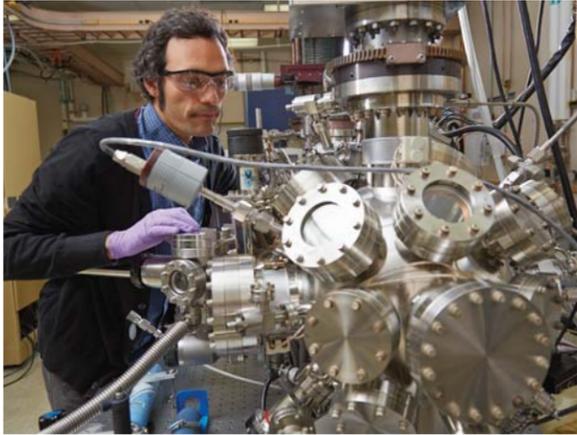


'Popcorn' particle pathways promise better-performing lithium-ion batteries



FARID EL GABALY (8656) aligns an LFP Li-battery electrode sample for chemical characterization with X-ray photoelectron spectroscopy (XPS). The samples will then be thinly sliced for state-of-the-art synchrotron X-ray microscopy. (Photo by Jeff McMillan)

By Bruce Balfour

Sandia researchers have confirmed the particle-by-particle mechanism by which lithium ions move in and out of electrodes made of lithium iron phosphate (LiFePO₄, or LFP), findings that could lead to better performance in lithium-ion batteries in electric vehicles, medical equipment, and aircraft.

The research is reported in an article titled "Intercalation Pathway in Many-Particle LiFePO₄ Electrode

Revealed by Nanoscale State-of-Charge Mapping" in the journal *Nano Letters*, 2013, 13 (3), pp 866-872. Authors include Sandia physicist Farid El Gabaly (8656) and William Chueh of Stanford University.

LFP, a natural mineral of the olivine family, is one of the newer materials being used in lithium-ion batteries and is known to be safer and longer-lasting than the lithium cobalt oxide (LiCoO₂) compound used in smart phones, laptops, and other consumer electronics.

While LFP material is intriguing to researchers and battery manufacturers for those reasons, the process by which lithium ions move in and out of LFP as the battery stores and releases its energy is not well understood. This has proven to be a barrier to the material's widespread adoption.

Cathode materials like LFP are critical in the search for higher-capacity, long-life, lithium-ion batteries for applications where batteries can't be replaced as easily or as often as they are in consumer electronics. Larger applications where lithium cobalt oxide cells eventually could be replaced by LFP batteries include electric vehicles and aircraft.

'Popcorn'-like particle movements seen

By observing complete battery cross-sections, the researchers have provided key insights on a controversy over the process that limits the battery charging and discharging rates.

Previous attempts to optimize the charging/discharging speed have included coating the particles to increase their electrical conductivity and reducing particle size to speed up their transformation, but have



JOSH SUGAR (8656) looks at the fluorescent screen of a transmission electron microscope to view individual LFP particles in a battery electrode slice. He is carefully focusing the image so that the edges of all of the particles are sharply focused, making it easy to correlate the Li distribution in the same particles from the maps obtained using the STXM at ALS. (Photo by Jeff McMillan)

overlooked the initiation process that may well be the critical rate-limiting step in the way that lithium moves from a particle's exterior to its interior.

By using X-ray microscopy to examine ultrathin slices of a commercial-grade battery, Sandia researchers found evidence that charging and discharging in LFP is limited by the initiation of phase transformation, or

(Continued on page 5)

Sandia's 401(k) plan

How good is Sandia's 401(k) plan for employees? A recent analysis shows that Sandia's plan stacks up very well against *Wall Street Journal* indicators. See the story and related chart on pages 6-7.

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Quality in all our work

FY13 Strategic Plan milestones demonstrate Sandia's commitment to quality

By Chris Miller

What do many of Sandia's FY13 Strategic Plan milestones have in common besides setting forth specific actions to measure progress against our strategic vision? "Quality," says Pat Smith, director of Mission Support and Governance Center 700, who is leading the charge to improve Sandia's corporate quality program.

Accomplishing this year's corporate milestones — which include critical deliverables such as a common framework for project management, quality standards for conducting research, improving our workforce capabilities and competencies, and implementation of engineered



(Continued on page 4)

Ernest Moniz sworn in as 13th Energy Secretary

Ernest Moniz was sworn in last week as the nation's 13th Secretary of Energy by Deputy Energy Secretary Daniel Poneman in a ceremony for DOE employees that was also webcast to DOE facilities around the country. Moniz was confirmed by the full Senate in a vote of 97-0 on May 16. He succeeds Steven Chu, who is returning to academia.

"I look forward to the progress we will make together in the coming years — advancing the president's all-of-the-above energy strategy, maintaining the nuclear deterrent, and reducing the nuclear danger, promoting American leadership in science and clean energy technology innovation, and cleaning up the legacy of the Cold War," Moniz wrote in an email to DOE staff. "I believe we can, and must, commit ourselves to the highest standards of management excellence, delivering results for the American people as efficiently and effectively as possible and enhancing our capacity to succeed in our critical missions."

Sandia President and Laboratories Director Paul Hommert welcomed Moniz's appointment.

"I congratulate Dr. Moniz as he assumes this consequential new role as Secretary of Energy," Paul said.



ERNEST MONIZ, left, joined by his wife Naomi, takes the oath of office as US Secretary of Energy. Administering the oath is DOE Under Secretary Daniel Poneman.

"Few individuals assuming this position have been better prepared. Dr. Moniz brings a wealth of experience to the job and has a deep and broad understanding of the department and its mission. The unanimous bipartisan support he enjoyed in his Senate confirmation proceedings is a testament to the impeccable reputation he has built over the past

decades as a scholar, scientist, and public servant. I'm sure I speak for all Sandians when I say we look forward to working with him to advance the important work that we do on behalf of the American people."

Prior to his appointment, Moniz was the Cecil and Ida Green Professor of Physics and Engineering Systems at the Massachusetts Institute of Technology (MIT), where he was a faculty member since 1973. At MIT, he headed the Department of Physics and the Bates Linear Accelerator Center. He was the founding director of the MIT Energy Initiative and of the MIT Laboratory for Energy and the Environment and was a leader of multi-disciplinary technology and policy studies on the future of nuclear power, coal, nuclear fuel cycles, natural gas, and solar energy in a low-carbon world.

From 1997 until January 2001, Moniz served as under secretary of DOE, responsible for overseeing the department's science and energy programs, leading a comprehensive review of nuclear weapons stockpile stewardship, and serving as the secretary's special negotiator for the disposition of Russian nuclear materials.

Moniz received a BS degree in physics from Boston College, a doctorate in theoretical physics from Stanford University, and honorary degrees from the University of Athens, the University of Erlangen-Nuremberg, and Michigan State University.



Learning Expo

Education offered through Sandia will be highlighted at a three-day expo June 11-13 during which attendees can sample classes or talk with university reps about available education programs. Read about the Learning Expo on page 10.

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That's that

Every year since Lockheed Martin assumed management of Sandia back in 1993, it has sponsored one of the more inspiring annual recognition programs in the community. I'm talking about the Thunderbird Awards program, in which a select group of seniors from area high schools are honored with award money for overcoming adversity or surmounting obstacles in their lives and finding success in their studies.

On the printed page, the words "overcoming adversity" come easy, aren't really very descriptive. "Oh, you overcame 'adversity.' Good for you." But when you get down to the nitty gritty, when you bore down into what the words really mean in individual cases, as Nancy Salem does with a story on page 12 of this issue, you come away in awe – I don't think that's too strong a word – for these kids.

We've been telling stories in the *Lab News* about the Thunderbird Award winners for many years. There was the girl who was homeless and then lived on her own from the eighth grade on. The boy with cystic fibrosis who, by the time he graduated, had endured 13 surgeries. The girl whose parents just walked out of her life, leaving her to be the sole support and primary caretaker for her grandmother. The girl whose family sought asylum in the US after the father was kidnapped by the Taliban never to be seen again. Bullying of a truly menacing kind. Drugs. Abandonment. Illness. Challenges faced and overcome. It's hard to write about these remarkable young people without contemplating your own life: Could I have done what they did? Endured what they endured? Do I have the character? Do I have the courage? They show us what's possible.

It's a bit odd to have a role model who is 20, 30, 40 years younger than you, but if you're looking for someone to emulate, start here.

* * *

Every now and then a YouTube video so captures the spirit of the times that it goes viral. Usually, the videos that grab the public imagination are fun stuff, fluffy stuff, curious stuff, even astonishing stuff, but by and large they're ultimately trivial: Cute kittens. An unlikely South Korean dance sensation. Someone, anyone doing something stupid. Or dangerous. Or, usually, dangerously stupid. But a couple of weeks back a new video went viral and in the process a new YouTube superstar was born.

