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LOS ALAMOS NATIONAL LABORATORY
WHERE SCIENCE MAKES A DIFFERENCE

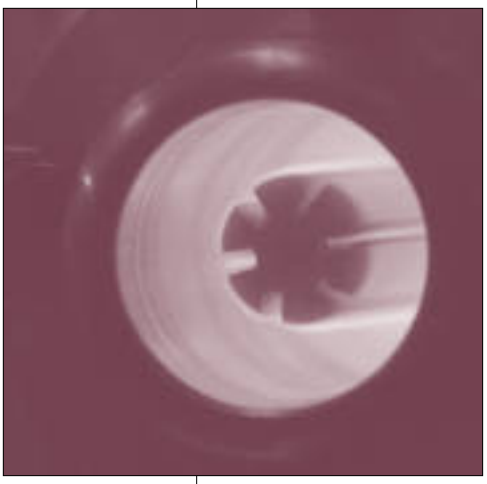
DATELINE LOS ALAMOS

U.S. DEPARTMENT OF ENERGY
UNIVERSITY OF CALIFORNIA

NEW DECONTAMINATION TECHNOLOGY

PLASMA JET NEUTRALIZES KILLER CHEMICAL AND BIOLOGICAL WARFARE AGENTS

The threat could be any modern nation's worst nightmare — a fanatical terrorist group, a rogue nation or perhaps just one raging individual releases chemical or biological agents on an unsuspecting populace and kills or injures thousands of innocents. Even though the vaccines exist, safeguards are in place and emergency responses are rehearsed again and again, governments know this threat is imminent. They also know that if deterrence and diplomacy fail to divert the threat, technology must work to counter the effects of an attack.



A closeup of the plasma — or ionized gas — streaming from the Atmospheric Pressure Plasma Jet.

Scientists at Los Alamos have recently developed a technology for neutralizing some of the world's most deadly chemical and biological warfare agents. Using the Atmospheric Pressure Plasma Jet, researchers

are able to quickly neutralize the deadly agents by decontaminating areas targeted with chemical or biological weapons.

The process uses electrically charged gas to create a chemically reactive gas spray that reacts with and destroys the killer agents on contact.

Chemical and biological weapons are as old as war itself and today biological and chemical warfare agents come in many forms. They can be spore-forming bacteria like anthrax, vegetative bacteria like bubonic plague and *E. coli*, viruses like small pox and yellow fever, or biotoxins like ricin and Botox. Bacterial spores like anthrax are often considered the most difficult to decontaminate because they spread easily and are hard to kill.

Chemical warfare agents are primarily blister agents like mustard gas and lewisite, nerve agents like sarin and soman, or choking agents like phosgene. The most persistent of these chemical agents are blister and nerve agents, but they all can be deadly. Tests conducted at Los Alamos lead researchers to believe that the APPJ can quickly decontaminate all these threats.

In the past, decontamination was a wet and dangerous process using bleaches or decontamination solutions. Decontamination solutions were often corrosive to materials like metal, plastic, rubber, paint, leather and, of course, human skin. The solutions could not be used on sensitive electronic equipment and the decontamination of affected areas often

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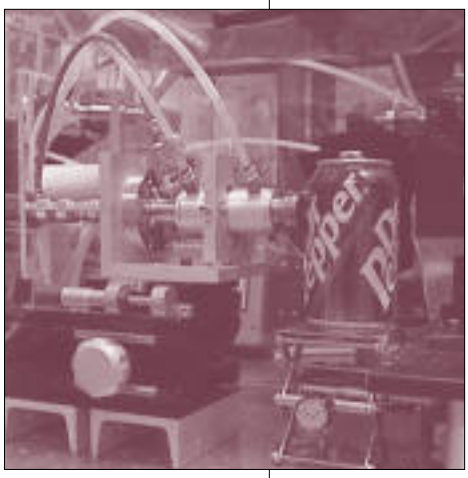

A soda can is used to demonstrate how the Atmospheric Pressure Plasma Jet can decontaminate and clean an object without damaging the underlying surface.

required long exposure times, typically 30 minutes or more, to be fully effective.

Existing decontamination approaches also require the transportation, storage and eventual release of large amounts of these chemicals into the environment.

To create an Atmospheric Pressure Plasma Jet, the pressurized feedstock gas, usually helium mixed with small amounts of oxygen, flows between an outer, grounded, cylindrical electrode and an inner, coaxial electrode. These electrodes create an electrical field that pulls off certain electrons to create an ionized gas, or plasma.

