves, he led an advance medical team of 50 physicians, nurses, and health care workers from the NIH, the NIEHS, and Duke University Medical Center to Mississippi to respond to the disaster. There he found "nothing short of what one would expect in a war zone," as he wrote on the NIEHS website when he returned two weeks later. The extent of destruction was "overwhelming, with cars upturned, tractor trailers scattered like matchsticks, homes completely leveled, buildings destroyed."

Schwartz was just one of many NIEHS specialists who were, and in some cases still are, part of the largest disaster response mobilization in U.S. history. The institute's response to Katrina involved quick, extensive planning and organization within the NIEHS and across a span of sister agencies, such as the NIH, the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention (CDC), the Department of Defense, the Food and Drug Administration, the U.S. Department of Agriculture (USDA), and the Department of Homeland Security and Federal Emergency Management Agency (FEMA).

"Katrina was an environmental health catastrophe, and [Hurricane Rita a month later] just added to the damage," says Allen Dearry, the NIEHS associate director for research coordination, planning, and translation, who has acted as the institute's response coordinator. "The institute's expertise is connecting environmental

exposure to human health, and there are bigger questions as the result of this natural disaster than we have encountered before."

Immediate Response on Many Fronts

The NIEHS went into action shortly after Katrina hit. On August 31, the day after the New Orleans levees broke, Joseph "Chip" Hughes and the team he directs at the NIEHS Worker Education and Training Program (WETP) developed a PowerPoint safety awareness training primer for first responders and posted it on the NIEHS website. The group had produced 11 versions of the primer by October 27, updated as the scope of the disaster unfolded to include information on such health threats as trench foot, waterborne diseases, and mold. The primer—available in English, Spanish, and Vietnamese (since there are many Vietnamese in the Gulf Coast region)—has been downloaded at least 1,600 times, and more than 35,000 printed copies have been distributed. The WETP team has also delivered hands-on hazards training to federal employees and federally employed contractors in the field in Mississippi, Louisiana, Alabama, and Texas.

Just as human health was at risk, so was that of the animals left stranded by the hurricane. Starting September 7, William Stokes, director of the National Toxicology Program (NTP) Interagency Center for the Evaluation of Alternative Toxicological Methods, who also serves as the chief veterinary officer of the U.S. Public Health Service, headed the federal effort to assist with the rescue and shelter of those animals. Stokes led an initial team of 10 veterinarians and a public health nurse whose number quickly doubled to meet the overwhelming needs of two emergency animal shelters, one located on the Louisiana State University Baton Rouge campus, and one at a livestock exposition center in Gonzales.

The shelters' residents included carriage horses from New Orleans, a pet alligator, an eight-foot-long python, pot-bellied pigs, birds, turtles, and a variety of other pets. A total of 35 Public Health Service veterinarians and countless volunteers examined and treated more than 5,000 creatures, inserted identifying microchips, took photographs, and moved many of the

animals out to other shelters to await their owners.

"In addition to keeping all of these animals healthy, our goal was to ensure that as many as possible were returned to their owners in order to avoid further stress from the pet loss on top of all their other losses," says Stokes. He adds that in the future, he hopes evacuation policies will allow for animals to accompany their owners.



Saving man's best friends. Bill Stokes and a team of vets and volunteers helped stranded pets.

Meeting of the Minds

As the extent of the disaster unfolded, the NIEHS continued to send out experts to assist other federal agencies. Mary Wolfe, director of the NTP Office of Liaison and Scientific Review, was sent to CDC headquarters in Atlanta for five days in mid-September to help assimilate field data from teams along the Gulf Coast who were assessing emerging health threats. Sam Arbes, an epidemiologist in the NIEHS Laboratory of Respiratory Biology who studies the health effects of mold, went to Baton Rouge with a CDC team to prepare a document that helped local and state officials assess environmental damage and public health issues as they planned for re-entry of residents and restoration. The document addressed public health issues associated with drinking water, sewage disposal, roads and transportation, toxic exposures, housing, and schools, among other things.

NIEHS-funded environmental health sciences centers also swung into action. Immediately after the hurricane, Schwartz asked the center directors to work collaboratively to define the research questions that would surround the effects of the hurricane and the recovery of the population. Five working groups within the centers



At the ready. NIEHS staff came soon after Katrina hit to help at a 500-bed field hospital in a Meridian, Mississippi, hangar.

program addressed issues of worker surveillance and health, water quality and microbes, water quality and chemical contamination, mold and respiratory consequences, and outreach and education for the affected populations. The groups have since provided Schwartz with a critical assessment of the research questions that could be addressed.