Canadian astronaut Chris Hadfield, who had already become something of a social media favorite during his several-months-long stint as commander of the International Space Station, recorded a hauntingly effective music video of the 1969 David Bowie song *Space Oddity*. It was his closing communique from space, and an unforgettable farewell to the station it was.

When I heard that the "first-ever!" music video recorded in space was available for viewing, I have to admit, I cringed. Amateur hour, right? But being a space buff, if not a music video buff, I opened the YouTube link and was immediately captivated. I won't try to describe it. Just look it up and watch it. I think you'll agree with David Bowie's own tweet about the video: "Possibly the most poignant version of the song ever created."

The *Space Oddity* video wasn't a spontaneous, spur of the moment creation; in fact, it was carefully planned out, the process beginning months before the mission. Hadfield even got permission from Bowie to subtly alter the words to make it relevant to his own flight. Hadfield recorded the video on his iPad – yes, that is him singing and playing the guitar in real-time – and it was subsequently edited planetside by Hadfield's son and another colleague.

Regarding Hadfield, he's a Canadian farm boy become fighter pilot become astronaut who strikes you as one of those individuals who's just good at everything he does. He clearly sees that there's a public component to being an astronaut and he has embraced that part of his role with enthusiasm, humor, and humility. And he is really, really good at it. Want some proof? Check out the social media stuff he's done from the space station: interviews, school lessons, a regular flurry of tweets, at least one REDDIT AMA (ask me anything) live streaming session. He's a natural. He doesn't seem too big for his britches.

The Canadian media is crediting Hadfield with singlehandedly "making space cool again." I can believe it. He's a cool guy and a real hero in Canada. If he were so inclined, I think he'd have a very successful career in politics. Whatever he chooses to do in his post-astronaut career, I hope he stays close to the space program. We need all the heroes and champions we can get and Hadfield is a particularly compelling one.

See you next time.

– Bill Murphy (505-845-0845, MS 1468, wtmurph@sandia.gov)

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Local ACS chapter gets climate change grant



ACS
Chemistry for Life®

With interest in climate change heating up, a New Mexico section of the American Chemical Society has received a \$3,000 ACS Presidential Climate Science Challenge Grant to help educate the general public to the science issues involved, says group leader and Sandia researcher Bernadette Hernandez-Sanchez (1815).

One difficulty to overcome for the Central New Mexico Climate Science Program is that "although we have one of the largest PhD per capita ratios, a large discrepancy still remains in education level between many of our state's citizens and our technical community," says Bernadette.

The difference is compounded by the large distances between New Mexico technical centers and the general population, and by economic and cultural differences.

To overcome these difficulties, the group has partnered with Explora, Sandia, Los Alamos National Laboratory, New Mexico Tech, and New Mexico Highlands University to conduct communication workshops to teach volunteers about climate science and about speaking to the public.

Also potentially useful will be the development of hands-on kits that illustrate basic chemistry concepts. The group plans a monthly or quarterly public seminar series called ACS NM Climate Science Saturdays, where climate experts will present updates on the subject.

Similar grants were awarded by ACS to other local sections, identified in an ACS press release as "Dallas-Fort Worth; Illinois Heartland; Iowa; Kalamazoo, Mich.; New York; Northern W.V.; Portland, Ore.; Puerto Rico; Puget Sound; and Wakarusa Valley in Kansas."

ACS Central New Mexico Section grant authors were Bernadette Hernandez-Sanchez and Jeffery Greathouse (both from Sandia), Michael Heagy from New Mexico Tech, and Donivan Porterfield of Los Alamos National Laboratory.

— Neal Singer



JUNE 11, 12 & 13

SANDIA'S LEARNING EXPO

2013

Call For Nominations:
Sandia Lifelong Learner Awards

Calling all Sandians to submit entries for the Sandia Lifelong Learner Awards.

As part of Sandia's Learning Expo 2013, CL&PD will be recognizing and showcasing Sandians for their pursuit of and commitment to lifelong learning.

Submission Categories: Sandia Lifelong Learner Award
Sandia Leader in Lifelong Learning Award

Deadline: May 31, 2013

Starting June 11, a list of awardees will be posted on the Learning Expo website. Sandia Lifelong Learner Award Certificates will be presented at an awards ceremony on June 26, 2:30pm at the T-Bird cafeteria.

for more info, go to
learningexpo.sandia.gov



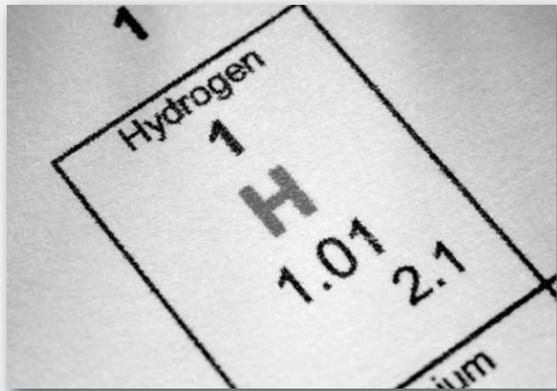
Corporate Learning & Professional Development
Chart your course.
University Programs

Now available Key hydrogen report on OpenEnergyInfo wiki site

By Holly Larsen

As part of the Open Government initiative launched by the Obama administration, Sandia's Technical Reference on Hydrogen Compatibility of Materials has made its debut on the Energy Dataset of OpenEnergyInfo, or OpenEI (<http://en.openei.org/wiki/>).

Many in the industry working to increase the competitiveness of clean hydrogen-powered fuel cell electric vehicles (FCEVs) already consult the reference guide, which has been available on Sandia's web page for several years. But, now, the information found in the publication is more widely available and easier to access.



"The Technical Reference is a valuable tool for the hydrogen delivery and storage industries," says Sunita Satyapal, director of DOE's Fuel Cell Technologies Office, which has sponsored Sandia's work on the Technical Reference. "It can help eliminate R&D redundancies by providing extensive compatibility data to the broader industry. By sharing these crucial findings on OpenEI, the Technical Reference can increase the rate of progress toward overcoming the barriers of hydrogen delivery and storage and allow us to reach full commercialization of FCEVs sooner."

The Technical Reference focuses on compatibility issues between hydrogen and other materials. Due to their small size, hydrogen molecules can seep into materials at room temperature. This high rate of diffusion can promote embrittlement in some of those materials and some materials can be downselected depending on the application and conditions.

To help overcome this challenge, the Technical Reference provides detailed information of the effects of hydrogen on the materials that might be used in equipment for storing hydrogen and delivering it to



A CONVOY of hydrogen-powered fuel cell vehicles demonstrates the potential viability of the technology.

Sandia California News

fuel cell electric vehicles. Developed and updated by researchers at Sandia, the Technical Reference consolidates results of extensive review of reports and journal publications, as well as new research conducted by Sandia, on a range of compatibility issues that must be addressed to increase the cost-effectiveness and ease-of-use of hydrogen vehicles and their infrastructure.

Browsing the reference reveals the extent and depth of detail available. Concentrating on relatively low-cost and high-strength materials — including a variety of steel, aluminum, copper, and nickel alloys, as well as non-metal polymers — the report provides data on potential high-priority impacts of hydrogen on such material properties as yield and tensile strengths, fracture toughness, and fatigue crack growth rates.

"The reviewed and tested data in the Technical Reference can help industry target and develop components and systems with fewer hydrogen compatibility issues," says Sandia researcher Brian Somerday, who, along with Sandia colleague Chris San Marchi (both 8252) was a principal developer of the report. "This could potentially accelerate the timetable for the hydrogen-fueled transportation system."



HYDROGEN FUELING STATIONS like the one pictured here could one day be as pervasive as the familiar corner gas station.

Aegis BMD System completes successful intercept flight test



SANDIA ASSISTED in the launch of this target missile (photo on left) that helped the Missile Defense Agency's Aegis Ballistic Missile Defense (Aegis BMD) system accomplish a successful test flight May 15. The target missile, an Aegis Readiness Assessment Vehicle-C, took off from the Pacific Missile Range Facility (PMRF). A major sub-system of the vehicle is the Attitude Control Module, a missile section designed, built, tested, and fielded by Center 5400. Target launch activities were controlled from Kauai Test Facility, a tenant on PMRF. US Navy sailors in the Pacific Ocean aboard the USS *Lake Erie* detected, tracked, and destroyed the target with a Standard Missile-3 (SM-3) Block 1B missile. It was the third consecutive successful intercept test of the Aegis BMD 4.0 Weapon System and the SM-3 Block 1B guided missile. (Photo, left, by Michael Bejarano)

STANDARD MISSILE – 3 (SM-3) Block 1B interceptor is launched from the USS *Lake Erie* during a Missile Defense Agency and US Navy test in the mid-Pacific. The SM-3 Block 1B successfully intercepted a target missile that had been launched from the Pacific Missile Range Facility, Barking Sands, Kauai, Hawaii. Following target launch, the *Lake Erie* detected and tracked the target. The ship, equipped with the second-generation Aegis BMD weapon system, developed a fire control solution and launched the SM-3 Block 1B. The intercept occurred a few minutes later. The mission was the third consecutive successful intercept test of the SM-3 Block 1B missile. (Caption information for photo at right courtesy of Missile Defense Agency; Photo courtesy of US Navy)



QUALITY in all we do



“With all the priorities that we have in the Laboratories, there comes a point when you hardly know which way to turn.”