The loose ions and electrons in the plasma boost other gas molecules in the tube into a metastable state, or relatively unstable state, that survive long enough to exit through a nozzle at the end of the plasma jet and reach a surface several centimeters away.

When the flow exiting the jet strikes the contaminated surface, the stream of metastable gas molecules destroys the biological or chemical contaminants, essentially “burning” them at low temperature, without damaging the underlying surface.

Because the metastable molecules only last a fraction of a second before returning to ordinary oxygen, the process is environmentally safe. It starts with helium and oxygen and ends with ordinary helium and oxygen; all are harmless breathable products.

The APPJ operates at temperatures less than 175 degrees Celsius and uses about 300 watts of power, less than half that of a conventional microwave oven.

The APPJ technology was originally conceived of as a replacement for traditional solvent-based

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Researcher Hans Herrmann sets up an experiment with the plasma jet.

cleaning processes in integrated-circuit manufacturing, but was easily adapted to meet the national security needs posed by the growing threat of biological and chemical weapons agents.

So far, the APPJ has been tested successfully against a broad spectrum of chemical and biological surrogate agents. Tests show the Los Alamos plasma jet capable of destroying 10 million surrogate anthrax spores in as little as 30 seconds. These surrogate agents are similar in nature to the actual chemical or biological warfare agents, but are far safer for researchers to transport, handle and study.

While researchers are currently operating the APPJ technology on a small scale, it can be tuned for decontamination of large areas such as airfields and ships using relatively high-power applications. It also can be used at much lower powers for decontamination of sensitive equipment (e.g. electronics, optics and avionics), the interiors of military vehicles and possibly personnel.

Future research will be aimed at reducing the jet's temperature, to make it more suitable for the decontamination of people, and making the unit smaller and more portable. It will be designed to mount on a mobile platform, such as a Humvee, light truck or trailer, that could carry a generator, gas cylinders, an air compressor and associated equipment necessary to power one or more APPJ units. A smaller unit may be developed in backpack form, resembling a large fire extinguisher in size and weight.

There are other uses for the APPJ technology in addition to biological and chemical agent decontamination, including water purification, graffiti removal and various cleaning processes involved in integrated circuit fabrication.

Beta Squared Inc. of Allen, Texas, a subsidiary of Photronics Inc., along with the University of California at Los Angeles and Los Alamos recently signed a Cooperative Research and Development Agreement for developing the APPJ as a means of cleaning semiconductor wafers and photomask substrates.

Los Alamos researchers also are seeking industrial or governmental partners to support the continued development and refinement of the APPJ as a counterterrorism technology.

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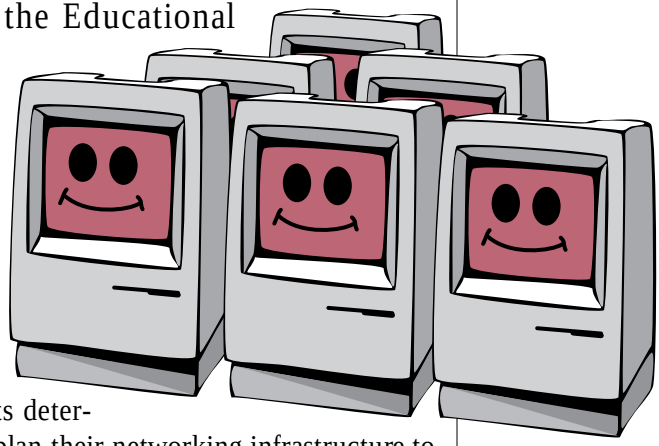
WIRING SCHOOLS FOR THE FUTURE

EDUNETS HELPS BRING THE INTERNET TO NORTHERN NEW MEXICO

Twenty-six public school districts, 13 nonpublic schools and 20 colleges and support partners from throughout Northern New Mexico have been recognized by Los Alamos for their participation in the Educational Networking Support — EduNets — program.



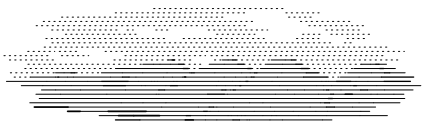
The program is designed to help Northern New Mexico school districts, colleges and universities establish online capabilities via the Internet.

EduNets uses Laboratory expertise and experience to help schools and school districts determine how to get connected and plan their networking infrastructure to ensure feasible and validated networking plans and implementation. The program primarily focuses on Northern New Mexico school districts, but a few districts in Colorado, Arizona, Texas and Oklahoma also have received some consulting and training support.

