SRS UPDATE

NEWS FROM THE SAVANNAH RIVER SITE • SEPTEMBER 2005

SRNL demonstration advances hydrogen production process

A step toward producing hydrogen to power the nation's vehicles

John Steimke checks out SRNL's Electrolyzer Test Facility, which successfully showed that hydrogen could be generated using a sulfur dioxide-depolarized electrolyzer.

Savannah River National Laboratory (SRNL) has made an advance toward the development of an economical process for producing hydrogen from water using the heat from advanced nuclear reactors. The laboratory successfully generated hydrogen in a device known as a sulfur dioxide-depolarized electrolyzer (SDE), which is a key component in the Hybrid Sulfur thermochemical process. This process is a leading candidate being investigated by the Department of Energy for using a next-generation nuclear reactor to generate hydrogen with high efficiency and low cost.

The SRNL device generated hydrogen using one-third of the electrical voltage required by traditional electrolyzers (which create an electrochemical reaction for splitting water into hydrogen and oxygen). This means that it would require much less electrical energy to obtain the desired quantities of hydrogen.

"In order to meet the President's goals for making hydrogen-fueled cars practical for the American consumer, the nation is going to have to be able to produce large quantities of hydrogen," says SRNL Director G. Todd Wright. "This achievement takes us one step closer."

> **"This process has the potential to be an efficient and cost-effective means of producing hydrogen from water using nuclear energy."**
>
> – Dr. William A. Summers, SRNL program manager

Hydrogen, though plentiful across the planet, is usually found locked up in water or other compounds. Being able to use hydrogen as a fuel requires extracting the hydrogen from water or hydrocarbons. Since 2003, SRNL has been studying the technical and economic issues surrounding the use of a new generation of nuclear reactors to "crack" water to produce hydrogen that could be used to fuel America's vehicles. That project is part of DOE's Nuclear Energy Research Initiative; like SRNL's work on the Hybrid Sulfur process, it is funded by DOE's Office of Nuclear Energy, Science and Technology.

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A sulfur dioxide-depolarized electrolyzer, which was successfully used to generate hydrogen.

Central to SRNL's design for nuclear hydrogen production is a two-step process called the Hybrid Sulfur thermochemical water splitting process. It is called a "hybrid" process because it makes use of two types of chemical reactions. One is a thermochemical reaction, driven by heat from the reactor. The second step is an electrochemical reaction, which uses the electrolyzer to isolate the hydrogen at one pole of the device, allowing it to be collected and stored for use. The process uses sulfur dioxide, in addition to water, in the electrochemical reaction. All of the chemicals used are recycled in the process; the only outputs produced are hydrogen and oxygen.

The sulfur dioxide-depolarized electrolyzer (SDE) is a unique variation of water electrolysis, a process that is used for extracting hydrogen from pure water. SRNL's experiment not only demonstrated the lower electrical voltage achievable with SDE, but it utilized for the first time a Proton-Exchange-Membrane (PEM) cell (a contemporary electrolyzer technology) operating under process conditions compatible with the Hybrid Sulfur Process. PEM technology is being developed for use in automotive fuel cells, so its application to SDE is expected to lead to more economical designs than were available previously.

The University of South Carolina assisted SRNL in constructing the cell.

Last active F Canyon crane deactivated

F Canyon is now without a working crane, as the New Hot Crane was recently deactivated.

The NHC was the last active crane in the facility. It was deactivated by Deactivation Team 3, led by Dave Premo.

The successful deactivation was the culmination of months of planning and preparation by the deactivation team, as well as radiological controls and crane experts on site.

This deactivation was a little different from those done previously because the crane, in addition to being deactivated, was prepared for possible future re-activation, in case it's needed to prepare the canyon for its final end state. All moving parts were lubricated, gear boxes were filled with oil and preservatives, and the electronic components in the crane cab were protected.

The crane maintenance area and the crane vestibule were emptied of materials, using B-25 containers to hold excess materials. Numerous gallons of waste oil, paints and other lubricants were removed and eventually disposed.

