Carbon sequestration: Can we bury or store global-warming greenhouse gas underground?

By Will Keener

Can we pump carbon dioxide underground and store it there to avoid warming the atmosphere? That is the question researchers at Sandia, teaming with 40 industrial partners and 10 technical partners (including state geologists, oil conservation departments, geological surveys, and the like) will attempt to answer over the next several years.

Following a phase one study, which showed a number of potential storage sites in the Southwest region, work toward phase two demonstrations is now under way, says David Borns, manager of Sandia’s Geotechnical and Engineering Dept. 6113. “Phase two will demonstrate at the field scale that sequestration really is possible with power plant outputs of CO2 injected in several types of geologic environments. In fact, multiple projects are possible in the region,” says David.

The Southwest Regional Partnership for Carbon Sequestration, which includes Arizona, New Mexico, Colorado, Utah, Texas, Oklahoma, Kansas, and Wyoming, has proposed a series of validation tests of the most promising sequestration technologies, including three major geologic tests and two terrestrial pilot tests.

Storage options

Geologic options include pumping CO2 into: (1) oil reservoirs to increase oil recovery rates, (2) coalbed methane zones where coal absorbs the carbon dioxide and releases methane gas, and (3) aquifers, where the CO2 combines with water stored in pore spaces in the rock. Terrestrial tests will determine if natural photosynthesis activity can be increased to tie up more CO2 from the atmosphere, David says.

DOE, spurred by a presidential goal of reducing carbon emissions by 18 percent, began an evaluation of sequestration two years ago, funding regional studies in seven regions. Three regions were selected for phase two projects. The Southwest regional project is funded at $16 million over four years, with New Mexico Tech acting as coordinator for the work.

“If carbon sequestration proves effective in managing global warming impacts, some of the first options are likely to coincide with existing CO2 transportation infrastructure,” says David. The Southwest region is home to an extensive CO2 pipeline network, transporting more than 30 metric tons of natural CO2 from the central Rockies to the Permian Basin, where it is used for enhanced oil recovery.

“Our phase one study concluded that the ‘lowest hanging fruit’ for sequestration would be to supplant the natural CO2 with power-plant sourced CO2,” says David. The partnership’s proposal includes:

- sequestration in a saline aquifer and enhanced oil recovery in Utah,
- enhancing coal bed methane production in the San Juan Basin in New Mexico,
- a two-year enhanced oil recovery project using CO2 from a nearby power plant in West Texas, and
- a terrestrial pilot test in the San Juan Basin and a regional analysis of terrestrial options.

A complex issue

Technically speaking, CO2 sequestration is a complex issue spanning a wide range of scientific, technological, economic, safety, and regulatory issues, says John Lorenz (6116). John and (Continued on page 4)

Sandia researchers collaborate to understand key phenomena controlling PEM fuel cell performance, durability

By Chris Burroughs

Sandia researchers Ken S. Chen (1514) and Mike Hickner (6245) are working hand in hand to understand key phenomena that control hydrogen-fueled PEM (proton exchange membrane or polymer electrolyte membrane) fuel cells. Ken is developing computational models to describe the phenomena while Mike is performing physical experimentation.

Their work is internally funded through a three-year Laboratory Directed Research and Development (LDRD) grant to tackle several key technical challenges. Proper water management and performance degradation or durability must be addressed before PEM fuel cells can be used to routinely power automobiles and homes.

“A natural byproduct of using hydrogen and oxygen to produce electricity in a PEM fuel cell is water [with waste heat being the other],” Ken, project principal investigator, says. “One challenge is maintaining the proper amount of water in a PEM fuel cell. Sufficient water in the membrane is needed to maintain its conductivity, whereas too much liquid water can result in flooding the cathode gas diffusion layer, which prevents reactant oxygen from reaching catalytic sites and causes performance deterioration.”

The work being done by Ken and Mike is leading to a better understanding of a couple of important areas, including how liquid water is produced, transported, and removed efficiently in PEM fuel cells to keep the cell performance from degrading. A better understanding is key in finding ways to

Riding on a dimer gives California researcher unique view of breakup

Mentoring program helps Sandians in personal, professional growth

(Continued on page 7)
Six Sandians complete project management professional curriculum

Course completion a key step toward PMP certification

Six Sandians have completed the seven-course Project Manager Professional (PMP) curriculum offered through Corporate Education, Development, and Training (CEDT). Completion of the curriculum is a key step in earning the prestigious PMP certification, a designation recognized worldwide as the professional project management profession's gold standard and a highly sought-after credential.

The six Sandians are Lourdes Romero (2024), Deborah Montoya (3332), Greg Shirley (10533), James R. Sieghers (3013), Lori Messer (3051), and Emily Sers (2027). The CEDT-offered curriculum covers the six core areas of the Project Management Institute's (PMI) PMP Certification examination, with the seventh course being an application practicum in which all the knowledge learned is applied to a project to demonstrate a transfer of learning.

An added benefit of successful completion of the PMP curriculum with CEDT is that George Washington University issues a graduate certificate in project management. To become a certified PMP, the individual must then take the PMP certification exam and meet the PMI experience qualifications. Like most professional certifications, the PMP examination requires you to demonstrate continuing education requirements to maintain the certification.

For information about the PMP curriculum or other CEDT course offerings, contact Linda Wilson, 844-8326.

Take Note

Tennis: A Junior Tennis Program at the Coronado Tennis Club started Jan. 15 and will run every Sunday for six weeks. The tennis program is available to all Sandia/Kirtland extended families. Membership in the CTC is not required for participation in Junior Tennis. For more information contact Linda Stutz, 299-3683.

Sandia News Briefs

Arlin Cooper co-authors chapter in new edition of CRC Electrical Engineering

Arlin Cooper, Senior Scientist in Airworthiness Assurance Dept. 6252, and former Sandian Anna Johnston are authors of a chapter titled “Computers, Software Engineering, and Digital Devices” in a new, just-published CRC Electrical Engineering Handbook, Third Edition. This volume is part of a six-volume Electrical Engineering Handbook series. Tom Mancini (6218) is also listed as a chapter author in another volume, Electronics, Electric E

Retiree deaths

Kenneth L. Romine (age 84) . . . . . . . . . . .December 31

Richard J. Dye (77)  . . . . . . . . . . . . . . .December 12

Lewis A. Faw (83)  . . . . . . . . . . . . . . .December 21

Harley D. Moody (91)  . . . . . . . . . . .December 13

Richard J. Dye (77)  . . . . . . . . . . . . . . .December 12

William C. Garcia (83)  . . . . . . . . . . .December 15

Retiree deaths

Kenneth L. Romine (age 84) . . . . . . . . . . .December 31

Richard J. Dye (77)  . . . . . . . . . . . . . . .December 12

Guy A. Coburn (66)  . . . . . . . . . . . . . . .December 29

Harley D. Moody (91)  . . . . . . . . . . .December 13

William C. Garcia (83)  . . . . . . . . . . .December 15

James Brice Hiller (87)  . . . . . . . . . . . . . .December 31

Sandia News Briefs

Arlin Cooper co-authors chapter in new edition of CRC Electrical Engineering

Arlin Cooper, Senior Scientist in Airworthiness Assurance Dept. 6252, and former Sandian Anna Johnston are authors of a chapter titled “Computers, Software Engineering, and Digital Devices” in a new, just-published CRC Electrical Engineering Handbook, Third Edition. This volume is part of a six-volume Electrical Engineering Handbook series. Tom Mancini (6218) is also listed as a chapter author in another volume, Electronics, Electric E