From every corner of Northern New Mexico, EduNets has helped schools and school districts in their efforts to become wired for the Internet. Since EduNets started, more than 150 schools in participating school districts in Northern New Mexico have established some level of Internet capability.

Given the rural nature of Northern New Mexico, making a school district or classroom Internet ready is no small feat. By the year 2000, the EduNets team hopes to have all 200 schools in Northern New Mexico school districts connected impacting 75,000 students and 4,500 teachers in 57 communities spread over 32,000 square miles.

The EduNets program closely aligns with Vice President Al Gore's national "information superhighway" initiative to have every school in the country networked and Internet ready.



EduNets, which started as a pilot in 1994, is funded by Los Alamos' Science and Technology Base Program Office.

Supporting partners in the EduNets program include the State Department of Education, Cooperative Educational Services in Albuquerque, Northern New Mexico Community College, the University of New Mexico Gallup and Zuni campuses, New Mexico Highlands University, the College of Santa Fe, Navajo Community Colleges, American Institute for Indian Art, Crownpoint Community College, Laredo Community College and Western Oklahoma State College.

Also the Golden Apple Foundation in Albuquerque, Jicarilla Community Education Center and the Jicarilla Apache Department of Education in Dulce, National Indian Telecommunications Institute in Santa Fe, the Technology Learning Center, also in Santa Fe, and LaPlaza de Taos Telecommunity in Taos.

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NEW INTERNAL SECURITY OFFICER

SCHIFFER BRINGS 30 YEARS OF EXPERIENCE IN COUNTERINTELLIGENCE FOR THE FBI

He's the top cop on Los Alamos' counterintelligence highway, but Ken Schiffer hopes he won't be giving out any tickets. Schiffer heads up the Internal Security office and is responsible for counterintelligence, operational security, and foreign visits and assignments.

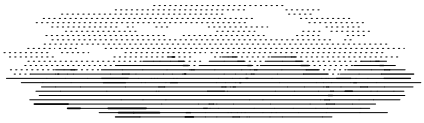
Schiffer came to the Lab after spending 30 years working in counterintelligence for the Federal Bureau of Investigation. He's studied Chinese in an intense language school and has worked in Indianapolis; Washington, D.C.; Quantico, Va.; and San Diego.

New internal security chief Ken Schiffer and his quarter horse, Bo Didley.

During his first year at the FBI, Schiffer made quite an impression on then-FBI Director J. Edgar Hoover. Schiffer has Hoover's autograph on a letter of admonishment for a vehicle crash. The car crash also resulted in Schiffer having to pay for the auto repair, receiving no annual raise and being relocated to the FBI field office in D.C.

"At the Bureau, I soon learned that if you take care of the little things, the big things will follow," he said.

Schiffer never got to meet Hoover, although it was required that every new agent meet the FBI director. "I was playing hockey and I got into a fight, which



happens often during hockey games, and I took a stick to the chin and had six stitches," Schiffer explained. The training instructor didn't know how to break the news to Hoover that one of his new agents had lost a fight, so they removed the stitches and the cut soon became infected, leaving Schiffer laid up on the day he was supposed to meet with Hoover.

Schiffer's most notable espionage case was when Larry Chin, a Central Intelligence Agency employee, was arrested, tried and convicted of espionage in the late 1980s. Schiffer was the supervisor of the investigating squad that brought Chin down. "It's significant, because most espionage cases never come to trial," Schiffer said.

Schiffer's goal for the ISEC office is to prevent disclosure of sensitive or classified information. "We're not the state highway cops of counterintelligence giving tickets to violators. It's our job to prevent it from happening at all." he said.

For too long, the three areas that he is responsible for have been separated, he said. Opsec and foreign visits both play into the bigger picture of counterintelligence. "Counterintelligence is the effort to protect information whether it is classified, sensitive or proprietary from being compromised by people or foreign countries that shouldn't have it," he said.

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PEOPLE IN THE NEWS . . .

HANS FRAUENFELDER, DIRECTOR OF LOS ALAMOS' CENTER FOR NONLINEAR STUDIES, WAS RECENTLY ELECTED TO THE POSITION OF FOREIGN MEMBER TO THE ROYAL SWEDISH ACADEMY OF SCIENCES IN STOCKHOLM. The Royal Swedish Academy of Sciences is an independent, nongovernmental organization responsible for, among other things, the annual nomination and selection of Nobel laureates in the fields of physics and chemistry. This is a lifetime appointment.

