'Bigdog' has a nose for ions. Page 2

DOE Pulse

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Research Highlights . . .

Lab takes it all out of the air

Lara Gundel of DOE's Lawrence Berkeley National Laboratory, working with colleagues in academia and industry, has developed "denuders" that measure different phases of airborne pollution separately and simultaneously. Air samples are sucked through tubes lined with resin beads that can trap molecules of organic gases in their microscopic pores; fine particles pass through the tube and are collected on filters. Gundel first used denuder technology, not normally employed with organic chemicals, to measure tobacco smoke. Her designs, dubbed Integrated Organic Vapor/ Particle Sampler (IOVPS) and Integrated Organic Gas and Particle Sampler (IOGAPS), now measure air pollution under a range of indoor and outdoor conditions. Standard air samplers fitted with denuders outperformed samplers without them in EPA field studies.

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Microcapsules test lab accuracy

Blind and double-blind tests for laboratories analyzing volatile organics in soil samples have been impossible until now—a process to create soil standards for these compounds did not exist. A scientist at DOE's Idaho National Engineering and Environmental Laboratory has patented such a process by microencapsulating such VOCs as trichloroethene (TCE), benzene, toluene, ethylbenzene, tetrachloroethylene and xylenes, among others. Mixing the microcapsules uniformly in soil samples results in true blind or double blind tests to measure the accuracy of a laboratory's analysis. The results can improve soil characterizations, increase efficiency and reduce costs of soil site remediation. The process is inexpensive, too, utilizing commercially available raw materials.

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Neutrino hunters break ground underground

Deep in a former iron mine, now a Minnesota state park, on July 20, scientists and government officials wielded pickaxes to chip away, at least symbolically, at the mysteries surrounding the subatomic particles called neutrinos. The under-groundbreakers, including DOE's Dr. John O'Fallon and Fermilab Director Michael Witherell, took the first steps in carving out a huge cavern, half a mile underground, to hold a 5,000-ton particle detector. Beginning in 2003, physicists of the 200-member MINOS experiment, which includes scientists from Argonne National Laboratory, will use it to explore the question of neutrino mass, using a beam of neutrinos from Fermilab's Main Injector accelerator 450 miles away.

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Nitrate waste breakdown

A team of scientists at DOE's Los Alamos National Laboratory has developed and installed a technology at the Lab's Liquid Radioactive Waste Treatment Facility that converts nitrates into harmless nitrogen gas. The technology uses a transition metal/acid mixture that strips oxygen atoms from nitrates, wastes typically generated in the mining, chemical, farming and nuclear power industries and during plutonium production. A number of industries have expressed interest in the process, which is more efficient and less expensive than reverse osmosis, evaporation and thermal or biological destruction, methods currently used worldwide to destroy or remove nitrate wastes.

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DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***DOE Pulse*** (www.ornl.gov/news/pulse/) is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

Tropical island hosts scientists worldwide

While it can't be compared to the infamous "Bermuda Triangle," the tiny island of Nauru in the Tropical Western Pacific lays claim to triangle of its own—in the form of two ships and an island.

Nauru is home to a major instrumentation installation, managed by DOE's Atmospheric Radiation Measurement Program, that serves as one point on a research triangle stretching 360 miles in circumference. The other two points consist of research vessels operated by the National Oceanic and Atmospheric Agency and the Japan Marine Science Technology Center—both major participants in an international climate campaign sponsored by the ARM Program.

The Nauru99 campaign investigates how the tropics influence the world's weather and climate.

In mid-June, researchers from around the world, including four DOE national laboratories, converged on and near the island to launch the Nauru99 campaign. Participants to uncover clues regarding how the tropics influence weather and climate worldwide. The TWP drives global weather events such as El Niño and La Niña, but is poorly understood.

Nauru99 boasts the most complete suite of atmospheric instrumentation ever installed in the TWP, including research vessels, aircraft, buoys, sea "snakes" and research balloons. Participants include DOE, NOAA, JAMSTEC, Australia's Flinders University, several American universities and ARM scientists at Pacific Northwest National Laboratory, Los Alamos National Laboratory, Brookhaven National Laboratory and Sandia National Laboratories.

Island-based measurements, such as those captured on Nauru, are cheaper and easier to obtain than ship-based measurements and provide the only opportunity for multi-year observations. Scientists, however, must identify and adjust for the influence of the landmass. The research triangle provides the first opportunity to simultaneously collect and compare data from the ocean and Nauru.

Though the field portion of the campaign concluded July 17, participants will analyze and integrate data for the next several months before results are finalized early next year.

Submitted by DOE's Pacific Northwest National Laboratory

Bigdog's nose for ions: It's not cold and wet, it's high tech

Six-foot-three Dave Atkinson's sports nickname, Bigdog, is apropos for work too. As an analytical chemist at the DOE's Idaho National Engineering and Environmental Laboratory, he's developing gadgets capable of sniffing out illicit drugs, explosive chemicals and environmental pollutants with the sensitivity of a canine nose.

Atkinson's passion is ion mobility spectrometry, a field of analytical chemistry that examines the behavior of ionized molecules in the gas phase. An IMS apparatus sucks in volatile molecules, zaps them with charging ionization and identifies the resulting molecular ions by how quickly they speed through an electric field. The mobility of an ionized molecule is influenced by its size and shape, so measuring its mobility can divulge its identity.

"This technology has serious analytical advantages," says Atkinson. "Its remarkable sensitivity, its ruggedness, its portability—the things it does, it does very well."

Atkinson's interest in IMS hails from his graduate school days, when he took IMS out of the lab and into the real world as a field screening tool. Since IMS functions at normal temperatures and pressures, and works best with low concentrations of molecules, it's destined for the great outdoors. "We're undergoing a paradigm shift in applied research from the lab to the field," says Atkinson. "Ion mobility spectrometry is part of that revolution."

Portable IMS devices have potential in such diverse areas as agriculture, environmental management, and anti-terrorism strategies—wherever organic molecules need to be detected and identified.

Now, the intellectually driven zymurgist heads up the Center for Ion Mobility Spectrometry, an INEEL-based collaboration between universities, industry and national labs to advance applied IMS research. The Center brings together the best researchers from the small IMS niche—there are only a handful of research groups who work on ion mobility spectrometry, although interest is growing internationally.

That makes him a Bigdog in a little field.

Submitted by DOE's Idaho National Engineering and Environmental Laboratory