Some action has begun. Staff from the centers' Community Outreach and Education Programs have banded together to create educational and outreach materials about the hazards that the populace may find in their homes [see "COEPs Contribute to Hurricane Relief," next article]. Centers will also be conducting pre- and postdeployment blood sampling and analysis of New York City firefighters deployed to help the relief efforts in New Orleans. And key experts from the centers have been invited by groups such as the American Red Cross to consult on environmental problems in the region that arose from the storms. They have done some sampling of water, molds, and sediment in the region.

Back home, institute staff developed a NIEHS Natural Disaster Response website to disseminate information to workers and residents about conditions in the Gulf Coast [see the EHPnet article, p. A27 this issue]. Derry acted as a liaison with call centers set up by the NIH and the CDC, providing information on human and environmental health issues to pass along to callers. The call centers ini-

tially took calls just from health care providers, state and local environmental and health agencies, clinics, and other providers, but were soon opened to calls from the public as well.

Long-Term Study of Environmental Health Risks

Some of the NIEHS disaster response efforts are unique programs that will help identify the environmental hazards produced by Katrina as well as provide long-term insights into the link between environmental toxicants and health outcomes. For example, the NIEHS website features a geographic information system (GIS) database that is designed to help expedite cleanup efforts, but which can be continually developed and updated as a tool to track environmental health.

Led by William Suk, director of both the NIEHS Center for Risk and Integrated Sciences and the Superfund Basic Research Program, the GIS overlays maps and high-resolution aerial photography of Texas, Louisiana, and Mississippi with a wealth of demographic, hydrographic, infrastructure, and industrial/agricultural data from publicly available sources. With the assistance of NIEHS academic partners at Duke University and the University of California, San Diego, supercomputing center, the interactive maps pinpoint the location of Superfund sites (four in New Orleans alone), scores of Toxics Release Inventory-reporting sites (those that release toxic contaminants), and the hundreds of oil and gas

rigs, gas stations, chemical industries, refineries, and crude petroleum and natural gas operations in the Gulf Coast region.

Information now being collected on water and air sampling in the area will be added as a way to model the movement of contaminants and identify sources of human exposure. For example, one-quarter of the areas sampled by the EPA in New Orleans by late September showed benzene levels that were more than twice the NTP intermediate safety level. And there were hundreds of reported oil and toxicant spills—including gas that may have seeped from an estimated 350,000 swamped cars—as well as drowned industrial and toxic waste dumps. Suk and his team of institute scientists and academic partners are working 14 to 20 hours a day to pull in data from federal agencies such as the EPA, the CDC, and OSHA in order to create what he calls a "national model that can track environmental health, both for the short-term use of responders and cleanup crews and long-term assessment of health consequences." The model is available on the NIEHS Natural Disaster Response website.

Among the resources they are tapping are the Centers for Oceans and Human Health, supported jointly by the NIEHS and the National Science Foundation. The four centers have been sampling and analyzing floodwaters from New Orleans, and received \$150,000 in National Science Foundation "rapid response" funding to collaboratively investigate the health of Lake Pontchartrain, into which 100 billion liters of New Orleans floodwater has been pumped. Researchers at these centers will sample and document the presence, abundance, and fate of waterborne pathogens such as *Escherichia coli* and *Vibrio vulnificus* (which produces a cholera-like infection and is already responsible for deaths in the area) as well as heavy metals and other toxicants in the pollution plume entering Lake Pontchartrain and beyond. They will also monitor the development of harmful algal blooms that could result from matter pumped into the lake. The information will then be linked to the GIS database.

Frederick Tyson, who administers the Centers for Oceans and Human Health program, says, "We have galvanized the talents we have to give us important answers to a public health crisis that is happening right now and that will impact public health in that region." Suk adds that Katrina has offered "an experiment that no one wanted but which we now have in place to study real problems that will allow us to gain a better understanding of environmental health risks." —Renée Twombly



Rebuilding safely. The NIEHS WETP has developed a primer to guide construction and cleanup workers in rebuilding the Gulf Coast in a safe manner.

BEYOND THE BENCH

COEPs Contribute to Hurricane Relief

The conditions in Louisiana and Mississippi following Hurricanes Katrina and Rita reminded us all of our commonality in the human experience and moved many to help. Among those moved to help were the staff at the Community Outreach and Education Programs (COEPs) of NIEHS Centers across the country. Responding to communities in need is one of the primary functions of the COEPs, so providing outreach to those areas on the Gulf Coast impacted by the hurricanes seemed a natural step to take.