Finally, the crane hallway leading to both the Warm and Hot Crane maintenance areas was deactivated. All materials inside the hallway were removed, electrical isolations made and portal monitors removed.

Work in F Area is on track to be complete in May 2006, six months ahead of schedule.

The New Hot Crane within F Canyon has been deactivated.

Tritium Storage Materials Team wins Award of Excellence

(From left) Steve Wyrick, Lee Nigg, Bob Malstrom, Sandy Riggsbee and Steve Harris are recipients of the Defense Programs Award of Excellence.

Members of the Savannah River National Laboratory Tritium Storage Materials Production Team have received the Department of Energy National Nuclear Security Administration Defense Programs Award of Excellence. Team members were Robert Malstrom, Hydrogen Technology; Stephen Harris, Statistical Consulting; H. Lee Nigg, Hydrogen Technology; and Sandra Riggsbee, Field Support Services Business Unit.

The processing of tritium at SRS depends on storage of hydrogen isotopes in solid form. While the storage of hydrogen in solid form is not unique to SRS, the storage and processing of tritium presents unique challenges and stringent specifications.

These materials were procured from a variety of vendors over several years. The length of time between procurements caused the vendor to lose competency in production, becoming unable to supply vital tritium process materials. The team performed extensive R&D experiments at both the laboratory and plant scale, and they worked with the vendor to learn and understand the production procedures, processes and control parameters in order to resolve production issues.

The procurement action required extensive negotiation to protect the vendor's proprietary information, while allowing WSRC access to facilities and technical data. They also developed new process controls.

The team made numerous trips and spent much time observing experiments. The information gained in the research and development study allowed the vendor to reestablish competency, preserve process knowledge and supply materials necessary for the Savannah River Site tritium operations.

Buckner receives ANS Presidential Citation

American Nuclear Society President James Tulenko (right) presents SRNL's Mel Buckner with the ANS Presidential Citation at the national Honors and Awards luncheon.

Dr. Mel Buckner of the Savannah River National Laboratory received an American Nuclear Society Presidential Citation at the organization's national Honors and Awards luncheon for "his dedication to the development of a strong non-proliferation activity within the American Nuclear Society." The citation salutes Buckner for being diligent in leading the Special Committee on Nuclear Non-Proliferation and for being a leader towards ensuring a permanent non-proliferation program in the American Nuclear Society.

Buckner, who leads the laboratory's University Relations program, is a nuclear engineer with over 35 years of experience at the Savannah River Site. He is involved in new mission activities, such as plutonium disposition, advanced fuel cycle initiatives, nuclear hydrogen production and the proposed university research reactor. He is an active member in the American Nuclear Society, both locally and nationally. He also serves on the Citizens for Nuclear Technology Awareness Board of Directors.

Modernization of Tritium Facilities earns Project of the Year award

Washington Group International, Inc. recently announced that modernization of the Savannah River Site tritium gas processing operation is "Project of the Year" for the company's Energy and Environment Business Unit.

The Project of the Year honor is bestowed as part of Washington Group's Lion Awards Program in which projects, teams and individuals are honored for extraordinary efforts in the areas of safety, construction, support services/administration, employee development, business development, sales, engineering, innovation, marketing and public/government/community service. Those selected for Lion Awards are recognized as representative of the finest performances in the industry.

The objective of the modernization project is to relocate, consolidate and upgrade processing of tritium gas from a 50-year-old processing facility to a modern operating plant. The Savannah River National Nuclear Security Administration tritium facilities provide several services including storage, loading, unloading and surveillance/testing support to the Department of Energy's nuclear weapons complex. Relocation of these functions improved the safety of operations and will result in a taxpayer cost savings of approximately $12 million a year.

The Tritium Modernization team members receive their Lion Award, pictured left to right: Danny Epting, Bob Pedde, Mike Mackison, Ken Brooks, Donna Hasty, Dan Tyson, Kim Wierzbicki, Pres Rahe and Larry Simmons.

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