Retiree deaths

Kenneth L. Romine (age 84) . . . . . . . . . . .December 31

Richard J. Dye (77)  . . . . . . . . . . . . . . .December 12

Guy A. Coburn (66)  . . . . . . . . . . . . . . .December 29

Harley D. Moody (91)  . . . . . . . . . . .December 13

William C. Garcia (83)  . . . . . . . . . . .December 15

James Brice Hiller (87)  . . . . . . . . . . . . . .December 31
Sandia-developed BioDAC simulation helps integrate military, civilian bioterror responses

By Nancy Garcia

A role-playing simulation that enables emergency response officials to see how their decisions might play out in an event may be more important for bioterrorism than for other terrorist scenarios because it involves release of a biological agent whose effects may take days or weeks to appear, researcher Lynn Yang (8114) said during a briefing of California site managers earlier this month.

The BioDAC (Biological Decision Analysis Center), simulates a release of anthrax or smallpox in an urban area (San Diego County). It was developed by Sandia researchers through the BioNet Program. Funded by the Department of Homeland Security and executed by the Department of Defense, BioNet was a year-long $23 million program to integrate civilian and military biodefense capabilities to facilitate the generation of a unified consequence management plan for a bioterrorism event. This includes jointly detecting and characterizing an event, leading to early phases of the response.

Sandia provided systems modeling and analysis of the population, medical response infrastructure, detection system, and key assets. Role-playing exercises help participants develop countermeasures and responses to an incident.

Ben Wu (8124) presented along with Lynn. He said there are approximately 100,000 military personnel at major Navy facilities in San Diego County, and timing of decisions reflects military mission priorities.

On the other hand, Lynn indicated that the civilian public health officials tend to be fairly conservative in part because of potential risks associated with responses like prophylaxis.

The first indication of an attack may be picked up as an anthrax reading on an air sampling detector in a civilian environmental monitoring system called BioWatch. The positive reading must be confirmed as a true positive. If confirmed, various decision alternatives need to be considered, including when (or if) the public should be notified and when (or if) antibiotic prophylaxis should be distributed.

Although the Navy would make decisions independently, both sides now appreciate the inherent interdependencies of their responses.

Using BioDAC, Navy and public health role players each had distinct views, including maps and other data showing resources and conditions impacting their role. The underlying scenario was visible to the analyst, which showed what Lynn called a “huge attack.” Antibiotic treatment can reduce the impact of the attack if administered in time.

Since the area has about 80,000 tourists a day, she said a scenario involving exposure to smallpox, which is contagious, would be more complicated. The disease would potentially spread beyond the county because large numbers of exposed travelers would leave the area before being aware of being infected.

The simulation allows role players to identify and fill gaps in their concepts of operations. It is being evaluated as a possible tool for operations support and training. Insights gleaned from BioDAC contributed to ongoing discussions of the National Bio-Monitoring Architecture.
Sequestration

(Continued from page 1)

A team of Sandians will conduct detailed studies on the long-term geologic impacts of CO2 on the host reservoir to determine what characterization work will be needed before sequestration can be deployed.

"The overall objective of the project is to better understand CO2 sequestration-related processes and to predict and monitor the migration and ultimate fate of CO2 after it's injected into a reservoir," says John. Although saline aquifers, deep coal seams, depleted gas reservoirs and several other potential reservoirs are available, depleted oil reservoirs make an attractive option for immediate sequestration for a variety of reasons, says John.

A key reason is that many oil reservoirs have previous experience with incremental oil recovery with CO2 injection that can improve the overall economics for sequestration projects. Geophysical and geochemical factors that occur after injection will demonstrate methods to monitor injections to make sure CO2 stays in the ground, John, following up on the recently retired Norm Warpinski's work in this area, will be joined by Dave Aldridge, Bruce Engler (both 6116), and Jim Krumholand (6118). Peter Kobos (6010), has been at work developing a high-level computer model to analyze physical, economic, and policy requirements needed to understand carbon sequestration in the region.

"We've got a prototype right now," says Peter. "We're trying to integrate all the information so that both experts and interested parties can understand how we assess a project. We've got geologists, regulators, academics, and people from industry all involved. The model is a way we can see all of the issues quickly and address them in an integrated way."

Model components
Len Matzynski (6315) is also a key player on the modeling project, developing much of the software that will tie large amounts of data in the Partnership team to the model itself. Several workshops developed the model's key parts. An example is screening criteria for underground storage of CO2. A team of geologists helped identify what would be needed to create a successful storage reservoir, Peter said.

Identifying sources of CO2 and how they would flow to these reservoirs, or "sinks," and some of the economics associated with the project were other model components. Currently, the team is working with a New Mexico test case, but Peter plans to expand it to a regional scope for the future.

"Our goal is an integrated assessment of the costs of the component parts," says David. "If (Continued on next page)
Ammonia, a molecule containing three hydrogen atoms and one nitrogen, is widely available. Approximately two percent of the world’s energy goes to NH₃ synthesis. More than 3,000 miles of pipeline deliver ammonia to farmers, who use it as fertilizer and as a cattle feed additive.

So, among the low-carbon, high-energy fuels available for transportation, why look elsewhere? That was the question asked by Peter Feibelman (1114) in a provocative talk delivered at Sandia’s Journal Club Seminar Series in November.

Chemical bonds do not need to be broken to store ammonia safely in a solid, he said. NH₃ can also be stored as a liquid at room temperature and modest pressure. Lighter than air, it disperses rapidly if inadvertently released. It combines readily with water, and so is not a great poisonous.

In comparison, the energy wasted in forming hydrides—a favored idea for hydrogen storage—stays locked up in a hydride until the heat is removed. Considerable, most researchers agree. Distribution and storage of pure hydrogen involves major engineering problems because hydrogen embrittlement metals and must be stored at very high pressures to be a practical fuel.

Why not use ammonia to distribute and store hydrogen?

“People just don’t like the stuff,” Peter offers. “And there are a great number of why researchers pursue more difficult alternatives. “It smells bad, is toxic at high concentrations, and [scientifically, out of left field] is used in making methampheta-mine.”