“When our director volunteered our COEP [to lead efforts], we remarked that if COEPs had never existed, they would have had to be invented on August 28,” says Pamela Diamond, director of the NIEHS Center COEP at University of Texas Medical Branch (UTMB) in Galveston. Adds Robin Fuchs-Young, director of the COEP of the Center for Research on Environmental Disease at the University of Texas, M.D. Anderson Cancer Center (UTMDACC), “All of us saw what was happening on television and felt compelled on a human level to help in whatever way we could.”

A Helping Hand

Says Diamond, “Most of the community outreach directors and staff across the country knew one another and trusted one another, and we could quickly organize a response. It was quite a pickup operation—cell phone calls, e-mails in the middle of the night. During our own evacuation due to Hurricane Rita, we sat on [Fuchs-Young’s] back porch, planning supply deliveries, editing public service announcements [PSAs], and identifying scientists in distant states to provide reliable information and data for flyers.”

Two teams from the UTMB COEP were dispatched in early October with different objectives. One team, led by Diamond, connected with shelters in rural LaFourche Parish and delivered humanitarian supplies including first aid equipment, diapers, and drinking water. The other team covered a wider range including Calcasieu, Jefferson, Orleans, Terrebonne, and LaFourche Parishes, as well as Baton Rouge and New Iberia and Port Arthur, Texas, to contact community-based environmental organizations whose operations had been disrupted by the hurricanes. These groups were asked how the events had disrupted their normal functions, what environmental damage they observed, what they saw as the greatest environmental threats facing residents on re-entering impacted areas, and how they could

unite their skills and networks with scientific and clinical expertise. These interviews were compiled in a DVD format and are being sent to the directors of each COEP and interested personnel at the national level.

The UTMB COEP is also collaborating with the Louisiana Environmental Action Network in funding the preparation and delivery of re-entry hazard protection kits for residents involved in recovery operations. These kits focus on mold and toxic residue hazards and—along with information prepared by the NIEHS, the Centers for Disease Control and Prevention, and the Federal Emergency Management Agency—aim to mitigate citizen exposures.

Education for the Re-entry Process

The COEPs also recognize that the devastated areas will need resources to help them deal with the long-term environmental aftermath of the hurricanes. Soon after Katrina hit, reports indicated high levels of arsenic and lead in the floodwaters and severe mold contamination. The programs joined forces to provide long-term outreach, and divided into areas of strongest expertise to develop fact sheets offering clear, useful information for citizens in the affected areas.

“The strong desire to return families to their homes and to rebuild neighborhoods needs to be balanced with care to do things right,” says Ruth Woods, program administrator of the Center for Child Environmental Health Risks Research and the Pacific Northwest Center for Human Health and Ocean Studies, both at the University of Washington (UW). “Environmental cleanup needs to be a high priority so that people are not made ill from [environmental exposures].”

The COEPs from UW, the Kresge Center for Environmental Health at Harvard University (in conjunction with Columbia University), the University of Iowa Environmental Health Sciences Research Center

(EHSRC), and the Wayne State University Environmental Health Sciences Center in Molecular and Cellular Toxicology with Human Applications have developed fact sheets addressing various elements of returning home safely. Topics include lead and arsenic contamination from floodwaters, mold hazards, and safe cleanup procedures.

Some of the fact sheet material is based on Katrina-specific studies. Peter Thorne, director of the University of Iowa COEP, says members of his group have collected air and surface samples from water-damaged homes in New Orleans. One study showed that the mean airborne endotoxin concentration was 200-fold higher than in nonflooded homes, and levels of airborne mold spores were so high that N95 respirators—devices with a filter efficiency of 95%—are inadequate protection. Thorne says the fact sheets his working group created describe mold hazards and instruct residents on precautions necessary for safe re-entry and cleanup.

To date, the COEPs have distributed more than 67,000 flyers to local leaders in the storm-damaged area. “We are hoping that other . . . COEPs have information on the same or other topics that can be developed into flyers,” says Lisa Pietrantoni, project coordinator for the Wayne State COEP.

What was particularly gratifying about the flyer effort was how clearly the flyers were needed. “I often encountered someone in a shelter who told me they had mold re-entry flyers,” says Diamond. “When we looked at them, they were the flyers that had been created at UW or Wayne State, . . . copied by shelter workers, and passed down the line.”

