



ANL's Dan Santini at the pump.

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Research Highlights . . .

A new way to make "neuts"

Ka-Ngo Leung and his colleagues in the Accelerator and Fusion Research Division at DOE's Berkeley Lab have devised powerful neutron generators small enough to lower into boreholes, use in brain-cancer therapy, peer inside airport luggage—or perch on a laboratory bench. The new designs are coaxial cylinders with ion sources that emit beams radially along their length, striking targets wrapped around them. The result: many trillions of neutrons per second. Less shielding allows the compact generators to be placed close to the experiment, where they deliver as many useful thermal neutrons as the largest sources now in use, at a fraction of the cost.

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Super-hard steel coating

DOE's Idaho National Engineering and Environmental Laboratory researchers create a Super Hard Steel coating by transforming steel alloy into a non-crystalline metallic glass. Metallic glass has essentially no flaws, making it both hard and tough—perfect for use as a coating. Once sprayed on, the coating cannot be removed, even with a hammer and chisel. The coating exhibits extreme hardness, corrosion, and abrasion resistance properties—far surpassing other high-performance coatings such as hard chrome plating or tungsten carbide coatings. Lead researcher Daniel Branagan feels that significant cost savings will result over the lifetime of coated parts because machine parts will last much longer, and require less maintenance.

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Salmonella detected with Livermore technique

Salmonella may soon be identified within hours, rather than as long as a couple weeks, thanks to a rapid-detection technique developed at DOE's Lawrence Livermore National Laboratory. A paper by biomedical scientists Peter Agron and Gary Andersen about their DNA-based detection system appeared in the Nov. 1 edition of *Applied & Environmental Microbiology*. While people who eat raw eggs in Caesar salads or egg nog are at increased risk for contracting salmonella food poisoning, that risk may become much less in the near future because of this technology. Livermore's diagnostic DNA signatures (or tests) have been in a field test for about six months.

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Unraveling anthrax

Researchers at DOE's Los Alamos National Laboratory have developed the Amplified Fragment Length Polymorphism analysis tool to analyze *Bacillus anthracis* samples taken from naturally occurring anthrax outbreaks around the world. In AFLP, DNA is extracted from the bacteria and "cut" into a set of small fragments using enzymes that recognize specific stretches of DNA in the genome. From these small DNA fragments a subset is then amplified by Polymerase Chain Reaction. The resulting PCR product is then analyzed and compiled into a "fingerprint" that can be read and compared to other AFLP fingerprints in Los Alamos' extensive *B. anthracis* database.

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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).

Sandia disease tracking systems attracts notice

Al Zelicoff, senior scientist at DOE's Sandia National Laboratories, told members of the House Oversight and Investigations subcommittee recently that the nation's hospitals and medical clinics have an urgent need for an Internet-based disease-reporting system that would alert public health officials at the first signs of symptoms that signal a bioterrorism incident.

He explained that Sandia originally developed such a system, called the Rapid Syndrome Validation Project (RSVP), as a way to verify that nations are complying with biological weapons treaties. And long before the anthrax scare that has rattled the country the past few weeks, he had been advocating widespread adoption of RSVP by medical clinics across the country as a way to quickly identify outbreaks of unusual diseases, either intentionally introduced into a population or not.

"What we realized about two years ago is that good health surveillance is also good counter-terrorism against biological weapons," he says.

The system comprises Internet-based, touch-screen software that allows individual physicians to quickly and easily report symptoms they think are unusual, and automatically alerts public health officials when clusters of symptoms indicate a possible outbreak of infectious disease, allowing them to respond quickly.

Zelicoff told members of the House panel Nov. 1 that "public health systems and traditional medical care delivery systems are minimally prepared to detect the early manifestations of disease that is intentionally introduced into a community. . . .

"In my ten years of medical practice, I never—not once—saw a physician or physician's assistant pick up the phone to report a so-called 'reportable' disease. . . . Why? The process is burdensome, inefficient, and most importantly, almost never gives anything back to the physician that is of relevance to the patient she is caring for."

The New Mexico Department of Health is applying significant resources to the RSVP system, which has not yet been formally evaluated and is still under development. It is operational at the University of New Mexico Medical Center and in several other hospitals in New Mexico as well as the New Mexico Department of Health in Santa Fe. Researchers from UNM, the Health Department, and Los Alamos National Laboratory have participated in developing the system.

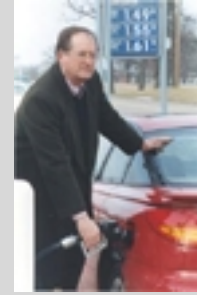
In contrast to other sentinel networks, RSVP tracks outbreaks of syndromes—signs and symptoms—rather than positive diagnoses of specific diseases. It is, therefore, less specific but more sensitive than existing disease surveillance systems.

The system helps physicians, hospitals, state health departments, and epidemiologists monitor the occurrence of certain illnesses that exhibit precursor symptoms similar to serious infectious diseases. By displaying syndrome information geographically, temporally, and—most importantly—immediately, RSVP allows public health officials to distinguish between benign sicknesses and deadly diseases in a much more timely fashion than has been possible until now.

Submitted by DOE's Sandia National Laboratories

ARGONNE ECONOMIST LINKS GAS PRICES TO ECONOMIC CONDITIONS

While swiftly rising prices at the gasoline pump caught motorists off guard in summer 2000, Argonne transportation economist Dan Santini was waiting for them.



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Santini, an economist in Argonne's Center for Transportation Research, then waited for the proverbial other shoe to drop—the beginnings of a recession in the spring of 2001.

Santini calls the one-two sequence "fundamental supply and demand—with a twist." He explained, "For an oil price shock to occur there has to be a divergent rate of change in U.S. consumption and production for a period of years, sort of like pressure building up. And then, the probability of a price shock goes way up," Santini said. "If the difference is positive, prices will rise, and vice versa."

Santini studies the reaction of the transportation sector—primarily changes in vehicle sales in response to gas prices—as a key cause of recession. Based on historical trends from the late 19th century to the present, he developed a model to predict recessions.

Santini's studies of the simultaneous roles of money and "real" oil prices—prices adjusted for inflation—for the 20th century show an inverse statistical link between oil price shocks and fluctuations in the growth rate of the money supply. So, when oil prices rise, money becomes tighter.

The first oil price shock peaked in 1920 and was followed by a recession in 1921.

Americans should show more interest in fuel efficiency at times when fuel prices are low and supply seems abundant, Santini believes. "Fuel prices are among the most volatile of all prices, and repeated fuel price shocks that slow or reverse economic growth have actually been typical of the U.S. economy," he said.

Submitted by DOE's Argonne National Laboratory