Agreeing with Peter on ammonia’s potential is Roland Stumpf (8763), an editor of a new Materials Research Society Research volume, Materials for Hydrogen Storage (see page 32). Roland is also an ammonia proponent, though his book—which consists of papers delivered at an MRS symposium—contains no ammonia-related research.

“We would have accepted ammonia-related talks but there is no funding for ammonia as an energy carrier,” in general,” says Roland.

“If we hadn’t had gasoline for a hundred years and someone came up with the idea to use it, it would be characterized as a carcinogen and highly flammable,”

—Peter Feibelman

Ammonia has been recognized for 50 years as a hydrogen storage material, but that hasn’t gotten it a lot of traction from funding agencies. People have a strong aversion to ammonia, he says: “Intelligent people discuss the idea immediately without knowing any details. This is a typical reaction from the normally technically minded, and it is ammonia’s biggest roadblock. There is overwhelming evidence there should be a research effort to learn to handle and store it safely.

The fear, he says, is that people think ammonia will kill thousands or even millions of people. “There’s generally less tolerance of risks today than in earlier days,” he adds. “If we hadn’t had gasoline for a hundred years and someone [today] came up with the idea to use it [for the first time], it would be characterized as a carcinogen and high flammable.”

Roland has already spent time studying ammonia’s qualifications, plans on spending more, and currently believes the best idea is to burn ammonia directly in internal combustion engines, rather than cracking it to supply hydrogen for fuel cells.

There are doubters, however.

“Whenver a source is chosen, it behooves the nation to do the entire lifecycle analysis: how do you transport it, what’s the efficiency,” says one Sandian, who prefers not to be identified, but who favors producing hydrogen from next-generation nuclear reactors or from decomposition of materials like sulfuric acid. “Three thousand miles [of already in-place pipeline] is nothing; what’s needed are tens of thousands, not just the material itself.”

Says Paul Pickard (6872), “Ammonia is a good storage medium because it has a lot of hydrogen and it’s a liquid—easily pressurized, pumped, and shipped. But it, you need a source of hydrogen. The way we make it now is from natural gas. That means ammonia is not a solution to our current problem, it is used for storing or shipping hydrogen. It’s just a way to save on infrastructure.”

Peter agrees that getting hydrogen is fundamental to a “hydrogen economy,” no matter how the hydrogen is later distributed and stored.

“Hydrogen production—powered by ocean temperature gradients was demonstrated decades ago, he says, and production using “waste” heat from nuclear power stations is being researched. Hydrogen produced in these fossil-fuel-free ways can conveniently be stored by using it to make ammonia.

Sequestration

(Continued from preceding page)

someone proposes to site a power plant, they will know the costs of carbon sequestration going in. They can look at the infrastructure availability to connect the plant to the sequestration options to help determine the best place to put the plant.

The concept of carbon avoidance by industry is already being practiced in Europe and is catching on in the US, says David. Colorado has a 99/ton tax credit for CO₂ avoided. “This is something that can tip the scale on the type of power plant you might build,” he says. More than 1,000 kilometers of pipeline cross north-western New Mexico and eastern New Mexico and Texas, moving 25 tons of CO₂ a year across the state. This is equivalent to the carbon emissions of about five million people. “We inject and move it now. The question is how much of a solution is it to the overall problem?”

Global Warming: Evidence mounts

Global warming: fact or fiction? Although debate continues on this issue, many scientists now say that the preponderance of recent evidence is tipping the scales in favor of the existence of the phenomenon. At the time of the American Revolution, Earth’s atmosphere included about 280 carbon molecules for each million total air molecules. Today, each million molecules of atmosphere include about 380 molecules of carbon dioxide, a number that climbs about two or three molecules each year, according to a recent Scientific American report.

Recent evidence from the National Oceanic and Atmospheric Administration suggests that dissolved carbon dioxide in the world’s oceans has increased acidity of the seas steadily over the past two centuries. One impact is a reduced ability of marine organisms to produce calcareous skeletons along regularity the world’s oceans. Global scientists reporting.

Other scientists are now tracing how health effects related to increased levels of CO₂ in the atmosphere impact humans. Children and the elderly in inner-city environments are particularly vulnerable when events such as summer heat waves combine with other health factors, often tied to increased levels of CO₂. “The problem is here today for these [urban] children, and it is only going to get worse,” concludes a Harvard Medical School report.

In a recent visit to Sandia, Steve Koonin, chief scientist for BP Inc., one of the world’s largest energy companies, told his audience there is a plausible connection between global warming and increases of CO₂ in the atmosphere. (See full story, Lab News, Jan. 5.) Although the scientific case is not overwhelming, Koonin said, “My bottom line and BP’s as well, that it is extraordinarily wise to be putting this much CO₂ into the atmosphere and that the world should do something about it… For CO₂, there are two technolo-gies necessary to harm the globe, scientists report: one is to capture CO₂ at the point of emissions instead of storing it. (See story on cleaning CO₂ in the next issue of Lab News.)

Carbon sequestration poses national laboratories-scale issue

An estimated 30 percent of US carbon emissions come from power plants and other large “point sources,” like industrial furnaces and refineries. Given the fact that fossil fuels are likely to remain the mainstay for energy production well into this century, most scientists believe that the exploration of carbon sequestration, or terrestrial storage of carbon, merits attention.

This is what the President’s Committee of Advisors on Science and Technology reported in a study of 21st-century challenges facing the nation: “A much larger science-based CO₂ sequestration program should be developed,” the committee reported. “This is very high-risk, long-term R&D that will not be undertaken by industry alone without strong incentives or regulation, although industry experience and capabilities will be very useful.”

Another approach to the problem is to reduce the carbon emissions from those working power plants through more efficient combustion processes: Sandia through its Combustion Research Facility at Livermore, Calif., has a role in this approach as well. Sandia researcher Chris Shaddix (8367) and his colleagues are at work on concepts to allow coal-fired plants to burn residual CO₂ at the point of emissions instead of storing it. (See story on cleaning CO₂ in the next issue of Lab News.)
Discipline

(Continued from page 1)

Discipline cases at Sandia

A discipline case at Sandia may arise from behavior or an incident taking place in or outside the workplace. For example, an arrest or illegal behavior must be reported to an employee's manager and may become cause for disciplinary action.

In FY2005, there were 255 disciplinary cases at Sandia, 110 of which resulted in "coaching and counseling," which until the recent policy change were reflected as disciplinary actions. Of the remaining 145 disciplinary actions, about 20 percent resulted in either termination or resignation in lieu of termination. The other 80 percent were resolved through other avenues, such as suspension or written reprimand. If you include coaching and counseling, about 70 percent of offenses in FY05 were security-related, and the leading infractions were bringing or using an unauthorized cell phone into a tech area or leaving classified documents unprotected. However, if you eliminate coaching and counseling, security-related infractions decline significantly to about 32 percent.

