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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.

Radioactive Waste Disposal Aided by Fusion Torch

Spent nuclear reactor fuel waste is presently stored around the country at nearly 100 sites, awaiting disposal at a U.S. Government site (Yucca Mountain, NV). Residents of Nevada oppose storing this material in their state, knowing it will take 10,000 or more years for it to decay to relatively safe levels. At the same time, temporary storage sites used by electric power utilities are reaching their limits.

One solution to this problem may be a new plasma technology that separates radioactive wastes and reduces their volume - *The Fusion Torch/Large Volume Plasma Processor (LVPP)*.

The Fusion Torch/LVPP uses an ultra-high temperature plasma to convert any material into an ionized gas – or plasma. It then uses magnetic fields to channel this plasma to appropriate collection points. In so doing, the process sorts the toxic elements in nuclear wastes (such as plutonium) from the safe elements (such as oxygen). The waste material can then be channeled to an ATW (Accelerator Transmutation of Wastes) device, which transmutes high level waste into more benign materials that will be safe after only 300 years.

The Fusion Torch/LVPP is unique in using a "dry" process to extract harmful wastes. Conventional technologies use acids or molten metals to dissolve waste products, thereby increasing waste volumes by factors of 10 or more.

This plasma-based approach is called the "Fusion Torch/LVPP" because it is a practical application of technologies developed in the U.S. Department of Energy (DOE) Magnetic Fusion Energy Science Research Program.

More information is available at the following web site: http://www.Eastlundscience.com

SOHO Spacecraft Detects Source of High-Speed Solar "Wind"

Solving a long-standing solar mystery, scientists have discovered the source of fountains of plasma that flow from the Sun like water gushing through cracks in a dam. Called the high-speed solar wind, this plasma flows out at two million miles per hour from the edges of honeycomb-shaped patterns of magnetic fields at the surface of the Sun.

Scientists detected the source using the NASA/European Space Agency's Solar and Heliospheric Observatory (SOHO) spacecraft. The nature and origin of the solar wind is one of the main mysteries SOHO was designed to solve.

Scientists have long thought that the solar wind flows from coronal holes. They have now discovered that these flows are concentrated in specific patches at the edges of the honeycomb-shaped magnetic fields.

Just below the surface of the Sun there are large convection cells, and each cell has a magnetic field associated with it. These cells have been compared to "paving stones in a patio," with the solar wind "breaking through like grass around the edges, concentrated in the corners where the paving stones meet."

The research will lead to better understanding of the high-speed solar wind, a stream of plasma that affects Earth's space environment. As it flows past Earth, the solar wind can cause dramatic space weather effects including enhanced fluxes of energetic particles, plasma currents and magnetic field fluctuations that can disrupt both space-based and ground-based communications and power systems.

SOHO operates at a special vantage point about one million miles out in space between the Sun and Earth. SOHO, launched in 1995, is a project of international collaboration between the European Space Agency and NASA, and is operated from NASA's Goddard Space Flight Center in Greenbelt, MD.

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Microplasmatron for Gasoline Engines Wins Discover Award

The Microplasmatron fuel converter, first mentioned in the Plasma Page in January 1998, has received the 1999 Discover Award in the transportation category. The soup-can-sized fuel converter works as an onboard "oil refinery," using plasma to convert a wide variety of fuels into high-quality, hydrogen-rich gas.

The new device, a kind of electrical gas heater known as a "plasmatron," fits neatly under the hood of a car. Fuel injected into the plasmatron is exposed to an electric discharge that turns the fuel and surrounding air into an electrically charged gas, or plasma. The plasma accelerates reaction rates, allowing the production of hydrogen-rich gas in a compact device. Adding only a small amount of such gas to the fossil fuel powering a car reduces emissions of pollutants like nitrogen oxides by up to 90 percent.

The microplasmatron fuel converter facilitates the use of alternative fuels, such as natural gas, diesel oil and oils derived from biomass. The relatively clean emissions from natural gas cars can be made much cleaner. In addition, biomass derived oils, which ordinarily are hard to use, might in the longer term be used in internal combustion engines. These fuels could be derived from rapidly growing trees, which absorb carbon dioxide. Consequently, greenhouse gas emission might be substantially reduced.

Plasmatrons have traditionally been used to produce hydrogen-rich gas for industrial applications such as metallurgical processing. They are usually quite large – about the size of a car engine – and require large amounts of electrical power. But this microplasmatron can be held in the hand, operated at a low power (around one kilowatt) and can process difficult-to-use fuels, even canola and Mazola oils.

An article on this device appears in the July issue of Discover Magazine. The research, conducted at the Massachusetts Institute of Technology Plasma Science and Fusion Center, is funded by the Department of Energy's Office of Heavy Vehicle Technologies.

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Plasmas Aid Gas to Liquid Conversions

Rentech, Inc (Denver, CO) and Thermal Conversion Corporation (TCC) of Kent, Washington, have received a $175,000 grant from the Department of Energy to demonstrate TCC's plasma reforming process.

This plasma technology uses a proprietary high-power, induction-coupled plasma torch and high temperature reactors to convert natural gas into tailored forms of synthesis gas, a mixture of carbon monoxide and hydrogen. Synthesis gas is an important intermediate step in converting gas into liquid hydrocarbon via Rentech's patented process.

Rentech describes the value of this process: "If a typical 100,000-barrels-per-day refinery had 15,000 barrels per day of heavy bottoms material to dispose of, a portion of the synthesis gas produced from that material could meet the refinery's estimated 50 Mw electrical requirements, and the remainder of the synthesis gas could be used by the Rentech process technology to produce approximately 5500 barrels per day of valuable liquid hydrocarbons. Assuming a $20 per barrel value for the hydrocarbon products, the value of the refinery's output could increase by approximately $40 million per year, not including the savings in electrical costs achieved by internal generation in lieu of outside purchase."

The success of this joint demonstration could positively affect the size parameters and the cost of building gas-to-liquids facilities, as well as provide a cost effective solution to barge-mounted gas-to-liquids processes used in conjunction with off shore drilling platforms.

Contact: Rentech, Inc. 1331 17th St., Suite 720, Denver, CO 80202. Phone (303) 298-8008

Plasma Science Articles Needed

If you are aware of plasma science related research or applications that should be included in the CPS Plasma Page, please send or e-mail a three to five paragraph description to: Paul Rivenberg, Editor, CPS Plasma Page, The MIT Plasma Science and Fusion Center, Room NW16-284, 77 Massachusetts Ave., Cambridge, MA 02139-4307; e-mail: rivenberg@psfc.mit.edu. Please include the research funding source and a contact name for more information.