— Pat Smith, director,
Mission Support and Governance

(Continued from page 1)

safety — helps bolster the overall quality of Sandia’s work, Pat says. And, she adds, what better way to demonstrate Sandia’s commitment to quality than to show how the strategic milestones inherently help Sandia to fulfill its quality standards and principles.

Pat describes an “aha moment” when she and members of Sandia’s Quality Steering Council reviewed the FY13 milestones posted on the Strategic Planning website. Many of the milestones, she says, readily correspond to Sandia’s quality criteria that enable Sandia to fulfill customer and Sandia expectations. Pat quickly called a meeting with the owners — primarily directors — of 15 milestones. She wanted to test the notion proposed by Gary Sanders, deputy chief engineer (2200), that this set of milestones integrated well under the banner of quality, and if so, they planned to propose that the milestone owners work together to achieve integrated results. They also saw an opportunity to apply quality processes and tools and to define ways to measure quality implementation and effectiveness with work already in progress.

The milestone owners gave Pat their immediate support. A small team of directors has formed to identify the relationships across milestones and to determine how the milestones could be used to create a more holistic quality methodology at Sandia.

“With all the priorities that we have in the Laboratories, there comes a point when you hardly know which way to turn,” Pat told the milestone owners at the start of the meeting. “Everyone wants to do the right thing. It’s frustrating when activities feel like they are layered one on top of the other, especially when they share common principles and should be integrated. We can have more impact by working together and by creating

efficiencies along the way.” Pat presented this approach to Sandia’s executive leadership on May 1 and received their enthusiastic endorsement.

“I’m really glad that the LLT [Laboratory Leadership Team] is excited about an integrated approach to corporate quality that links together many of the milestones,” says Gary. “As one would expect, many of these corporate milestones are elements of a quality management and continuous improvement system. We can use this big picture to assess the completeness of our overall quality system, identify and fill gaps, improve processes, and identify priorities for FY14 as well.”

For example, Gary leads milestone 1.5.1, “Define and implement a management assurance system that supports NNSA’s expectations for an Earned Value Management System approach for stockpile modernization.”

Ensuring the right skills, competencies

Gary said during the milestone integration meeting that completion of his milestone is closely tied to milestone 3.3.4, to develop “a graded approach to project management,” led by Jeffrey Kallio, director of Business Management and Operations Center 10600. Gary said the completion of both of these milestones is also linked to the achievement of other milestones, from 5.2.2, to ensure Sandia’s workforce has the right skills and competencies to carry out the work, owned by Karen Gardner, director of Human Resources Center 3500; to milestone 4.2.1, to deploy a sophisticated common engineering environment that provides a common engineering architecture built on best practices and advanced competencies, owned by Gary and David Williams, principal staff director

(100), Justine Johannes, acting director of Engineering Sciences (1500), and Ann Campbell, at the time serving as director, Information Solutions and Services (9500), and now director, Systems Research Center (5900).

“Clearly we don’t want to create just another island,” said Larry Walker, director of Nuclear Weapons Planning, Operations, and Integration Center 200. “Our goal is to meet our customers’ expectations and we need common tools and common processes to do that.”

David said the milestone to deploy a common engineering environment could easily be integrated into the rest of the milestones covering mission work. Rob Nelson, director of Health, Benefits, and Employee Services Center 3300, said improving TotalComp, covered by milestone 5.1.2, is key to creating an inspired and engaged workforce and therefore applicable to all the other milestones.

The discussion with the other milestone owners progressed in much the same vein — with Charles Barbour, director of Physical Chemical and Nano Sciences Center 1100, owner of milestones 3.3.5, the implementation of engineered safety which concerns how activity level work is conducted; and Carol Jones, deputy chief information officer (9010), owner of milestone 3.2.2, execution of a Data Center consolidation strategy — discussing how their milestones overlap with other milestones.

Pat pointed out how these milestones “fall under the quality umbrella, which we call the ‘Big Q.’ Quality provides a common denominator, tying activities together and helping to bring a consistent approach.”

“I’m excited about us coming together to accomplish the Laboratories’ most pressing matters,” Gary says. “Completing the milestones takes us closer to fulfilling our strategic objectives and providing continued exceptional service in the national interest.”

“I’m really glad that the LLT is excited about an integrated approach to corporate quality that links together many of the milestones.”

— Deputy chief engineer Gary Sanders



Sandia moves forward with invigorated quality expectations

Following extensive deliberation by the Laboratory Leadership Team (LLT), Sandia has documented its expectations to ensure that quality is fully integrated into all facets of the Labs’ work. These expectations include routinely measuring work results to promote continuous improvement and troubleshooting.

“On the whole, Sandians already are performing their work according to quality principles and processes,” says Pat Smith, director of Mission Support and Governance Center 700. “These refinements establish a common quality standard for work performed at Sandia, as well as the expectation for measures and metrics in order to take credit for that work.”

The improvements are detailed in Corporate Governance Procedure 100.5.6 — Achieve Quality and Mission Success, which Pat signed in early May after receiving essential feedback from many staff and managers across the Labs. The procedure includes Sandia’s definition of quality and corporate standard for quality, which were vigorously discussed and endorsed by LLT.

Sandia has chosen to define quality as “Meeting customer and Sandia expectations consistently and predictably through flawless execution of our personal and collective responsibilities.” After spirited debate, LLT purposely included the terms “flawless execution” as an aspiration goal. In the context of the procedure, flawless execution is described as “a systematic approach to detecting and removing inadequacies and imperfections from our work products at the same phase of the work where these imperfections were generated, so that they do not progress to the next phase of work.”

“The aspiration for ‘flawless execution’ recognizes that humans make errors,” says Jack Loye, senior manager, Management and Assurance Systems (750). “It’s impossible for people to not make mistakes. However, if these mistakes affect our ability to work effectively, they could prevent us from meeting customer and Sandia expectations. We need to strive to detect and remove inadequacies and imperfections early in our work, and to prevent mistakes and errors from propagating. The key is preventing defects in everything we do.”

The procedure is posted online in the Corporate Policy System (CPS), and is accompanied with an updated process, CG100.5 — Ensure Quality, that incorporates CG100.5.6 as one of the implementing corporate procedures. The procedure defines quality-related authorities and accountabilities and incorporates the 12 criteria of DOE Order 414.1D, Quality Assurance, as Sandia’s corporate quality standard.

The procedure features a graded approach to quality to ensure that the level, documentation, and actions used to meet customer and Sandia expectations correspond to the type of work being performed. The graded approach takes into account the degree of risk involved, the customer’s requirements and expectations, and the relative importance to safety, safeguards, and security.

The new procedure has set in motion a series of baseline activities that must be completed by Sept. 16. Each of Sandia’s management entities (the four SMUs, the Executive Support Division, Sandia’s 11 divisions, and Sandia’s eight policy areas) must declare a quality management process that is consistent with the Sandia corporate quality standard or to an appropriate national or international standard for quality. After documenting their quality management processes, the entities will grade themselves on how well they currently are executing to these expectations. Finally, each management entity will establish measures to assess how well its quality management process contributes to high-quality work results. The measures will contribute to corporate-level quality measures and metrics, which will be part of Sandia’s management review process.

Most of the management entities have already posted their quality standards and performance measures on their entity’s assurance websites. For instance, the Nuclear Weapons Strategic Management Unit identifies ISO 9001:2008, Quality Management Systems-Requirements, as its quality standard in addition to adhering to DOE quality standards. Division 10000 also complies with ISO 9001:2008 as well as many entity-specific policies, such as the Controllers Manual, Procurement Quality Assurance Manual, Logistics Quality Management System, Guidelines for Interacting with External Auditors, and the Quality-Significant Procurement Handbook.

“All of these elements help Sandia transition toward a greater emphasis on quality as the way we choose to do business,” Pat says. “We are now in a better position to ensure that quality is fully understood and integrated into all of our work. We can never forget that we are on a continuous journey of improvement to meet customer and Sandia’s expectations consistently and predictably through the flawless execution of our personal and collective responsibilities.”

— Chris Miller

Detecting homemade explosives without also finding toothpaste

By Sue Major Holmes

Sandia researchers want airports, border checkpoints, and other security areas to be able to detect homemade explosives made with hydrogen peroxide without also singling out people whose toothpaste happens to contain peroxide.

That's part of the challenge in developing a portable sensor to detect a common homemade explosive called a FOx (fuel/oxidizer) mixture, made by mixing hydrogen peroxide with fuels, says Chris Brotherton (6633). The detector must be able to spot hydrogen peroxide in concentrations that don't also raise suspicions about common peroxide-containing products.