A discipline case at Sandia hasn't always occurred in the past. "What's needed is a transformation in how we view and manage discipline and performance. This radical change will only occur with a more comprehensive overhaul of disciplinary and performance improvement policies and procedures," Julian says. "Another requirement is more proactive early intervention with respect to developing problems. Everyone involved in administering the policies (Employee and Labor Relations, Human Resource consultants, Legal, and ultimately the line managers) needs to focus more on early intervention and training."

Our policies need to ensure that poor performance and discipline are addressed consistently across the Labs and its various sites, and in accordance with the severity of any violations. This hasn't always occurred in the past.

Discipline cases at Sandia

A discipline case at Sandia may arise from behavior or an incident taking place in or outside the workplace. For example, an arrest or illegal behavior must be reported to an employee's manager and may become cause for disciplinary action.

In FY2005, there were 255 disciplinary cases at Sandia, 110 of which resulted in "coaching and counseling," which until the recent policy change were reflected as disciplinary actions. Of the remaining 145 disciplinary actions, about 20 percent resulted in either termination or resignation in lieu of termination. The other 80 percent were resolved through other avenues, such as suspension or written reprimand. If you include coaching and counseling, about 70 percent of offenses in FY05 were security-related, and the leading infractions were bringing or using an unauthorized cell phone into a tech area or leaving classified documents unprotected. However, if you eliminate coaching and counseling, security-related infractions decline significantly to about 32 percent.

A discipline case at Sandia hasn't always occurred in the past. "What's needed is a transformation in how we view and manage discipline and performance. This radical change will only occur with a more comprehensive overhaul of disciplinary and performance improvement policies and procedures," Julian says. "Another requirement is more proactive early intervention with respect to developing problems. Everyone involved in administering the policies (Employee and Labor Relations, Human Resource consultants, Legal, and ultimately the line managers) needs to focus more on early intervention and training."

Discipline cases at Sandia

A discipline case at Sandia may arise from behavior or an incident taking place in or outside the workplace. For example, an arrest or illegal behavior must be reported to an employee's manager and may become cause for disciplinary action.

In FY2005, there were 255 disciplinary cases at Sandia, 110 of which resulted in "coaching and counseling," which until the recent policy change were reflected as disciplinary actions. Of the remaining 145 disciplinary actions, about 20 percent resulted in either termination or resignation in lieu of termination. The other 80 percent were resolved through other avenues, such as suspension or written reprimand. If you include coaching and counseling, about 70 percent of offenses in FY05 were security-related, and the leading infractions were bringing or using an unauthorized cell phone into a tech area or leaving classified documents unprotected. However, if you eliminate coaching and counseling, security-related infractions decline significantly to about 32 percent.

A discipline case at Sandia hasn't always occurred in the past. "What's needed is a transformation in how we view and manage discipline and performance. This radical change will only occur with a more comprehensive overhaul of disciplinary and performance improvement policies and procedures," Julian says. "Another requirement is more proactive early intervention with respect to developing problems. Everyone involved in administering the policies (Employee and Labor Relations, Human Resource consultants, Legal, and ultimately the line managers) needs to focus more on early intervention and training."

Discipline policy changes took effect in August

Changes were made to Sandia's Employee Discipline and Corrective Action CPR 400.3.4 in August 2005. Here are some of the more significant changes:

• "Coaching and counseling" is now a separate category of disciplinary action. The first step in Sandia's progressive disciplinary approach is now a verbal reprimand, which is documented in an employee's organizational file. As before, other disciplinary actions are written reprimand, suspension without pay, and termination.

• A decision to place an employee on administrative leave without pay or excused unpaid absence — sometimes done pending completion of an investigation — must be reviewed with the Employee and Labor Relations Department.

• If an employee is suspended without pay, his or her badge must be taken by management. Previously, this was at management's discretion.

• Several items were added to the list of examples of misconduct, which is provided for guidance and not intended to be comprehensive. Examples are categorized according to severity — minor, serious, and very serious. One addition is a section called "Failure to Manage." Lack of attention to management responsibilities, leveraging organizational resources to break an employee misconduct, or deliberate acts of misconduct; and failure to address employee misconduct and/or performance issues comprise this section. All are considered serious to very serious infractions.

• Managers are now responsible for providing documentation on all disciplinary cases to Employee and Labor Relations or Human Resources at Sandia/California. While use or possession of an unauthorized cell phone in a limited area has always been grounds for disciplinary action, it has now been added to the misconduct examples list.

• Other items added to the list of examples are accessing sexually explicit material by telephone (serious) and improper use of proprietary information (very serious).

• Clarifying when the Disciplinary Review Committee (DRC) should be convened. The DRC's purpose is to provide comprehensive, cross-functional review of discipline cases in which the offense is very serious to determine the appropriate disciplinary action. It consists of the Employee and Labor Relations manager, the employee's director, and the director of Safeguards and Security or the director of Environment, Health, and Safety. Other members may be called to provide advice and information. DRC meetings are called when discipline cases are very serious, precedent setting, have broad impact, could result in external scrutiny, or are necessary to ensure "firm, fair, and consistent treatment."

For the full CPR, see http://www.irn.sandia.gov/hr/policies/Lr/disciplinary_actions.htm.
A hydrogen-fueled polymer electrolyte membrane (PEM) fuel cell uses hydrogen and oxygen to generate electricity by an electrochemical process in which electrons are produced in the anodic hydrogen-oxidation reaction and consumed in the cathodic oxygen-reduction reaction. A single fuel cell consists of the MEA (membrane-electrode assembly), the anode and cathode GDLs (gas diffusion layers), and GFCs (gas flow channels).

The MEA is the heart of the fuel cell, which is fabricated by sandwiching the polymer electrolyte membrane (e.g., Nafion) between two electrodes. They are composed of conductive-carbon support, catalytic platinum particles, and polymer electrolyte binder. Carbon papers or woven carbon cloths are typically used as GDLs. The GFCs are usually etched out of graphite or metal materials. To achieve the desired voltage, single cells are connected in series to produce a fuel cell stack.

In an operating PEM fuel cell, humidified hydrogen is fed to the anode GFCs whereas humidified air is forced through the cathode GFCs. Hydrogen and oxygen are then transported through the respective GDLs. Electrons produced in the anode are conducted through the electrical load to the cathode where they are consumed; protons from the hydrogen oxidation reaction are transported through the membrane. This movement of electrons is an electrical current that can be used to power an automobile or a home. Water and heat are generated in the cathodic oxygen-reduction reaction. The waste heat generated is mostly attributed to the efficiency loss (more specifically, loss due to various over-potential) in converting chemical energy to electricity.
Feedback

Readers question building temperatures, solar energy features, and building numbers

Q (To simplify and save space, this summary is being substituted for the original Feedback question.)

Q: (To simplify and save space, this summary is being substituted for the original Feedback question.)