The COEPs are also using PSAs to get safety information out to residents. The program at the University of New Mexico Center for Environmental Health Sciences produced six PSAs on topics such as safe cleanup methods, water safety, and toxics, and is working with American Forum, a



Pitching in. Center staff stepped in at several points, including taking water samples (left, at the 17th Street Canal) and helping area victims sign up for assistance and humanitarian aid (above, at the LaRose community shelter).

nonprofit media company, to disseminate them to over 3,000 radio, television, and print media outlets in the Gulf Coast area. The UTMDACC COEP is developing PSAs for especially susceptible groups of people, including immunocompromised patients. Still more PSAs may be developed to target specific regional issues and incorporate data that emerge from environmental health studies being conducted. Spanish-language PSAs might also target workers doing the repairs and rebuilding.

More to Be Accomplished

At the NIEHS Core Centers Annual Meeting held this fall at the Vanderbilt University Center in Molecular Toxicology, COEP staff discussed their outreach efforts and looked ahead to some next steps, such as community forums, town hall sessions, and continued data collection. They concluded that there is still much environmental health aid these towns and cities will need.

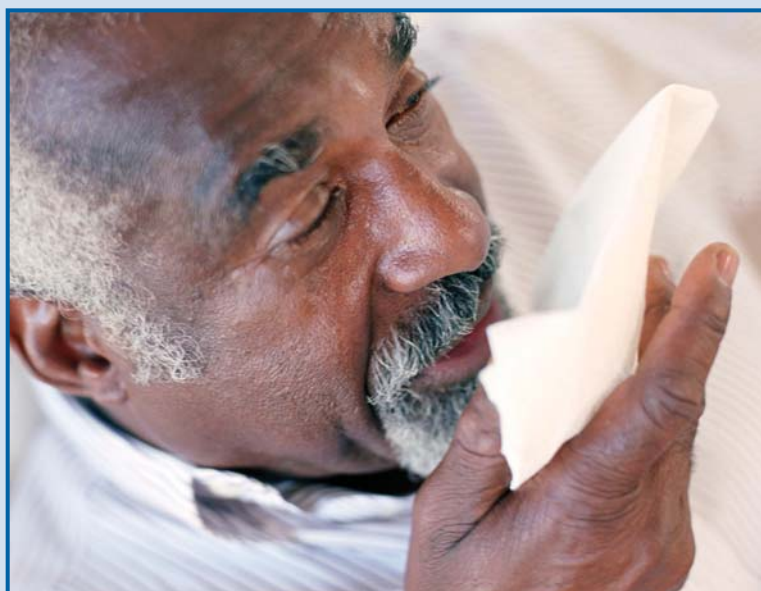
One potential partnership that could help the COEPs offer some long-term solutions is the Katrina Environmental Research and Restoration Network (KERRN), a vision conceived by John McLachlan, director of the Center for Bioenvironmental Research at Tulane and Xavier Universities in New Orleans. According to McLachlan, KERRN is “a network of researchers sharing data and ideas, crossing disciplinary, geographical, and institutional boundaries, providing models to respond to and recover from major environmental disasters.” The network, funded by a grant from the National Science Foundation, could be a great help for the residents in the affected area. As Fuchs-Young notes, “Folks in the Gulf Coast want science and data. They want to know what’s going to happen to their water supply and wetlands, and what will be the effect of flooded toxic waste dumps on their lives and livelihoods.”

The communities located throughout the Gulf Coast have a long road ahead of them. There is no question in the minds of most that they can and should rebuild; many have lived in this area for generations, and don’t want to change their way of life. But environmental health experts caution that much care must be taken because of the health threat that contaminants like mold can pose. States Thorne, “There remains extensive remediation work [in the Gulf Coast area] that will expose residents and contractors to mold hazards. The potential for allergy, asthma, and lung infections is high due to the enormous concentrations encountered. It is critically important that residents of Louisiana and Mississippi are protected from these exposures.” —**Tanya Tillett**

Headliners

NIEHS-Supported Research

Immune Response



Lead Disrupts T Cell Function

Farrer DG, Hueber SM, McCabe MJ Jr. 2005. Lead enhances CD4⁺ T cell proliferation indirectly by targeting antigen presenting cells and modulating antigen-specific interactions. *Toxicol Appl Pharmacol* 207:125–137.

Although lead has been banned from use in products like house paint, gasoline, and water pipe solder in the United States, it is still present in older housing, and is used in products in other countries. Besides its widely studied neurotoxicity, lead is also a well-known immunotoxicant, though little is known about its mechanism of action. Now NIEHS grantee Michael McCabe and colleagues at the University of Rochester have discovered how lead may work to disturb T cell function in the body.