"Hydrogen peroxide explosives are a challenge because they are dangerous, but there are so many personal hygiene products that have hydrogen peroxide in them that the false positive rate is very high," says Chris, principal investigator for an Early Career Laboratory Directed Research and Development (LDRD) project on chemiresponsive sensors to detect a common homemade explosive.

Hydrogen peroxide is found in everyday products ranging from soap, toothpaste, and hair color to laundry bleach, carpet cleaners, and stain removers.

The LDRD proved a sensor could identify relatively high concentrations of hydrogen peroxide and differentiate that from a common interfering substance such as water, Chris says. The next step, he says, will be to work with an industrial partner to design an overall system that is faster and can be mass produced.

His work is built on field-structured chemiresistor technology developed at Sandia more than a decade ago by James Martin (1114) and Doug Read (1716). Chemiresistors are resistance-based sensors for volatile organic compounds. James and Doug, who have published several papers on their work, developed a significantly improved material that allows sensors' response range and sensitivity to be tailored.

Finding the right polymer

Chris also faced the problem of coming up with a way to distinguish between hydrogen peroxide and water, which can exhibit similar behavior in chemiresistors.

The key was choosing certain molecules in a polymer matrix, suggested by his technical mentor, polymer chemistry expert David Wheeler (1714). When exposed to peroxide, those molecules react in a different way than when exposed to water.

The idea is to engineer the polymer to be as similar to the target material as possible, relying on the undergraduate rule that like dissolves like. For example, David says, if the target is a substance that's not very polar, you'd choose a polymer with nonpolar groups. If the target had a lot of polarity, like water does, you'd develop polymers that could hydrogen-bond with water.

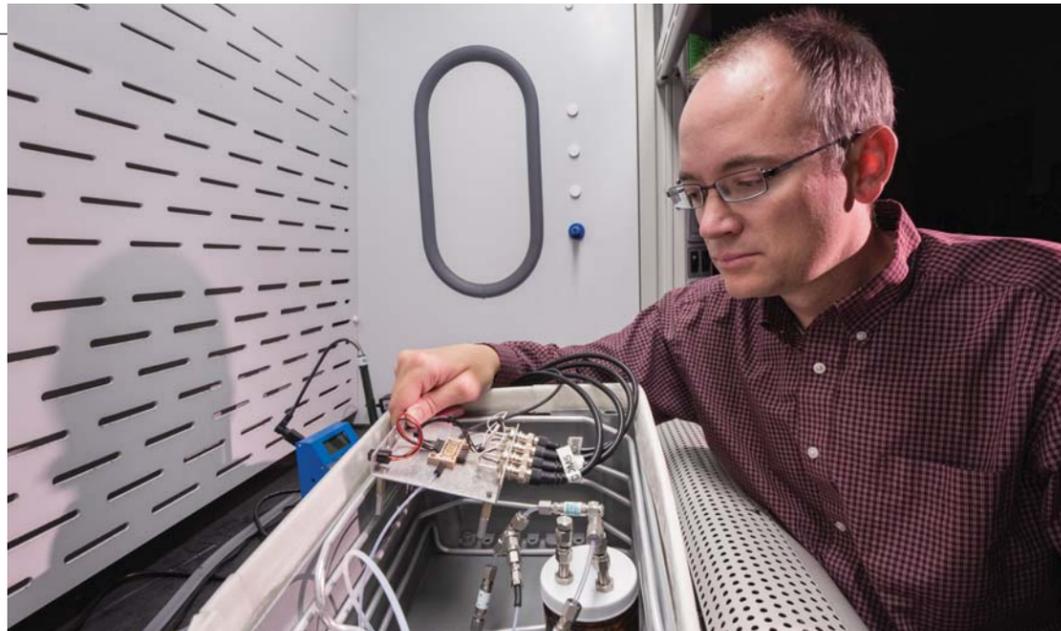
The tiny sensor incorporates the polymer and chains of miniscule conductive metal beads. The polymer reacts when it's exposed to the substance being analyzed.

"We tried to include specific molecules that would react with the peroxides," Chris says.

Exposure to water also changes the polymer's properties, but it returns to its previous state once the water is removed. Exposing the polymer to concentrated hydrogen peroxide, however, irreversibly changes it.

"So once you've done this to the polymer you've permanently changed it," Chris says. "Instead of being a reusable sensor, it's more of a disposable dosimeter."

It's also a detector that doesn't react to toothpaste and other common peroxide products, he says.



DETECTING HOMEMADE EXPLOSIVES — Chris Brotherton (6633) checks four tiny sensors in a test fixture, where he exposes the sensor to different environments and measures their response to see how they perform. Chris was principal investigator on a project aimed at detecting a common type of homemade explosive made with hydrogen peroxide. (Photo by Randy Montoya)

Detector has other potential uses

Manager Paul Smith (6633) says the sensor has other potential uses, such as monitoring underground water, looking for plumes of contamination, or monitoring industrial processes.

Chris cautions that it's not a silver bullet, but says the technology has shown good results.

"It has some challenges that have to be overcome, but we think it's worth pursuing to the next level," he says.

Researchers need to reduce the chemical reaction time so the sensor doesn't take too long to be useful at a checkpoint, Chris says. The detector also must be incorporated into a larger unit that includes equipment to gather a sample for analysis.

The sensor doesn't need a significant amount of electronic processing or power supplies, Chris says, adding, "This technology would be easier to integrate into other detection technologies without impacting them too significantly."

It wouldn't have to be a large unit. Various detectors on the market today are about the size of a small handheld vacuum cleaner, Paul says.

Getting the air to the detector

The support equipment would suck up a sample of air and the detector would test it.

"You'd need to know where the fumes were coming from," Chris says. "It's not enough to open up the whole room and suck in all the air and say, 'There are peroxides somewhere in here, watch out.' What we'd like to do is go up and down luggage, or be next to some sort of industrial process so we know this is most likely the source and it's above a level we care about."

Although a detector package could target a single type of vapor, a manufacturer could add it to a unit to detect several substances. That way a checkpoint could have one sensing system rather than separate units for every material of concern, Chris suggests.

"Maybe it's a suite of sensors to try to hedge our bets," he says. "We've focused on a very specific application, but there's no reason you couldn't take this concept and use different polymers and look at multiple substances at the same time."

Popcorn particle

(Continued from page 1)

nucleation, and is unaffected by particle size.

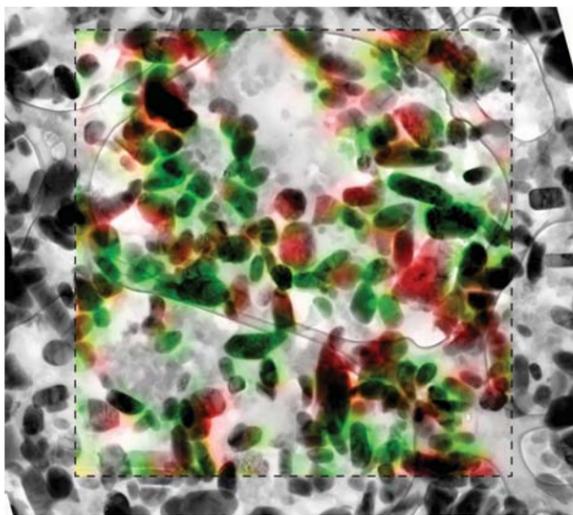
The LFP electrode forms a mosaic of homogeneous particles that are in either a lithium-rich or lithium-poor state. The Sandia research confirms the particle-by-particle, or mosaic, pathway of phase transformations due to insertion of lithium ions into the cathode. The findings contradict previous assumptions.

"One propagation theory said that when all the particles were exposed to lithium, they would all start discharging slowly together in a concurrent phase transformation," says Farid. "We've now seen that the process is more like popcorn. One particle is completely discharged, then the next, and they go one-by-one like popcorn, absorbing the lithium."

Slicing-and-dicing

Lithium ions move in and out of battery electrode materials as they are charged and discharged. When a rechargeable lithium-ion battery is charged, an external voltage source extracts lithium ions from the cathode (positive electrode) material, in a process known as "delithiation." The lithium ions move through the electrolyte and are inserted (intercalated) in the anode (negative electrode) material, in a process known as "lithiation." The same process happens in reverse when discharging energy from the battery.

"We observed that there were only two phases, where the particle either had lithium or it didn't," says Farid. "In many previous studies, researchers have focused on understanding the charging process inside



LFP PARTICLES as seen by Josh Sugar's TEM with overlay of the chemical information as seen by Farid El Gabaly's STXM. Red is LiFePO_4 (Li-LFP) and green is FePO_4 (LFP without lithium).

one particle."

Farid and his Sandia colleagues took a slice just a bit thicker than a human hair from a commercial-grade battery, just one layer of LFP particles, and mapped the locations of the lithium in about 450 particles when the battery was at different states of charge.

"Our discovery was made possible by mapping the lithium in a relatively large particle ensemble," he says.