Q: You question whether Sandia has done enough in other areas of energy reduction. Sandia is measured, per DOE Order 420.1a, by New Mexico reduction. Since the 1985 energy baseline, Sandia has reduced energy usage by 40 percent through modifying systems to gain efficiencies. There are very few to no high return opportunities left in office buildings, and we are examining options in major laboratory space. It would be nice if everyone at Sandia were energy conscious and turned off lights, monitors, printers, copiers and computers when not in use. However, the ability to control and enforce a requirement involving over 11,000 individuals isn’t achievable. All we can accomplish is to publish Lab News articles and issue reminders to all Sandians, which we do at least twice each year as part of our Energy Program.

The energy reduction competitions a few years ago were part of the Energy NAG program, which is still ongoing in most buildings. If you would like to volunteer as an Energy NAG for your facility please go to www-im.sandia.gov/esh/p2/nag.htm and let one of our point of contacts work with you.

New buildings being erected are compliant with LEED (Leadership in Energy and Environmental Design) concepts. Solar energy features are incorporated into designs of these facilities with light harvesting and solar energy gains. However, sometimes some of these design features are traded off to allow for additional square footage due to the current corporate high-risk issue of inadequate space for mission work.

Other interesting issues concerning energy and forthcoming requirements are: 1) the Presidential Directive mandates an energy reduction of 10 percent from baseline 2004 usage levels, 2) DOE Order 420.1a requires a 35 percent reduction from baseline 1985 usage levels, and 3) the new Energy Bill requires a reduction of 2 percent per year from a baseline 2000 usage level.

Energy reduction within the federal complex is a big issue and will remain so in the future. Our ability to meet these new requirements on energy reduction will be a direct result of the competition within the laboratory. Based on efforts already taken we have addressed the large-payback items, and large returns for energy reduction will not be easily achievable in the future.

I fully acknowledge that reducing building thermostat set points and increasing energy efficiency may be an inconvenience or a potential discomfort to those affected. All I would ask is that we all consider this part of our responsibility in losing a home from a hurricane or being unable to afford heating for our homes due to natural gas demands driving gas prices to over four times the cost during the summer. I believe we need to do all we can to support this federal directive.

— Lynwood Dukes (10860)

Q: What process is used to determine building numbers for new buildings? It seems fairly random.

One example is the new Bldg. 729, which is flanked by new buildings 821, 823, 827, 856, and 869. Surely there was a number in the 800s available for use that could have better reflected the proximity of the new building to its neighbors. At best, the discrepancy is curious, but a lack of consistency in building numbering logic also makes navigating the tech area increasingly difficult.

A: The Facilities master building table assigns building numbers during the design phase of a project; the numbers are assigned by geographical proximity to the site. The DOE FIMS system (Facilities Information Management System) does not let us reuse building numbers. The Energy Bill requires a reduction of 2 percent per year from a baseline 2000 usage level.

Energy reduction within the federal complex is a big issue and will remain so in the future. Our ability to meet these new requirements on energy reduction will be a direct result of the competition within the laboratory. Based on efforts already taken we have addressed the large-payback items, and large returns for energy reduction will not be easily achievable in the future.

I fully acknowledge that reducing building thermostat set points and increasing energy efficiency may be an inconvenience or a potential discomfort to those affected. All I would ask is that we all consider this part of our responsibility in losing a home from a hurricane or being unable to afford heating for our homes due to natural gas demands driving gas prices to over four times the cost during the summer. I believe we need to do all we can to support this federal directive.

— Lynwood Dukes (10860)
Earth science: Communicating about meteor craters from billionths of a second to billions of years

By Will Keener

Retired Sandia physicist Bob Graham has a message for his colleagues in the world of shock physics: "If you don't understand the problem posed in other shock regimes, you don't understand shock physics." At a recent Sandia colloquium Bob illustrated his point by discussing a meteor impact crater he is studying near his South Texas home: "We can learn from meteor impact scientists and they can learn from us," he said.

Bob, who retired from the Labs in 1996, attracted more than 40 of his colleagues, former colleagues, and some new shock researchers to his November talk. Arriving at Sandia in 1958, Bob pursued a career in which he proved to be a prolific author and pioneer in shock physics concepts, including piezoelectric gauges. He is credited with helping organize the topical shock physics group within the American Physical Society. Currently there are about 550 members of the topical group, according to Lalit Chhabildas (1647), who hosted Bob's talk.

Bob reviewed his field studies of the Bee Bluff Structure, near Uvalde, Texas. The feature currently is not listed as a meteor crater in the Earth and Impact Database by geologic authorities at the University of New Brunswick, Canada, but it certainly is a crater, Bob emphasized. One of his goals is to get the site listed as a meteor crater, but he has a higher goal: "It's time for field geologists with ideas about billions of years of Earth history to start talking about the nanoseconds involved in these crater impacts with their shock physics colleagues," Bob said.

Big time, small time

Bob has investigated the site on his own, with the help of local geologists, local agricultural scientists, and associates at Sandia and Georgia Tech. "It's big-time science on a small-time budget," he joked. After moving around the two-kilometer-wide crater site collecting samples, Bob developed a detailed story of how the meteorite collision occurred. He proceeded on the approach that determining shock compression information would lead to an explanation of the big picture of the impact. Bob found evidence of the venting of some calcium carbonate minerals in the form of a heated vapor south of the impact crater.

He observed that goethite, a hydrous iron oxide mineral, occurred more frequently in the altered sandstone samples he collected as he moved toward the center of the impact area. His major find, which he refers to as his "Rosetta Stone," is a 75-kilogram rock with an intact collection of shocked sandstone and siltstone materials and other features revealing the nanosecond history of the actual impact event. Discovered a kilometer from the impact's "ground zero," the large stone was tossed away in the impact, Bob believes.

He noted differences in regional rocks and their impacted counterparts, renaming some of them, including one he calls "Sandia Ironstone." Using microscopy taken at the Uvalde Texas Agricultural Science Center, scanning electromicrographs taken by Prof. Naresh Thadhani at Georgia Tech, X-ray diffraction analysis by Bruno Morosin (Sandia retired) and Ralph Tissot (1822) — all parts of his "beg, borrow, and steal" mode of operation — Bob observed words and steam bubbles that helped him piece together the story of the crater.

Crater computer code

With his rock evidence and advice from his Sandia colleagues, Bob used an online computer code developed at the University of Arizona to estimate the size and velocity of the meteorite. He described the impact of an iron meteorite at a velocity of 7.3 kilometers/second that produced pressures of about 250 GPa. The wave compressed the underlying sandstone and siltstone layers at different rates. Part of the wave rebounded from underlying geologic strata, passing upward through the formations. The impact resulted in a "bottom up" crater in Bob's words, where some material was crushed and welded, a smaller amount thrown outward, and other material vaporized.

Although different from the more typical "top down" type crater, Bee Bluff is a meteor impact structure, Bob concluded. The site provides an opportunity to meld shock physics and geologic science to the benefit of both, he said.

