CPS PLASMA PAGE

Vol. 2, No. 1 Published by the Coalition for Plasma Science **March, 1999**

These brief summaries are drawn from several sources and are issued throughout the year. For more information please contact the source given at the end of each article, or contact the editor at the address given on the back.

Plasma-Based Device Purifies Water in Central American Relief Effort

In the aftermath of Hurricane Mitch's devastating rampage through Central America, a plasma-based ultraviolet lighting system invented at the U.S. Department of Energy's (DOE's) Lawrence Berkeley National Laboratory is being deployed to disinfect drinking water in areas ravaged by the storm.

Mitch left some 10,000 people dead and laid waste to the economies and infrastructures of Honduras, Nicaragua and El Salvador. Thousands of others were at risk for lack of sanitary drinking water.

In response, many of the disaster-relief efforts are bringing in "UV Waterworks," a small, simple device that uses ultraviolet light (generated by a plasma) to quickly, safely, and cheaply disinfect water of the viruses and bacteria that cause cholera, typhoid, dysentery and other deadly diseases.

UV Waterworks, invented by Ashok Gadgil, a scientist with Berkeley Lab's Environmental Energy Technologies Division, is ideally suited for emergency situations. "Unlike other ultraviolet-based water purifiers, UV Waterworks does not require pressurized water-delivery systems and electrical outlets," says Gadgil. "It is designed to rely on gravity for water flow which means it can be used with any source of water."

Needing only electricity to operate its small UV lamp and automatic shutoff valve, UV Waterworks can be powered by a car battery or a 60-watt solar cell. About the size of a microwave oven and weighing 15 pounds, it can disinfect water at the rate of four gallons per minute, similar to the flow from a typical American bathtub spout. Exposing water to the ultraviolet light inactivates the DNA of pathogens and purifies the water at a cost of about five U.S. cents for every 1,000 gallons.

Gadgil has been busy designing a second larger "disaster-relief" version of the device " to remove silt, suspended solids, and turbidity from inlet water which can then be treated with UV Waterworks to produce potable water," says Gadgil.

Although this new version of UV Waterworks can not handle "severe" chemical contamination of the water, it can be used to treat the soil, mud, and biological contaminants that are common in most disaster-relief situations. The research prototype of this new larger version of UV Waterworks weighs 250 pounds and can produce more than 5,000 gallons of drinking water daily.

Contact: Ashok Gadgil, Berkeley Lab's Environmental Energy Technologies Division
Contact: Lynn Yarris (510) 486-5375, lcyarris@lbl.gov

NASA To Study Space Plasmas

A project using a small spacecraft to study space plasmas in the vast region between our Sun and nearby stars has been selected as one of the first missions in NASA's University-class Explorers (UNEX) program.

The Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) spacecraft will use an extreme ultraviolet spectrograph during its one-year mission to study the "local interstellar bubble," a tenuous cloud of what is believed to be million-degree plasma surrounding our solar system. Scientists believe that the plasma in this region is generated by supernovae and stellar winds from hot stars, but want to better understand the origins and cooling of this plasma, and apply knowledge of these processes to the study of other galaxies beyond our Milky Way.

A second UNEX mission, the Inner Magnetosphere Explorer (IMEX), will study the dynamics of the inner magnetosphere, a collisionless magnetized plasma located within about 6 earth radii of the earth. The high energy components of this plasma are the energetic charged particles that comprise Earth's Van Allen radiation belts, which are potentially hazardous to both astronauts and satellite systems. Data from this mission should help

improve both our ability to predict hazardous conditions in Earth's radiation belts and our understanding of the underlying physical processes that connect the solar wind with the state of the Van Allen belts.
CHIPS: Dr. Mark Hurwitz, markh@ssl.berkeley.edu
IMEX:Dr.JohnWygant wygant@ham.space.umn.edu

Plasmas Used to Monitor Smokestack Emissions

Smokestack emissions from incinerators, power plants and manufacturing plants can contain hazardous metals such as lead, chromium and arsenic. Using plasmas to detect and measure such pollutants has been key to creating feedback controls that could limit such emissions, insuring compliance with environmental regulations.

"Devices for sensing these pollutants continuously and in real time are lacking," ac-cording to Dr. Paul P. Woskov, a principal research engineer at the MIT Plasma Science and Fusion Center (PSFC). So he and colleagues went to work on a new device that would use plasmas to become "more accurate and affordable."

The result is the R-TiC Metals Emission Monitor, which has won a 1998 R&D 100 Award. In tests last fall at an EPA facility, R-TiC "measured within the accuracy range that the EPA is looking at" for two of the three metals tested, Dr. Woskov said. "Before that test, no monitor could get close to that goal."

This is also the only monitor on the market that can be calibrated, or "tuned," in real time while the device is running. Calibration is im-portant because when a monitor is running, there are many conditions that can change (i.e. velocity, composition of exhaust). These factors change the signal strengths for a given metal, which are key to determining its concentration. As a result, the monitor must be retuned (or recalibrated) periodically to account for these changes.

Dr. Woskov expects that R-TiC could also be relatively inexpensive, costing much less than the approximately $300,000 for the metals emissions monitor currently on the market. R-TiC grew out of PSFC basic research on plasmas. It was originally developed to monitor emissions from a plasma furnace Dr. Woskov and colleagues built to remediate wastes. In effect, the furnace plasma remediates the waste, while the microwave plasma in the R-TiC monitors the pollution from the furnace plasma. "So the microwave plasma can be used to control and improve the performance of the furnace plasma," Dr. Woskov said, an example of "plasmas helping each other." Research on R-TiC is sponsored by the U.S. Department of Energy.
Contact P. Woskov, MIT/PSFC, NW16, 77 Mass. Ave, Cambridge, MA 02139; email: ppw@psfc.mit.edu

Plasma Science Education Draws Crowds

Plasma science education events at November's American Physical Society Division of Plasma Physics (APS-DPP) meeting in New Orleans (Nov. 16-20) attracted record numbers. Science Teachers Day, during which teachers could learn about plasmas, fusion and related research through overviews and workshops, attracted 132 teachers.

The Plasma Sciences Expo, featuring an exhibit hall full of hands-on demonstrations and exhibits geared to help students learn about plasmas and related science and technology, attracted approximately 3,200 students from elementary through high school, more than double the number at past events.

These events, and others like them staged around the country, are proving that science teachers and their students are eager for physics instruction and hands-on experiences. The 32 exhibits included demonstrations from companies and national laboratories, such as General Atomics, Princeton's Plasma Physics Laboratory, MIT Plasma Science and Fusion Center and Lawrence Livermore National Laboratory, combined with local companies and organizations, such as NASA's Stennis Space Center.
Contact: Carol Danielson, General Atomics, PO Box 85608, San Diego, CA 92186; danielson@gav.gat.com
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