Researchers building biologically fueled microfuel cells

Some of tomorrow’s microelectronics may be powered by glucose obtained from living biological systems

By Chris Burroughs

Tomorrow’s sensors, communication devices, and other microelectronics technology may be powered by life. That is, powered by glucose obtained from living biological systems, ranging from microscopic microbes to plant tissues. Doug Loy (6245) and Kent Schubert (1763) are leading a three-year internally funded Laboratory Directed Research and Development (LDRD) Grand Challenge to develop new compact power sources for devices fueled by biological hosts such as plants or animals. The project, Bio-Microfuel Cell Grand Challenge, could fill a need for uninterrupted autonomous power for applications where batteries are too large and/or too short-lived.

“We are initially looking at ‘harvesting’ glucose from living plants to serve as the power source for sensors,” Kent says.

A fuel cell is an electrochemical energy conversion device that converts a fuel, typically hydrogen and oxygen, into electricity. Instead of hydrogen, the fuel for the bio-microfuel cell will be glucose from a living system. But like a hydrogen/oxygen fuel cell, the primary emission is water. The biofuel cell will also create a small amount of carbon dioxide. But unlike a hydrogen fuel cell, which has to be refueled with hydrogen periodically, the bio-microfuel cell will continue to produce electricity as long as the plant or other biological host remains alive.

The grand challenge is divided into six research teams:

- Bio-MicroFuel Cell Architecture Team, led by Chris Appblett (1763), designing a microfuel cell compatible with biofuels.
- Membrane Materials, Fabrication and Testing Team, led by Chris Cornellius (6245), making membranes more robust and more compatible with microfabrication techniques.
- Bio-Micsystem Interfaces & Surface Compatabilization Team, led by Susan Brozik (1744), engineering the interface for harvesting the fuel.
- Electrodes/Electrochemistry Team, led by David Ingersoll (2521), focusing on the oxidation of the fuel and incorporating the electrode structures into the micro-architecture.
- Biological Materials Team, led by Andy Walker (8130), working on integrating new bioselective membranes and engineered enzymes for selective transport and oxidation.
- Systems Integration Team, led by David Peterson (1738), integrating all components into one system.

To date the researchers have built several operational microfuel cells. They separately demonstrated the feasibility of converting glucose to electricity, but have not yet powered a micro fuel cell with glucose.

The Sandia researchers are simultaneously developing two types of catalysts — one made from enzymes and one from a precious metal, probably platinum alloyed with other materials. (See “How it works” on page 5.) In its final form, the fully integrated system is expected to be the size of a small matchbox with a “harvester” tail protruding. The harvester will be a simple input device that could be a short circuit.

By Neal Singer

Los Alamos and Sandia national laboratories will jointly receive more than $75 million for design and construction of the practical yet visionary joint Center for Integrated Nanotechnologies (CINT).

DOE’s Office of Science approved funding in July for the national user facility that will permit university, industry, and government researchers to explore and develop the rapidly emerging field of nanotechnology.

Nanotechnology is used to build materials and devices on the scale of atoms and molecules. Among its advantages are smaller components, more precise functionality, lower energy requirements, and reduced waste and exploitation of natural resources. Innovations from this field are expected by many scientists to expedite improvements in drug discovery and health, computing, transportation, and manufacturing.

Two new buildings will include a joint core facility in Albuquerque just north of Sandia. A smaller building will be built in Los Alamos to serve as a gateway. Sandia, for its gateway — distinct from the core facility — will use space in Bldg. 897. Through these facilities, researchers from industry and universities will enjoy access not only to the equipment of CINT but also to the resources of the two huge labs.

(Continued on page 4)

Bldg. 810 Energy Nag goads coworkers into miserly energy habits

With it well into summer, the Bldg. 810 Energy Nag is, well, nagging everyone to conserve energy. Irritable, maybe. Rational, certainly. Read all about this man of mystery in John Gorman’s story on page 8.

Sandia breaks ground for $28 million JCEL computational facility

‘It will be home to science and computing at the highest level in history’

By Neal Singer

On an overcast day last week, in a tent surprisingly inconspicuous at one end of the large bare field that one day will be MESA, approximately 100 Sandians and outside workers celebrated with balloons, cookies, and brief speeches the ceremonial groundbreaking for Sandia’s long-awaited computational nerve center, the JCEL building.

JCEL — for Joint Computational Engineering Laboratory — will house 175 people, stand three stories high, contain 61,000 square feet of working space, and (from artist’s renderings) have glassed-in staircases at each end and sky gardens giving crashing views of the Clearwater Mountains.

Artist’s rendering of the core structure for the Center for Integrated Nanotechnologies (CINT), facility in Albuquerque just north of Sandia. A smaller building will be built in Los Alamos to serve as a gateway.