Horton Newsom, research professor and curator of the Institute of Meteoritics at the University of New Mexico, attended the talk and agrees that more cooperation between the two groups can be valuable. "We have already been talking about how to encourage more collaboration, and I am interested in helping Bob with his study of the Bee Bluff Structure," he said.

One of Horton's graduate students also is interested in working with Sandia researchers on some shock experiments relevant to her study of the Bee Bluff crater. Horton added. That crater, associated with the post-Cretaceous mass extinction event, is now buried beneath a kilometer-thick sequence of ocean sediments off Mexico's Yucatan Peninsula. It is one of Earth's largest impact structures.

Cautionous approach

Impact crater scientists approach identification of a site cautiously, said Sandia's Mark Boslough (1433). "This looks like an impact structure, although it's not one of the name-listed meteor craters used to identify shocked quartz aren't there. ... There are a huge number of possibilities with different rock types, impact objects, direction, size, and speed of objects. Every impact structure is going to be different in terms of age, erosion, and other factors.

That's not surprising."

— Mark Boslough

SANDIA LAB NEWS • January 20, 2006 • Page 9
Mileposts

New Mexico photos by Michelle Fleming

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Matter</td>
<td>30</td>
<td>6923</td>
</tr>
<tr>
<td>Alicia Cloer</td>
<td>25</td>
<td>7000</td>
</tr>
<tr>
<td>Michael Saavedra</td>
<td>20</td>
<td>2455</td>
</tr>
<tr>
<td>Michael Morrow</td>
<td>20</td>
<td>5918</td>
</tr>
<tr>
<td>Jeffrey Morgan</td>
<td>20</td>
<td>2663</td>
</tr>
<tr>
<td>Jeffrey Everett</td>
<td>25</td>
<td>12300</td>
</tr>
<tr>
<td>Mary Wendt</td>
<td>30</td>
<td>243</td>
</tr>
<tr>
<td>Jeffrey Romine</td>
<td>30</td>
<td>5711</td>
</tr>
<tr>
<td>Wayland Bell</td>
<td>30</td>
<td>5742</td>
</tr>
<tr>
<td>Ernest Garcia</td>
<td>30</td>
<td>2614</td>
</tr>
<tr>
<td>Timothy Drummond</td>
<td>20</td>
<td>5917</td>
</tr>
<tr>
<td>Robert Avline</td>
<td>30</td>
<td>5711</td>
</tr>
<tr>
<td>Mark Montavon</td>
<td>30</td>
<td>5424</td>
</tr>
<tr>
<td>Andrew Rogulich</td>
<td>30</td>
<td>225</td>
</tr>
<tr>
<td>Jeffrey Romine</td>
<td>30</td>
<td>5536</td>
</tr>
<tr>
<td>Mike Stone</td>
<td>30</td>
<td>1527</td>
</tr>
<tr>
<td>Ronald Hoskie</td>
<td>20</td>
<td>10842</td>
</tr>
<tr>
<td>Roger Adams</td>
<td>20</td>
<td>1384</td>
</tr>
<tr>
<td>Arnold Augustoni</td>
<td>20</td>
<td>1128</td>
</tr>
<tr>
<td>Kevin Linker</td>
<td>25</td>
<td>6418</td>
</tr>
<tr>
<td>Mark Dickinson</td>
<td>20</td>
<td>224</td>
</tr>
<tr>
<td>Daphne Moore</td>
<td>25</td>
<td>10872</td>
</tr>
<tr>
<td>David Myers</td>
<td>25</td>
<td>1702</td>
</tr>
<tr>
<td>Thomas Gutierrez</td>
<td>25</td>
<td>10843</td>
</tr>
<tr>
<td>Teresa Jordan-Cullen</td>
<td>25</td>
<td>5422</td>
</tr>
<tr>
<td>Evelyn Moore</td>
<td>25</td>
<td>10872</td>
</tr>
<tr>
<td>Charles Myers</td>
<td>20</td>
<td>5423</td>
</tr>
<tr>
<td>Spencer Luker</td>
<td>20</td>
<td>1384</td>
</tr>
<tr>
<td>Leonard Martinez</td>
<td>20</td>
<td>1653</td>
</tr>
<tr>
<td>Timothy Mitchell</td>
<td>20</td>
<td>24312</td>
</tr>
<tr>
<td>Jeffrey Morgan</td>
<td>20</td>
<td>2663</td>
</tr>
<tr>
<td>Christine Chavez</td>
<td>15</td>
<td>38151</td>
</tr>
<tr>
<td>Pauline Duran</td>
<td>15</td>
<td>12800</td>
</tr>
<tr>
<td>Linda Konkel</td>
<td>15</td>
<td>5925</td>
</tr>
<tr>
<td>Mary Wendt</td>
<td>15</td>
<td>3655</td>
</tr>
</tbody>
</table>
MISCELLANEOUS

HOTY, Sony 36,- LCD 2.0-wrancor, 1080p components input, wind window, AC/DC power supply, metal stand $325. 851-350-6066.

UPPER DOOR KEEPER, Signature, 21-cu.- ft. refrigerator, all Stainless steel, $500. 379-426-9900.

ION HAND DRILL, portable, like new $15. 453-78-4685 or (lubabartian@comcast.net).

LAMINATOR STAND, $28. 283-5279.

Lingerie, baby diapers, pops paper, trained 2,4, socks, occasional children & trusted buddies, $1.00. Cash only, 259-1556 or 453-7930.

CAR BRAS: '79 Firebird TransAm; Fiero; GTR.

GRACO PACK-N-PLAY, $30; 1/6-hp electric motor, $17. 10-28-7443.

COMPUTER MEMORY: 2, 64MB PC100 $10/ea.

ELECTRIC RANGE, freestanding, GE, white, 30”, stainless steel. Excellent condition, $300 OBO. 586-7-9090.

SLEEPER SOFA, red, $350; butcher-block table, w/6 chairs, $60. Barraza, 839-3934.

UPRIGHT FREEZER, Signature, 21-cu. ft., upright, excellent condition, $450 OBO. 281-2282.

WATERBED MATTRESS, queen, foam, like new, $350 OBO. 886-6222.


CAMERA LENSES & FLASH, Olympus, $35. 854-3813.

CHILD CAR SEAT, Summit Deluxe high-back booster, $75. 946-5229.

CHILD CAR SEAT, Evenflo, $35. 854-3813.

COLOR TV, 25-in., Sanyo, w/remote, excel-

lent condition, $200; 15-in. rims, new tires, $500. 936-5-3834.

DINING ROOM SET, 7-pc., $150. Graham, 296-0644.
Unbroken chains, unexplored challenges draw Sandians to each other for mentoring

By Iris Aboytes

“I have had each of my mentees read Tuesdays with Morrie,” says Phil Montoya (10508). “It gives us a common denominator to start. I share my expectations with my mentee and listen as my mentee's expectations are shared with me. I take my role as mentor very seriously.”