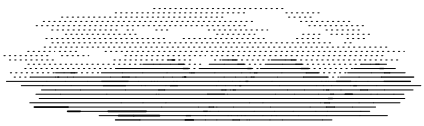
During his nearly 50 years of research in physics, Frauenfelder has studied nuclear energy levels, explored the surface effects with radioactivity, discovered perturbed angular correlation, helped elucidate parity violation in the weak interactions and investigated the physics of proteins. His current interest is in biomolecular physics.

In addition to his teaching and research, Frauenfelder has served in various leadership positions with the American Institute of Physics, the Board of Physics and Astronomy of the National Research Council, the International Union of Pure and Applied Physics Commission on Biological Physics and the Physics Section of the National Academy of Sciences.

Frauenfelder's life work has been recognized by his election to the National Academy of Sciences, the American Academy of Arts and Sciences, the Academy Leopoldina and the American Philosophical Society. He holds honorary doctoral degrees from the University of Pennsylvania, the Technical University of Munich and the University of Stockholm.

TONYA KUHL, A LOS ALAMOS AFFILIATE, RECENTLY RECEIVED THE PRESTIGIOUS PRESIDENTIAL EARLY CAREER AWARD FROM THE NATIONAL SCIENCE AND TECHNOLOGY COUNCIL. The NSTC coordinates the multi-agency science and technology policy-making process and implements and integrates the president's science and technology policy agenda across the federal government.

The award, begun in 1996, honors outstanding young scientists and engineers who show exceptional potential for leadership in their respective fields. It is the highest honor that can be given to them by the U.S.



government. Kuhl and the other winning researchers also received funding for their projects for five years.

Kuhl, a chemical engineer at the University of California at Santa Barbara, has been performing her experiments at the Laboratory's Manuel Lujan Jr. Neutron Scattering Center since 1991. She also is a member of the LANSCE Users Group Executive Committee.

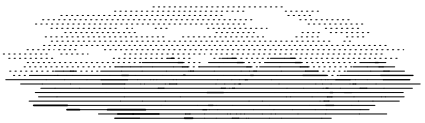
The focus of her work currently is on developing new "smart materials" and surface coatings, manipulating materials' characteristics by attaching thin films to their surfaces. These coatings then can be used as corrosion inhibitors, adhesives, lubricants or wear-resistant coatings. Kuhl uses the Lujan Center to study these materials.

"This is just incredible," said Kuhl regarding the award and grant money. "The extra funding will allow my research to progress further than I anticipated. It also will continue and strengthen the collaboration and research program between UCSB and LANSCE and enable us to try more high-risk but high-potential projects. I am very excited."

FRED KOCKS, A FELLOW IN THE MATERIALS SCIENCE AND TECHNOLOGY DIVISION, WAS RECENTLY ELECTED TO MEMBERSHIP IN THE NATIONAL ACADEMY OF ENGINEERING. Kocks was elected for his lifelong work in advancing the theory of materials strength, kinetics of plasticity of metals and texture analysis.

Kocks came to Los Alamos in 1983 as a founding member of the Center for Materials Science and became a Laboratory Fellow in 1986. He retired from the Laboratory in 1997, but remains active as an Associate Fellow. Since 1958, his work has been supported by the Department of Energy's Basic Energy Research Division and its predecessors.

Kocks is one of 80 American engineers and eight foreign associates elected to membership in The National Academy of Engineering this year. The academy's total U.S. membership is 1,984 members with 154 foreign associates. Kocks joins former Los Alamos Director Sig Hecker, Acting Deputy Director Warren "Pete" Miller and former Deputy Director Jim Jackson in this accomplishment.



BRIEFLY ...

THE INTERNATIONAL ATOMIC ENERGY AGENCY RECENTLY AFFIRMED THE LEADING ROLE DEPARTMENT OF ENERGY LABORATORIES PROVIDE IN DEVELOPING SAFEGUARDS TECHNOLOGY FOR INTERNATIONAL APPLICATIONS. At a U.S. Support Program review meeting in Vienna, an IAEA official lauded the performance of the prototype Advanced Multiplicity Shift Register developed by Los Alamos staff and discussed the status of testing on the reproduction commercial version of the AMSR. The AMSR is one of a family of neutron-measuring instruments used by the international safeguards inspectors to verify nuclear materials. It also can be tied into external sensors such as cameras to initiate real-time monitoring and has capability for other sophisticated features such as data storage and encryption software. This announcement before the interagency gathering was a ringing endorsement of DOE's leadership role in the world community in developing advanced verification and safeguards instrumentation for nuclear material measurements and translating those developments into commercial instruments and software that enable accountability of nuclear materials.

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