The researchers were able to build a commercial-grade coin-cell battery from raw materials using Sandia's cell battery prototyping facility in New Mexico, which is the largest DOE facility equipped to manufacture

small lots of lithium-ion cells. The battery was then charged, tested for normal behavior, and disassembled at Sandia/California using a new method of slicing layers that conserved the spatial arrangement from the cathode to the anode.

Characterizing the material

The Sandia researchers went to Lawrence Berkeley National Laboratory to characterize the materials with state-of-the-art scanning transmission X-ray microscopy at the Advanced Light Source (ALS), and then returned to Sandia's California site for study by transmission electron microscopy (TEM).

"The X-ray spectroscopy from the ALS tells you what's inside an individual particle, or where the lithium is, but it has low spatial resolution. We needed the electron microscopy of the same slice to tell us where all the particles were distributed across the entire layer of the battery," says Chueh, a former Sandia Truman Fellow who is lead author of the journal article and an assistant professor and center fellow at the Precourt Institute of Energy at Stanford University.

Sandia's research team and others presented their technical findings at the recent Materials Research Society Spring Meeting in San Francisco. As a result of that presentation, says Farid, other researchers are using the results to validate theoretical models. The team also may partner with industry, as one company has already indicated a strong interest in Sandia conducting similar studies on different, more complex battery materials.

The research team at Sandia has been funded internally, including support from the Sandia Truman Fellowship in National Security Science and Engineering, and by DOE's Office of Science, which also supports the ALS.

Your 401(k)

Sandia 401(k) plan scores well against *Wall Street Journal* indicators

It's a good idea to periodically monitor your 401(k) plan savings to ensure you're on the right path toward building that hoped-for nest egg for retirement. Are you saving

By Connie Lee and Chris Miller

It's a good idea to periodically monitor your 401(k) plan savings to ensure you're on the right path toward building that hoped-for nest egg for retirement. Are you saving enough? Have you sufficiently analyzed your investment choices? Are your investments adequately diversified to mitigate risk? And, do you understand the fees you're being charged?

The Wall Street Journal reported in January 2013 under the headline, "How Good Is Your Company's 401(k)," that employees should evaluate their company's 401(k) plan to determine their best option for financing their retirement.

Using indicators that scored things such as the level of fees, the quality of the investments offered, and the level of the company match, the newspaper gave 401(k) plans either a green light (try to max out your 401(k)); yellow light (after contributing enough to get the match, comparison shop for a better deal in an IRA or annuity); or red light (get the match, then put your other savings elsewhere).

Sandia's plan scored squarely within the green light category.

"Sandia's 401(k) plan scores very well across all the different categories," says Kim Sawyer, Deputy Laboratories Director & Executive VP for Mission Support and chair of Sandia's Investment Committee. "We work hard to ensure we provide employees with a quality plan that will help them reach their retirement goals, so we're certainly not surprised that our plan scores so well."

At the end of 2012, about 11,700 Sandians and retirees had \$2.3 billion invested in the 401(k) plan, administered by Fidelity Investments. Eighty-three percent of on-roll Sandians were participating in the plan, meaning 17 percent chose not to put money into the 401(k) plan and take advantage of the company match. Of the participants, 75 percent were also eligible for Sandia's Retirement Income Plan, a defined benefit pension plan, and 25 percent were eligible only for the 401(k) plan, but received an enhanced contribution because they were hired on or after Jan. 1, 2009.

"I highly encourage employees to think about saving for their retirement as early as possible in their careers," Kim says. "Our 401(k) plan, with its low fee investment options and company match, provides an excellent way to save that nest egg."

The table that accompanies this story (see below) provides a closer look at how Sandia scored against all six indicators provided by *The Wall Street Journal*.

Total expenses:

Green light criteria: Under 1 percent — preferably no more than 0.75 percent

On an annual basis, Sandia's 401(k) plan participates in a defined contribution fee survey conducted by CEM Benchmarking. According to the survey, which considers costs such as the cost of the available investment options and administrative expenses, Sandia's 401(k) total plan expenses average 0.41 percent.

A national survey of 803 households conducted in December 2010 for the AARP
(Continued on next page)

Go! Go! Go! Sandia 401(k) gets the green light all the way

Investment Factor	Sandia Laboratories	Green Light	Yellow Light	Red Light
Total Expense to employee	0.41%	Under 1%; preferably no more than 0.75%	1% to 2%	More than 2%
Maximum company match	2/3 of the first 6% (or 4%)	At least 3% of pay (such as half of first 6%)	Less than 3% of pay	No match
Access to company match if you leave	Immediate vesting	Immediate vesting	Graded vesting	Cliff vesting, typically meaning no vesting for several years
Variety & quality of investment choices	Target-date funds, plus 14 decent funds in a variety of asset classes (including the addition of Harding Loevner emerging markets fund)	Target-date funds, plus at least 5 to 10 decent funds in a variety of asset classes	Several poor-performing funds, or the absence of alternatives including target-date funds, emerging-market stock funds or inflation-adjusted bonds	Few decent choices and a requirement to hold company stock
Cost of stock and bond options	Large-Cap: <ul style="list-style-type: none"> S&P 500 Fund (US Equities Commingled Pool): 0.02% T. Rowe Price Large-Cap: 0.59% Small-Cap: <ul style="list-style-type: none"> DFA US Small-Cap: 0.37% International: <ul style="list-style-type: none"> BlackRock All-Country World Index: 0.10% Bonds: <ul style="list-style-type: none"> SSgA Bond Market Index: 0.12% Fidelity Interest Income Fund: 0.22% 	Large-Cap: <0.6% Small-Cap: <0.85% International: <0.8% Bond: <0.45%	Large-Cap: 0.6–0.9% Small-Cap: 0.85–1.1% International: 0.8–1.1% Bond: 0.45–0.6%	Large-Cap: >0.9% Small-Cap: >1.1% International: >1.1% Bond: >0.6%
Cost of target-date funds	BlackRock LifePath funds are index-based, with an expense ratio of 0.22%	Fee is less than 0.6%	Fee is 0.6% to 0.9%	Fee is above 0.9%

Sandia 401(k) plan gets a bright green light based on *Wall Street Journal* criteria

(Continued from preceding page)

found that 71 percent reported they were unaware of paying any fees on their 401(k).

The Department of Labor provides an example of how fees can affect one's retirement savings. The DOL example assumes a beginning balance of \$25,000 that grows with an annual average return of 7 percent, without any additional employee contributions. With an annual fee of 0.5 percent, the \$25,000 would grow to nearly \$227,000 over 35 years. But with an annual fee of 1.5 percent, the \$25,000 would grow to only \$163,000, a difference of \$64,000, or 28 percent. The example shows how even a difference of 1 percent in fees can have a big effect on the amount of funds available for retirement.

Beginning in 2012, Department of Labor regulations require that Participant Disclosure Notices be provided to employees annually. This notice provides information related to fees and can be accessed on NetBenefits under "Plan Information and Documents." Sandians recently received the notice by either email or hard copy from Fidelity.

Maximum company match:

Green light criteria: At least 3 percent of pay.

Sandia matches 2/3 of the first 6 percent of employee contributions into the 401(k), or 4 percent. That means if an employee contributes 6 percent of his or her pay to the plan, the 4 percent match brings the total contribution up to 10 percent. As an example, an employee with a salary of \$70,000 who contributes the full 6 percent, or \$4,200, would receive a \$2,800 company match each year.

In addition to the company match, employees hired on or after Jan. 1, 2009, are also eligible for an enhanced company contribution to the 401(k) plan since they are not eligible for a pension. The enhanced contribution provides employees an additional company contribution of 6 percent of pay. That means if an employee contributes 6 percent of his or her pay to the plan, the 4 percent company match plus the 6 percent enhanced contribution brings the total contribution up to 16 percent. After 15 years of employment, the enhanced contribution increases to 7 percent. Pension-eligible employees receive only the company match and not the enhanced contribution.

Access to company match if you leave:

Green light criteria: Immediate vesting.

Sandia has immediate vesting for the company match, employee contributions, and associated earnings.

Separately, for employees hired on or after Jan. 1, 2009, the enhanced contribution portion of their account and any associated earnings will vest after they are credited with three years of vesting service. If the employee terminates from Sandia before completing three years of vesting service, the nonvested account balance will be forfeited.

Variety and quality of investment choices:

Green light criteria: Target-date funds, plus at least 5 to 10 decent funds in a variety of asset classes.

Sandia offers target-date funds, plus 13 funds in a variety of asset classes. The funds range in risk, return objectives, and investment strategies to provide employees with an opportunity to create diversified portfolios to accomplish their retirement savings objectives.

With the target-date funds, employees choose the fund with the year that most closely matches the employee's anticipated retirement year. The target-date funds are pre-mixed diversified investment portfolios that adjust in risk over time as employees approach retirement.

Currently, Sandia offers 9 funds ranging from the BlackRock LifePath Retirement Fund for those who are currently in retirement to the BlackRock LifePath 2050 Fund for those reaching retirement age in 2050.