The Sandia Mentoring program recently celebrated its tenth anniversary. The program has a number of events and activities that will go on throughout the month of January to celebrate National Mentoring Month. The pilot program that began with 68 participants has grown to its current enrollment of 650. The program was designed to provide a mechanism for developing people who can respond to changing requirements and complex customer needs.

Participation in the program does not guarantee a promotion. What it does provide is an opportunity for Sandians to improve employability and contribution through increased knowledge of Sandia’s culture, strategy, and programmatic directions.

All that I mean is Sandians are willing to help each other through networking, sharing of experiences and knowledge, support, encouragement, and giving of themselves. The program strives to match Sandians with mutual interests so together they can grow and become stronger.

“I feel that I have become a better human being,” says Phil. “I can relate better to the people I work with, as I offer no blame but reconciliation. Growing up, our hearts were open as our grandparents, and I offer some of the experiences and knowledge possessed by its employees — that chain must not be broken. Phil says his favorite mentors and role models were the experiences and knowledge possessed by his employees — that chain must not be broken.

“In my mentor I have someone to talk to and bounce ideas — someone to offer support and suggestions.”

“Mentoring and networking has been a very positive and invaluable experience for me.”

“Mentees are committed to continuous self-assessment,” says program administrator Rebecca Burt (3522). “Mentors are more development-minded and savvy about the business. Mentees are willing to experiment, grow, and share as mentors are more authentic and share their own story. Together they fill the mentee’s thirsty appetite.”

“We offer monthly lunches with great speakers that participants can attend alone or as a team,” says Rebecca.

For more information on the program, you can contact any of the coordinators on the list at: https://hrprod.sandia.gov/ctoc/ctd/apps/cst/web/brml/programs/mentorhome.

Derius Swinton talks about soaring beyond limitations

Sponsored by the Diversity Leadership Program and Sandia’s Business Program, motivational speaker Derius Swinton spoke at a mentoring luncheon in December. Relating the many hardships, but successful in finding a career, that Swinton has dealt with over his life:

He offered three: “A’s to so approaches, awareness, attitude, and action. Only you can make it happen,” said Swinton. “Don’t give anyone permission to hold you back. You have the power. “Your expectations need to be realistic and you need to be proactive,” he said. “Take time and write your own mission statement. Focus on one common purpose and be future oriented. You can then exceed from there.”

Swinton talked about having a trusted friend/mentor to keep you going when you want to give up. “You can make it happen,” he said.

Seventy-four percent of last year’s participants rated the program as worth the time investment. Sixty-five percent of their goals and objectives had been met.

Here are excerpts from comments by participants in the program:

• “I have a mentor who is dedicated to the program and making a difference for others. It was wonderful sharing my mentor’s experiences and insight of changes at the corporate level.”

• “In my mentor I have someone to talk to and bounce ideas — someone to offer support and suggestions.”

• “This program gave me a contact I could talk with honestly about issues and gain a deeper understanding. I felt I could ask and not worry about any repercussions of personality or culture cliques.”

Derius’ mentor’s guidance and his connections have impacted my career.”

“My mentorship has offered me a great opportunity to learn about Sandia.” — Jerylín Moore

“I believe my mentor’s guidance and his connections have impacted my career.”

“My mentorship has offered me a great opportunity to learn about Sandia.” — Jerylín Moore (3012). “My mentor, Phil Montoya, has always made himself available to me, providing support, guidance and friendship. Him also challenges me to work on areas in my own life, while sharing experiences from his life. The mentoring partner-ship has been a very positive and invaluable experience for me.”

“Mentees are committed to continuous self-assessment,” says program administrator Rebecca Burt (3522). “Mentors are more development-minded and savvy about the business. Mentees are willing to experiment, grow, and share as mentors are more authentic and share their own story. Together they fill the mentee’s thirsty appetite.”

“We offer monthly lunches with great speakers that participants can attend alone or as a team,” says Rebecca.

For more information on the program, you can contact any of the coordinators on the list at: https://hrprod.sandia.gov/ctoc/ctd/apps/cst/web/brml/programs/mentorhome.

Mentoring coordinators
Burt, Rebecca . . . . . . . . . . . . . . . . . . . . . .04000
Bruce, Edwin A. . . . . . . . . . . . . . . . . . . .02100
Bryce, Edwin . . . . . . . . . . . . . . . . . . . . .02300
Bryce, Edwin . . . . . . . . . . . . . . . . . . . . .02400
Bryce, Edwin . . . . . . . . . . . . . . . . . . . . .02500
Chavez, Frank . . . . . . . . . . . . . . . . . . . . .02800
Chavez, Frank . . . . . . . . . . . . . . . . . . . . .02700
Chavez, Frank . . . . . . . . . . . . . . . . . . . . .02600
Frank, Regina . . . . . . . . . . . . . . . . . . . . .02500
Fredericks, Diana J.O. . . . . . . . . . . . . . . .05000
Hollis, Charles . . . . . . . . . . . . . . . . . . . .10800
Howell, Carrie . . . . . . . . . . . . . . . . . . . .15000
Ketley, Beverly . . . . . . . . . . . . . . . . . . . .08000
Platt, Goldie . . . . . . . . . . . . . . . . . . . . .06000
Smallwood, Sandra . . . . . . . . . . . . . . . . .03000
Tidwell, Mary . . . . . . . . . . . . . . . . . . . . .10000

Recent Retirees
Norm Corlis 43 5419
Jim Kvak 27 2541
Gil Yariv 27 3011
Jerry Bechtold 24 2951
Cecilia Ohrmad 13 5993

Hydrogen: Don’t leave home without it

Roland Stumpf helps edit MRS volume on hydrogen storage

One of Sandia’s favorite organizations, the Materials Research Society (five Sandians have served as presidents), has published a timely volume on the subject of hydrogen storage.

The book, edited by Roland Stumpf (8761) and three other researchers, is titled Materials for Hydrogen Storage - 2004, and consists of 21 papers delivered at a symposium held December 2004 at the annual MRS meeting in Boston. The 153-page hardcover volume covers a range of materials proposed for hydrogen storage, including simple and complex metal hydrides, chemical hydrides, and carbon-based systems.

Among other topics, the volume examines the quality and amount of hydrogen storage possible in nanostructured materials, as well as their thermodynamics and kinetics, and discusses tools used to examine the results. Other topics include a discussion of catalysts for reversible hydrogen storage with complex metal hydrides, oxides and heterogeneous adsorbents such as zeolites, metal-organic frameworks, solid state reactions, bulk and surface diffusion, and the relationship between material structure and hydrogen binding energies.

The volume is available free on the MRS web site (www.mrs.org) for members of the Society. All others pay $93. (The book is available for $81 to MRS members wanting a hard copy.) — N.S.