Previous studies have suggested that lead’s immunotoxic effects may occur at exposures even lower than those required for neurotoxicity to occur; thus, suboptimal immune function may affect people who do not even realize they have been exposed to lead. Older adults and lactating, pregnant, and postmenopausal women are at greater risk for lead exposure as lead stored in the bones is released back into the blood and soft tissues. Children are also at heightened risk for lead exposure because they engage in more hand-to-mouth activity and absorb a larger proportion of ingested lead across the intestinal epithelium than do adults.

The Rochester researchers used flow cytometry to analyze T cell division in cell cultures derived from lead-treated mice. T cells help regulate the body’s immune system by attacking bacteria, viruses, foreign tissue, and tumor cells. At day 4 of treatment, the frequency of proliferating T cells was much greater in treated than in nontreated cultures. Lead appeared to target a type of cell known as antigen presenting cells, and its effect was based on specific peptide-major histocompatibility complex conjugate. The results suggest that lead may pose even more long-term health threats than originally thought. —**Tanya Tillett**

The American Plastics Council respectfully requests that *EHP* address the misinformation that appeared in these articles and which is available on the *EHP* website.

The author is employed by the American Chemistry Council/American Plastics Council.

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REFERENCE

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Phillips ML. 2005. Children's centers study kids and chemicals. *Environ Health Perspect* 113:A664–A668.
SC Johnson. 2006. Bogus E-Mail Attacking Plastic Wraps Refuted. Available: http://www.scjohnson.com/family/fam_pre_pre_news.asp?art_id=64 [accessed 12 January 2006].

Editor's note: The following erratum was published in the January 2006 issue (Environ Health Perspect 114:A21):

In the October articles "Children's Centers Study Kids and Chemicals" [Environ Health Perspect 113:A664–A668 (2005)] and "Are EDCs Blurring Issues of Gender?" [Environ Health Perspect 113:A670–A677 (2005)], photographs and their captions erroneously imply that plastic drink bottles contain ortho-phthalates. Plastic drink bottles sold in the United States are made from polyethylene terephthalate and do not contain ortho-phthalates. Also, at the end of the EDCs article, references are made to plastic wrap and Saran Wrap. For clarification, neither plastic wrap nor Saran Wrap contains ortho-phthalates. EHP regrets these errors.

ERRATA

Azziz-Baumgartner et al. noticed two errors in "Case-Control Study of an Acute Aflatoxicosis Outbreak—Kenya?" [*Environ Health Perspect* 113:1779–1783]. The units in Figure 2 and Table 2 should be nanograms per milligram instead of micrograms per milligram. The errors were introduced when new figures and tables were generated during the final revision of the paper. The authors apologize for these errors.

In the article by Feist et al. [*Environ Health Perspect* 113:1675–1682], the units were incorrect in several figures and tables: "Lipid ($\mu\text{g/g}$)" should be " $\mu\text{g/g}$ lipid" in Tables 1 and 2 and in the y -axes of Figures 2 and 3A–C. Also, on the y -axes in Figure 5A–D, "dL" should be "mL." *EHP* regrets these errors.

The photograph on page A29 of the January 2006 NIEHS News section should have been credited to Jennifer Gorenstein/UTMDACC COEP. The photographs on page A30 should have been credited to Tom Van Biersel/Louisiana Geological Survey (left) and Bryan Parras/UTMB (right). Additionally, Parras's photograph depicts residents of Pointe-aux-Chenes, not LaRose, and includes no COEP staff.

In the Beyond the Bench article in this same section, "COEPs Contribute to Hurricane Relief" [*Environ Health Perspect* 114:A30–A31 (2006)], Peter Thorne was incorrectly identified as director of the University of Iowa COEP; he is in fact director of the University of Iowa Environmental Health Sciences Research Center as well as head of the NIEHS Working Group on Mold, Microbial Agents, and Respiratory Diseases. It was the latter group that "collected air and surface samples from water-damaged homes in New Orleans" as our article stated. Finally, the aid teams that traveled throughout Louisiana included members from the UTMDACC COEP as well as the UTMB COEP.

EHP regrets the errors.

In the January Focus article "In Katrina's Wake" [*Environ Health Perspect* 114:A32–A39 (2005)], Hurricane Katrina was identified as a Category 4 storm, reflecting statements from the National Hurricane Center as of press time. The National Hurricane Center has since reported that Katrina was actually a Category 3 storm at the time of landfall.