Cost of stock and bond options:

Green light criteria: Large-Cap Equities <0.60 percent; Small-Cap Equities <0.85 percent; International Equities <0.80 percent; Bonds <0.45 percent.

Sandia offers low-cost options that meet the green light criteria across all the asset classes mentioned (for specific investment options, visit NetBenefits at www.netbenefits.com or www.401k.com). The percentages listed above are expense ratios. The expense ratio is the total annual cost of a fund expressed as a percentage of the balance of the assets in the fund and can include costs such as investment management fees, administrative costs, recordkeeping expenses, and other operating expenses.

Cost of target-date funds:

Green light criteria: Fee is less than 0.6 percent. The cost of Sandia's target-date funds, also called "LifePath Funds," is 0.22 percent.

Investment Advice:

In addition to scoring well against *The Wall Street Journal* indicators, Sandia's 401(k) plan recognizes that investing for retirement can be complex and confusing and that many employees would like help with their 401(k)s. Since 2010, Sandia has offered investment advisory services from Financial Engines, an independent, third-party company. Financial Engines acts as a fiduciary. This means that Financial Engines is legally obligated to offer advice that is in the best interest of the participant and is liable if it fails to do so.

Each year, generally in the fall, Financial Engines sends out a Retirement Evaluation to each Sandia 401(k) participant that provides feedback based on 401(k) participation, how prepared the participant is for retirement, and if there are changes the participant could make to improve his or her retirement outlook.

In addition, Financial Engines provides two services to participants. The first is Online Advice. Sandia currently covers the cost of Online Advice, so it is available at no cost to employees. The service provides help with determining an appropriate allocation to the available investment funds. It is then up to participants to implement the suggested changes through NetBenefits, monitor the allocations, and rebalance their investments when necessary.

The second service is the Professional Management program. Financial Engines determines an appropriate allocation to the available investment funds and then implements the asset allocation recommendation, monitors the participant's portfolio, and rebalances when necessary. The annual program fee is 0.60 percent of the participant's account balance, which is about \$5 a month for each \$10,000 in the account. Discounts apply for balances over \$100,000.

For both Online Advice and Professional Management, Financial Engines encourages participants to provide information about other retirement accounts held outside of Sandia's 401(k) to see a more complete retirement forecast and investment strategy. For more information about Financial Engines, you can log in to the NetBenefits website and click on the Financial Engines link.

"Whether to participate in a 401(k) program is an individual decision based on each employee's particular financial needs, risk tolerance, and retirement objectives," says Jane Farris, senior manager of Pension Fund and Savings Plan Management. "The results of the study should help assure Sandians that they have a good savings plan available to them."



Texas A&M students get up-close look at Sandia

Undergraduate and graduate students in nuclear engineering from Texas A&M University recently visited Sandia to learn more about employment opportunities at the Labs. After welcoming remarks and a Sandia overview by Center 5400 Director David Keese, the group toured major facilities in Tech Areas 3 and 5, including the Centrifuge Complex, seen in the photo at left. After the tours, the students heard directly from a panel of hiring managers about what it's like to work at Sandia. During that session, Recruiting team lead Roberto Archuleta (3555-3) also provided information about Sandia's Student Intern programs, Graduate Study programs, and employment in general. In the photo at left, Roberto, third from right, joins the student delegation as Ed Romero, Mechanical Environments Dept. 1534, at left, explains the work at Sandia's large centrifuge.

TAMU is a Sandia Campus Executive school. The Campus Executive program was established in 1997 as a way to partner with universities to conduct leading-edge science, hire the most accomplished scientists and engineers, and develop strategic collaborations in focused research areas. Sandia executives, acting as ambassadors, are paired with top university officials, usually deans of engineering, at schools that have synergistic research interests and capabilities with Sandia. This program enables the campus executives to deliver a coordinated message to educate key university personnel regarding the programs being put in place to mutually benefit Sandia and its strategic university partners. (Photo by Randy Montoya)

RESILIENCY



LAST HOUSE STANDING — In this iconic photo by *Houston Chronicle* photographer Smiley Pool, the last house standing on the waterfront at Gilchrist, Texas, in the wake of 2008's Hurricane Ike demonstrates the value of engineering buildings to withstand the forces to which they are likely to be exposed. (PHOTO: © *Houston Chronicle*. Photo used with permission)

Motivating business to design a more resilient nation, one building at a time

By Neal Singer

Anyone who's ever come home from vacation to find a home partly destroyed by a leaking roof, broken water line, or backed-up sewage knows the horror of drywall replacement, rotted rug ejections, mold tests, and other reconstruction measures that force life as we know it to a halt.

The difficulties are even larger when a commercial or government workplace is struck by disaster. Employees usually vacate the premises or wait for help. Little gets done.

Self-reliant buildings

But imagine a building resilient enough to allow people to continue their daily tasks even while an emergency is in progress. The self-reliant building might have its own small electrical generating system to maintain lights and computers during a power outage, employ mobile communications, maintain compartmentalized clusters of rooms to prevent water damage in one sector from affecting others, shatter-proof windows to minimize hazards from imploding glass, and sufficient electronics to quickly pinpoint a trouble spot.

For obvious reasons, increased building resilience in

the face of hurricanes, earthquakes, terrorism, or cyber-attacks has been a major national security focus over the past decade.

Such resilient buildings not only would be less susceptible to damage and work interruption but could become community gathering places in times of general crisis, according to a recently published Sandia paper, "Resilience certification for commercial buildings: a study of stakeholder perspectives," published in *Environment Systems and Decisions* on March 13, 2013.

But it won't be easy to secure voluntary adoption by industry and construction companies if the wrong justifications are presented, says lead author Barbara Jennings (6924).

Expecting industry to act, for example, merely because "it's the right thing to do" came out lowest (3 votes) in a questionnaire presented to 15 industry representatives.

The highest number of respondents were motivated by business reasons. These included increased revenue (10 votes), better competitive edge (9), and quicker, cheaper recoveries (9) from more efficiently handling a disruption. The upper middle ground was held by "decreased insurance premiums" (8) and "tax incentives" (7), while the lower middle ground

included more problematic benefits: "Increased chance of receiving financing or lower finance rates" and "ability to charge higher lease rates due to increased attractiveness of the building to tenants" (both 5).

Five concepts

While the respondents were generally favorable to the resilience concept, they found it daunting to plow through the government forms and language necessary to apply for sizable tax credits to offset the increased building costs.

The paper proposes five concepts to make the concept of resilient buildings real to the construction, design, insurance, and building owner communities.

Most imaginatively, the authors (who include Eric Vugrin and Deborah Belasich, both 6921) suggest that program sponsors collect stories and images that demonstrate resilience during alarming times and use these as proxy incidents to motivate others who had not experienced disasters themselves.

They also suggest government-based incentives, public-private partnerships, training and education programs, and simple, clear explanations of the federal governments' multiple programs "to minimize confusion by describing the different role each plays."

Onsite reps demystify complex world of health insurance

By Nancy Salem

Often the most painful part of an injury or illness is when the medical bills arrive, and keep arriving. A mountain piles up from hospitals, clinics, physicians, therapists, anyone who helped in a time of need. Do you pay or wait? Then come insurance forms with thumbs up or down on claims. Opening those envelopes is downright scary.

"Health insurance can get complicated," says Deborah Nunez, manager of Benefits Dept. 3332. "We want resources available onsite to help members with claims issues and understanding benefits."

Deborah says Sandia is taking steps to help employees engage insurance providers and figure out everything from out-of-pocket expenses to the most affordable way to have, say, knee surgery.

United Healthcare (UHC), which insures the majority of Sandians, has a new full-time, onsite customer advocate at the Labs in Albuquerque. Mia Scofield has been with UHC since 1991 and can answer pretty much any question that comes up.

"I can expedite claim adjustments. I can help you find a primary care physician or specialist," she says. "I can help with appeals if a charge is denied. Not every issue is simple. I'm here to support members and walk them through the process step-by-step."

Scofield helps employees navigate the UHC website, www.myuhc.com, which has a variety of tools to help people understand the insurance process. "We find the answers," she says. "The intent is to help members utilize the online tools. You can access claims, benefits, look up providers, learn about preventive services, chat online with a nurse, and check your deductible balance. There's a slew of information."

Blue Cross Blue Shield of New Mexico (BCBSNM) has an onsite customer advocate, Christina Hart, who is at the Labs two days a week, Monday and Thursday. Hart can walk people through their claims, explain benefits, help with billing, and tap into tools on the www.bcbsnm.com website. "She can explain the Sandia Health Partner Network, which offers lower coinsurance, deductibles, and out-of-pocket maximums to BCBSNM members who visit certain providers," Deborah says. "BCBSNM also has a concierge line that finds providers and sets up appointments."

Hart says it's often easier to understand health insurance by talking to someone in person. "It's less confusing for the member," she says. "I can make sense of it and explain the online tools."