Sandia’s Diversity Cinema wins Best Practices Award

Sandia’s Diversity Cinema Program was recently announced a winner of the 2005 US Department of Energy EEO/Diversity Best Practices awards by the Office of Economic Impact and Diversity.

Since April 2001 Sandia has hosted the monthly Diversity Cinema during lunch hour. The program convenes participants to view videos on diversity issues, with time to discuss the videos in a group setting. Videos are loaned out, on request. Response to the program has been overwhelming positive.

The program has been benchmarked by other Lockheed Martin business units. DOE/NNSA Services Center in Albuquerque and Los Alamos National Laborator-y have implemented their own version of Diversity Cinema. DOE/NNSA Services Center has the impetus and model for their programs.

Sandia’s Diversity Cinema Program recently celebrated its tenth anniversary. The program has a number of events and activities that will go on throughout the month of January to celebrate National Mentoring Month. The pilot program that began with 68 participants has grown to its current enrollment of 650. The program was designed to provide a mechanism for developing people who can respond to changing requirements and complex customer needs.
By Iris Aboytes

"I have had each of my mentees read Tuesdays with Morrie," says Phil Montoya (10508). "It gives us a common denominator to start. I share my expectations with my mentee and listen as my mentee's expectations are shared with me. I take my role as mentor very seriously.”

"The Sandia Mentor Program recently celebrated its tenth anniversary. The program has a number of events and activities that will go on throughout the month of January to celebrate National Mentoring Month. The pilot program that began with 68 participant-pairs has grown to its current enrollment of 650. The program was designed to provide a mechanism for developing people who can respond to changing requirements and complex customer needs.

Participation in the program does not guarantee a promotion. What it does provide is an opportunity for Sandians to improve employee contribution through increased knowledge of Sandia’s culture, strategy, and programmatic directions.

What all that means is Sandians are willing to help each other through networking, sharing of experiences and knowledge, support, encouragement, and giving of themselves. The program strives to match Sandians with mutual interests so together they can grow and become stronger.

"I feel that I have become a better human being," says Phil. "I can relate better to the people I work with, as I offer no blame but reorganization.

Growing up, our hearts were open as our grandparents and parents offered us lessons in life. So at the corporate level."

"My mentorship has offered me a great opportunity to learn about Sandia," says Jerilyn Moore (3012). "My mentor, Phil Montoya, has always made himself available to me, providing support, guidance and friendship. Phil also challenges me to work on areas in my own life, while sharing experiences from his life. The mentoring partnership has been a very positive and invaluable experience for me.

"Mentees are committed to continuous self-assessment," says program administrator Rebecca Burt (3522). "Mentors are more development-minded and savvy about the business. Mentees are willing to experiment, grow, and share as mentors are more authentic and share their own story. Together they fill the mentee's thirsty appetite.

"We offer monthly luncheons with great speakers that participants can attend alone or as a team," says Rebecca.

For more information on the program, you can contact any of the coordinators on the list go to: https://hrprod.sandia.gov/cdofc/products/hrd/ctd/apps/cedtwet/brml/programs/mentorhome.

**Mentoring coordinators**

<table>
<thead>
<tr>
<th>Mentor</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burt, Rebecca</td>
<td>04000</td>
</tr>
<tr>
<td>Bruce, Edwin A.</td>
<td>02100</td>
</tr>
<tr>
<td>Brye, Edwin</td>
<td>02300</td>
</tr>
<tr>
<td>Brye, Edwin</td>
<td>02400</td>
</tr>
<tr>
<td>Brye, Edwin</td>
<td>02500</td>
</tr>
<tr>
<td>Chavez, Frank</td>
<td>02700</td>
</tr>
<tr>
<td>Chavez, Frank</td>
<td>02700</td>
</tr>
<tr>
<td>Chavez, Frank</td>
<td>02660</td>
</tr>
<tr>
<td>Franks, Regina</td>
<td>01000</td>
</tr>
<tr>
<td>Fredericks, Diana J.O.</td>
<td>05000</td>
</tr>
<tr>
<td>Holiss, Charles</td>
<td>01800</td>
</tr>
<tr>
<td>Howell, Carrie</td>
<td>01500</td>
</tr>
<tr>
<td>Kefley, Beverly</td>
<td>08000</td>
</tr>
<tr>
<td>Platt, Goldie</td>
<td>00600</td>
</tr>
<tr>
<td>Smallwood, Sandra</td>
<td>03000</td>
</tr>
<tr>
<td>Tidwell, Mary</td>
<td>10000</td>
</tr>
</tbody>
</table>

---

**Derius Swinton talks about soaring beyond limitations**

**Sponsored by the Diversity Leadership Program and Mentoring Program, motivational speaker Derius Swinton spoke at a mentoring luncheon in December. He talked about many lifestyles, but said we all have only one life.**

He shared three “A’s to positive approaches awareness, attitude, and action. Only you can make it happen,” said Swinton. “Don’t give anyone permission to hold you back. You have the power. Your expectations need to be realistic and you need to be proactive,” he said. “Take time and write your own mission statement. Focus on one common purpose and be future oriented. You can then proceed from there.”

Swinton talked about having a trusted friend/mentor to keep you going when you want to give up. “You can make it happen,” he said.

Seventy-four percent of last year’s participants rated the program as worth the time investment. Sixty-five percent felt their goals and objectives had been met.

Here are excerpts from comments by participants in the program:

- “I have a mentor who is dedicated to the program and making a difference for others. It was wonderful sharing my mentor’s experience and insight of changes at the corporate level.”
- “In my mentor I have someone to talk to and bounce ideas — someone to offer support and suggestions.”
- “This program gave me a contact I could talk with honestly about issues and gain a deeper understanding. I felt I could ask and not worry about any repercussions of personality or culture

**Hydrogen: Don’t leave home without it**

**Roland Stumpf helps edit MRS volume on hydrogen storage**

One of Sandia’s favorite organizations, the Materials Research Society (five Sandians have served as presidents), has published a timely volume on the subject of hydrogen storage.

The book, edited by Roland Stumpf (8761) and three other researchers, is titled Materials for Hydrogen Storage - 2004, and consists of 21 papers delivered at a symposium held December 2004 at the annual MRS meeting in Boston. The 353-page hardcover volume covers a range of materials proposed for hydrogen storage, including simple and complex metal hydrides, chemical hydrides, and carbon-based systems.

Among other topics, the volume examines the quality and amount of hydrogen storage possible in nanostructured materials, as well as their thermodynamics and kinetics, and discusses tools used to examine the results. Other topics include a discussion of catalysts for reversible hydrogen storage with complex metal hydrides, oxides and heterogenous adsorbents such as zeolites, metal-organic frameworks, solid state reactions, bulk and surface diffusion, and the relationship between material structure and hydrogen binding energies.

The volume is available free on the MRS web site, www.mrs.org, or for MRS members only. All others pay $93. (The book is available for $81 to MRS members wanting a hard copy.) — N.S.