Deborah says Scofield and Hart know Sandia's plans inside out, and what resources UHC and BCBSNM have to offer. Members can walk into their offices, make



MIA SCOFIELD, the onsite customer advocate for United Healthcare, says the UHC website has a variety of tools to help people understand the insurance claims process. "There's a slew of information," she says.

appointments, call, or email. Both advocates are in the Thunderbird Café Mondays 11 a.m.-12:30 p.m.

There is also an onsite representative for the Kaiser Sandia Total Health Plan three hours every other week at Sandia/California for help with billing, claims, and other insurance issues.

The stepped-up efforts are part of Sandia's consumer-driven health plan launched in 2011. It encourages employees to be healthier and build a health reimbursement account by taking a health assessment and participating in Virgin HealthMiles. Routine claims are paid using the consumer-controlled account versus a fixed health insurance benefit. That gives patients greater control over their own health budgets and incentive to consider cost and seek more affordable treatment options.

"One of the biggest questions with consumer-driven health plans is, 'You tell me I need to shop for services, but I don't know how to do that. I don't know how much it costs. Sometimes a provider won't tell me. Do I have to call every provider?' This is what these tools are trying to help members do," Deborah says.

The UHC and BCBS websites have cost estimators that analyze the four "Ps" of planning for care: procedure, provider, place, and price. "It helps you determine approximately what your price might be for a procedure. There are differences in pricing and you can make choices that affect your out-of-pocket expenses," Deborah says. "The insurance providers are offering more services to help people make decisions. It's more interactive."

Scofield says working directly with health plan members has been rewarding. "I can make a difference through personal interaction," she says. "I can see the impact of my services immediately."

Hart says she works with more than a dozen people a day. "We are here for you," she says. "Come in and we'll help you out."

Close at hand

Sandia's onsite health insurance advocates encourage members to ask questions and get tips on using website tools. Here's how to reach them:



Mia Scofield, United Healthcare
Office: Bldg. 832, Rm. 33B, Monday-Thursday, 7 a.m.-3:30 p.m.
Phone: 844-0657
Email: mia_i_scofield@uhc.com
Website: www.myuhc.com



Christina Hart, Blue Cross Blue Shield of New Mexico
Office: Bldg. 832, Rm. 33A, Mondays and Thursdays, 8 a.m.-4 p.m.
Phone: 284-8669
Email: christina_hart@bcbsnm.com
Website: www.bcbsnm.com



KAISER PERMANENTE

Alison Huff, Kaiser (California)
Office: Sandia/California Bldg. 925, every other Thursday, 9 a.m.-12 p.m. (by appointment)
Phone: 925-294-2700
Email: Alison.C.Huff@kp.org
Website: www.kp.org

Sandia's 13th Habitat House halfway through build schedule

By Stephanie Hobby

Every Friday and Saturday from March until June, Sandia Labs employees, family members, retirees, and contractors meet at the Habitat for Humanity build site to bring another family closer to the dream of owning their own home. The future homeowner, Zulema Hernandez, is pictured in the center left in the photo below. Hernandez, in the work apron and cap, is joined by members of the Div. 2000 work group including VP Bruce Walker in center rear. The division 2000 volunteers worked on Friday, April 12, and Saturday, April 13, to frame doors and windows and help with layout. This project marks the 13th home that Sandia has built for Habitat for Humanity. The dedication is scheduled for Saturday, June 29. If you are interested in volunteering, contact Patty Zamora (3652) at 844-2146.

(Photos by Nancy Gabaldon, volunteer coordinator for Habitat for Humanity)



No excuses

Three schools offer Sandians onsite master's programs

By Nancy Salem

Sonia Martinez has been on a fast track since joining Sandia in 2005 in clerical support. After lots of focused learning, she's now a software applications engineer.

Sonia (9548) says she doubts she would have advanced as quickly without having earned a master's degree in national security from the University of New Haven (UNH), which offers the program onsite at Sandia. "The national security program gave me a firm foundation to learn and grow professionally," she says. "After completing the program I got the opportunity to move into a professional position in this new subject area, which I firmly believe would not have happened if I hadn't pursued my master's degree and the rich education I received from UNH."



SONIA MARTINEZ (9548) earned a master's degree in national security from the University of New Haven.

(Photo by Randy Montoya)

New Haven is one of three schools offering master's programs onsite at Sandia. New Mexico State University (NMSU) offers a master's in business administration (MBA) and Stevens Institute of Technology of Hoboken, N.J., a master's in systems engineering.

Charline Wells, senior manager of Corporate Learning & Professional Development Dept. 3520, says the onsite schools are an important part of Sandia's continuing education program. "We want to make it easier for Sandians to further their education," she says. "From an adult learning perspective, we want to eliminate barriers that get in the way of people learning so that they can increase their knowledge to advance their career, and so Sandia can best serve the nation. We want people to continue their education and get a degree in an area important to Sandia's mission."

There are about 60 people in the onsite master's programs at any one time, says University Programs administrator Bernadette Montano (3520). Sandia tuition assistance provides regular employees who qualify up to \$6,000 per calendar year and covers most of the cost of getting a master's degree at state schools and helps with the price of higher education at other schools.

Eleven schools will be represented at the 2013 Sandia Learning Expo (see box at far right). The three-day event June 11-13 will provide information on an array of educational opportunities. "This event is worth your time," Bernadette says. "You can talk directly to university representatives about educational options and find out what courses and programs are available onsite at Sandia and offsite at universities."

Benefits of a business degree

The onsite NMSU program, which has been in place since 2008, offers an opportunity to earn an MBA in two years. It's a cohort program, meaning a class of 18-20 students goes through together, starting and finishing at the same time. "An outcome we have observed is the majority of graduates who completed their MBA through the NMSU program have qualified for other opportunities within the Labs and transferred into new positions," Bernadette says. "Some have been promoted."

The program includes two courses per semester, one taught one evening a week in Bldg. 856 and the other online. Charline says a business degree can round out the career of a Sandia manager or individual contributor. "For people who interact with government or corporations it is useful to understand, from a business perspective, where your customer is coming from so you can relate to them," she says.

Participants have indicated that they learned more going through the program with a cohort. Not only are they able to get a traditional MBA education, they get a better understanding of how to apply that knowledge across Sandia through the experiences of others in the program. They also build their Sandia network with fellow students ranging from OAAs to senior managers.

Wider view of national security

UNH, based in Connecticut, has offered its national security degree program since 2002. It started at Sandia/California and in 2005 moved to Sandia/New Mexico. In 2010 the program relocated to the Kirtland Air Force Base (KAFB) Education Center so base personnel can participate.

New Haven is one of 13 US universities with a national security program. Students can earn a graduate certificate requiring 12 credits or a master's degree with 36. They complete the program at their own pace rather than in a cohort setting, generally in two to five years. Most of the courses are offered onsite, with a few online.

The dozens of classes range from "The Economics of National Security" to "Information Systems, Threats, Attacks, and Defenses." "All of the professors who come out here to teach these courses are experts in their field," Bernadette says. "They're not just teaching out of a book. These are people who have held high positions in the government."

And Charline says taking classes with students from KAFB "gives Sandians exposure to other security types of issues that could arise."

"It's not just focused on Sandia but rather looks to the larger spectrum," she says.

Sonia says the program "gave me an insight into how national security programs work and how those principles are directly related to the work we perform here at the Labs."

"The convenience of attending evening classes on Sandia campus and having the flexibility to complete a portion of my degree online was amazing," she says.

A nice lineup of programs

Stevens has been onsite three years offering a certificate program and master's degree in systems engineering with four concentrations: software engineering, systems engineering, security program management, and advanced systems engineering. Students work at their own pace in classes in Bldg. 856. Courses are completed in four day-long sessions over two months.

"The program can go faster because students are in



HEATHER KRAEMER (2136) took courses onsite at Sandia to earn a master's in systems engineering from Stevens Institute of Technology.

(Photo by Randy Montoya)

class a lot more often each week," Bernadette says. "It's not just one evening a week."

Heather Kraemer (2136) earned a master's in systems engineering from Stevens in 2010 after joining Sandia in 2004. She has received several promotions and is now an integrated risk manager and a technical integration lead in Dept. 2100.

"Each of the positions has built on the knowledge gained through the Stevens program, each with increasing levels of responsibility, complexity, and visibility that tie directly to my education through Stevens," she says. "It was fantastic to get a master's onsite. It allowed me the experience of working with world-class faculty but not having to leave Sandia."

Charline says the three onsite programs line up nicely with their focuses on business, national security, and systems engineering. "They enhance the skills that Sandia brings to our mission," she says.

In any given year, 400-450 Sandians participate in the Tuition Assistance Program and about 50 in Special Degree Programs including University Part-Time, Special Master's, and Doctoral Studies. Assistance is offered for education relevant to Sandia and taken at US regionally accredited schools with accredited programs.

A commitment to continuing education supports Sandia's Strategic Objective No. 5, to provide a learning, inclusive, and engaging environment for employees. "Providing employees the opportunity to continue to learn through accredited formal education programs always serves the Labs' best interest," Charline says. "Renewing and keeping employees at the top of their game keeps our mission focus at the top of its game."

Learn about learning at the 2013 expo

Education offered through Sandia will be highlighted at a three-day expo June 11-13. "People can come to the fair and sample classes or spend a little time talking with university representatives about available education programs," says Charline Wells, senior manager of Corporate Learning & Professional Development Dept. 3520.

The first day of the expo, in Bldg. 858EL from 10 a.m.-noon, showcases internal training courses and programs offered by 11 schools including Lehigh University, Stanford University, Stevens Institute of Technology, University of New Mexico, Missouri University of Science and Technology, New Mexico State University, University of New Haven, University of Texas at Dallas and El Paso, University of Arizona, Central New Mexico Community College, and New Mexico Institute of Mining & Technology.

Schools will showcase learning programs in such fields as business, accounting, computer science, information technology, engineering, math, and science. The schools will set up booths and have representatives available to discuss their programs. "People can gather information and get their questions answered directly by university representatives," Charline says. "Attendees can put a face with the name at a school."

The second day's activities, at the Steve Schiff Auditorium lobby, focus on informal learning opportunities. Tables include Lean Six Sigma, Security Connection, SERP, Society of Women Engineers, HBE, KAFB Outdoor Recreation, Toastmasters, Diversity & Inclusion, Talent Management & Employee Engagement, National Museum of Nuclear Science & History, and the National Training Center.

"This is the perfect opportunity for employees to focus on professional development, continuous learning, and skills development," says University Programs administrator Bernadette Montano (3520). "Sandia prides itself on being a learning organization that is committed to employee learning and sees the strong connection between a highly skilled workforce and mission readiness."

Activities for Day 3, at Bldg. 856, focus on leadership and communication skills.

At the end of the expo, employees who embody lifelong learning and leaders who support education will be recognized at a ceremony at the Thunderbird Cafe. Nominations are being accepted for the Labs' Lifelong Learning Awards.

For more information about the awards see <http://learningexpo.sandia.gov/>.

Triumph of the spirit

Sandia helps kids who conquered adversity to get a high school diploma

By Nancy Salem

Abraham Palacios and Misty Osterholt had to grow up fast.

Abraham was three months old when his father abandoned the family. His mother tried to make ends meet, but the bills piled up. "Her check was not enough to pay the expenses," Abraham says. "I had to go to work or risk losing our house."

Abraham found jobs in his teens to keep the family afloat. His income became even more important when his mother fell ill and couldn't work. "I worked in restaurants and hamburger places," Abraham says. "I worked long hours and supported the family."

Misty lost a 2-month-old sister to Sudden Infant Death Syndrome, sending her parents into a downward spiral of alcohol and drug abuse. "My parents couldn't care for me so I moved in with my grandmother," Misty says.

At times she tried to live with her mother or father, but the environment was unhealthy so she returned to her grandmother. At one point Misty ended up in foster care.

Her father died in prison when Misty was a sophomore in high school, and she became further estranged from her mother, who also spent time in jail.

Abraham and Misty persevered through the hard times and graduated in May, Abraham from Independence High School and Misty from La Cueva High School. Abraham is headed in the fall to Central New Mexico Community College and Misty to the University of New Mexico.

Both will have help from Sandia and Lockheed Martin. They are among this year's 24 Thunderbird Award winners who received \$1,500 in recognition of their exceptional ability to overcome significant personal challenges on the path to high school graduation.

"It has been said that adversity builds character," Kim Sawyer, deputy Laboratories director and executive VP for Mission Support, told the honorees at the 19th annual awards ceremony on May 8. "I believe that to be true and these young people certainly embody that maxim."

Stories of courage

Family, friends, school principals, advisers, and mentors of the winners attended the ceremony at the Embassy Suites. Also on hand were representatives of the New Mexico congressional delegation, members of the Albuquerque Public Schools board, and superintendents Winston Brooks of APS, Allan Tapia of Bernalillo Public Schools, and Ron Marquez of Belen Public Schools.

No one in the audience was untouched by the stories of courage. There was Karen, who had two major hip surgeries that kept her out of school for long periods of time. Raquel took care of herself and raised her younger siblings in the absence of responsible parents. Yuri attended nine different schools and lived in 16 different homes starting in second grade. Ismael rose from an impoverished background to become an honors student. Cheyene grew up with a hearing impairment that affected her speech and led to severe bullying.

"Their stories, both heartwarming and amazing, demonstrate the enormous character each of them showed to persevere in the face of adversity," Kim said. "You are an inspiration to everyone here."

College and careers

Each of the students is headed to college with a career goal. Majors range from photography to engineering to medicine.

Misty plans to study architectural engineering. She says she would not have graduated without the support and stability provided by her grandmother, who eventually won guardianship of Misty.

"I struggled with the problems in my family but the adversity motivated me to work harder and strive for a degree," Misty says. "I didn't want to have the life that my parents did."

Abraham will study heating, ventilation, and air conditioning, or HVAC, at CNM and hopes in the future to go into law enforcement. "I worked long hours but always tried to find a way to make time for my studies," he says. "I would stay awake at night to get work done."

Misty, Abraham, and the other recipients all said

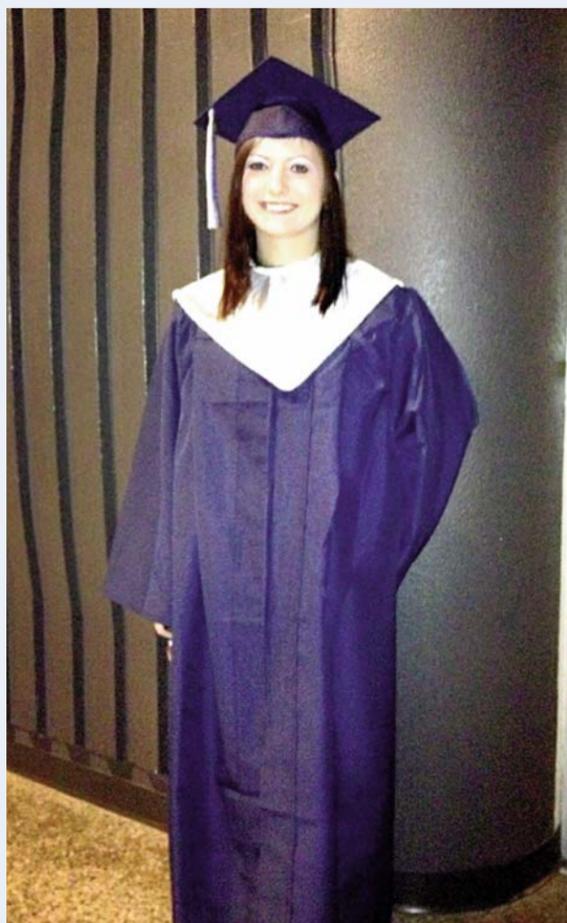


DID YOU EVER KNOW THAT YOU'RE MY HERO? — Area high school seniors are all smiles after being honored for overcoming adversity on the road to a high school diploma. Sandia and Lockheed Martin awarded each student \$1,500 in recognition of their accomplishments. Joining the students are Deputy Labs Director and Executive VP for Mission Support Kim Sawyer, standing third from right in second row, and Communications and Public Relations Center 3600 Director Bruce Fetzer, at far right.

they are excited about college and grateful to Sandia and Lockheed Martin for the Thunderbird Award.

"It's awesome," Misty says. "I'm going to be in school a while and this money will help out tremendously."

Kim said Sandia wishes all the recipients continued success in life. "Throughout our lives, it's the choices we make that determine our character. This year's recipients of the Thunderbird Award have already demonstrated they know how to make the right choices, which are often the tough choices," she said. "You exemplify the triumph of the human spirit over adversity. May you spread your wings and soar."



MISTY OSTERHOLT on the day she graduated from La Cueva High School. "Adversity motivated me to work harder and strive for a degree," she says.

2013 Thunderbird Award winners

- Jazlin Mendoza**
Albuquerque High School
- Ismael Chavez**
Atrisco Heritage Academy
- Alicia Lopez**
Belen High School
- Phillip Hurley**
Bernalillo High School
- Karen McGuire**
Cibola High School
- Nicolette Totschek**
V. Sue Cleveland High School
- Raquel Vega**
Del Norte High School
- Montie Avery**
Eldorado High School
- Raven Haldane**
Freedom High School
- Yuri Loera**
Highland High School
- Abraham Palacios**
Independence High School
- Myranda Morales**
Infinity High School
- Misty Osterholt**
La Cueva High School
- Isaac Mendez**
Los Lunas High School
- Erica Baca**
Manzano High School
- Tabitha Sanchez**
New Futures High School
- Raquel Trujillo**
Rio Grande High School
- Carlyn Schweizer**
Rio Rancho High School
- Cheyene Andrews**
Sandia High School
- Estrella Cardenas**
School on Wheels
- Luis Soto**
Valencia High School
- Steven Bishop**
Valley High School
- Kristine Jordan**
Volcano Vista High School
- Luis Vega**
West Mesa High School