Genomes to Life funds research in two projects at California site

Bldg. 807 investigation provides no new scientific leads

Atomic anchors to quicken computer boot-up

Follow a map to create a healthier you with ¡SALUD!
What’s What

Retiree Bill Busby, who’s been enjoying that job description since 1982, e-mailed to point out pleasantly that I must have a warped gastronomic sense since I complained about e-mail spam, comparing it to kudzu along Southern highways (What’s What, Lab News, June 14) and wrote that Spam is an “otherwise good staple.”

“Anyone who can say [that] has never ‘enjoyed’ diced Spam with reconstituted dehydrated eggs or Spam fried in lard and served with dehydrated potatoes,” he wrote. “Or any of the many delicacies the American Army devised to use up the stuff and feed it to poor, hungry GIs during WWI. You couldn’t even give the stuff away to Italian civilians in the winter of 1944-45. In my opinion,” he continued, tongue firmly in cheek, “of all the times ever—was it?—there should be a law that the manufacture, distribution, sale, or advertising-for-sale of Spam is a felony calling for a public hanging. I think your comparison of Spam to kudzu is apt.”

Chris Burroughs, 505/844-0948

MTC and OPEIU memberships ratify new three-year contracts

Members of both the Metal Trades Council (MTC) and the Office & Professional Employees International Union (OPEIU) voted in separate meetings last week to accept new three-year contracts with Sandia.

Both previous contracts expired at midnight July 31.

The MTC has approximately 490 Sandia employees who work various jobs throughout the labs, including custodians, electricians, machinists, mechanics, materials handlers, dock workers, receiving clerks, and truck drivers.

Some 435 Sandia office administrative assistants and clerical employees are represented by the OPEIU.

“We are pleased that the Sandia employees represented by the MTC and the OPEIU have voted to accept their contracts, which offer wages and benefits competitive with those in comparable private industry and other DOE facilities,” says Julian Sanchez, manager of Employee and Labor Relations Dept. 3061.
Genomes to Life funds research in California

Research efforts will focus on metal/radionuclide-reducing bacteria and identifying protein complexes

By Nancy Garcia

Two California-site Sandians are among the collaborators in newly announced DOE genomics research grants. Sandia/New Mexico leads another winning genomics proposal described last month (Lab News, July 26). The awards are part of the department’s new “Genomes to Life” program that plans to take advantage of solutions that nature has already devised using help solve problems in energy production, environmental cleanup, and carbon cycling. Through biological, physical, and computational sciences, the program seeks to understand entire living organisms and their interactions with the environment.

“The fact that Sandia is participating in three of these laboratory awards validates and legitimizes Sandia’s emerging capabilities in biotechnology,” says Deputy Director Len Napolitano (8130).

Metal/radionuclide-reducing bacteria

Sandia is a partner in the $36.6 million, five-year grant to Lawrence Berkeley National Laboratory to study “Rapid Deduction of Stress Response Pathways in Metal/Radionuclide-Reducing Bacteria.” The team, including Anup Singh (8130), will develop computational models to describe and predict the behavior of gene regulatory networks in microbes in response to the environmental conditions found in waste sites contaminated with metals and radionuclides. “Bacteria either convert the soluble, easily transportable metal compounds into insoluble compounds or immobilize them,” Anup says. “Most of the sites are heavily contaminated so the bacteria need to survive in an environment that is very different from their natural environment.”

To deduce how soil bacteria may aid site remediation, the team will compare types with varying levels of activity to see which cellular machinery (proteins and their assemblies, called complexes) is involved.

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CHEERFULLY ‘SEEING RED’ — Malin Young (8130) is using Sandia’s unique MS30 capability to study the structure and function of rhodopin, a red photosensitive pigment/protein that aids vision in dim light. On her screen is a ribbon representation of this membrane protein’s three-dimensional structure in its unactivated form. Activated by light, the complex changes form and sends an electrical signal to the brain, which decodes the information into a visual image. The activated structure remains unknown for now. (Photo by Bud Pelletier)

Sandia will focus on analyzing the proteins and protein complexes that act like molecular machines, Anup says, while most of the bioremediation-related microbial research will be done at LBNL. Other research partners are Oak Ridge National Laboratory; the University of California, Berkeley; the University of Missouri, Columbia; the University of Washington, Seattle; and Diversa Corp., in San Diego.

The individual microbes being studied under the grants have all had their genetic sequence determined through DOE’s Microbial Genome program (http://microbial(ace)project.org). Since it is the proteins that carry out almost all cellular functions, Sandia, LBNL, and Diversa will try to identify the relevant protein complexes in various bacteria, both “wild types” and mutant forms. When bacteria are exposed to stressful conditions, some alter their metabolism to ensure survival. Sandia will try to help identify and quantify proteins and complexes involved in bacterial stress response pathways, examining large number of proteins at a time, using its unique expertise and infrastructure in microoperations and mass spectrometry to determine the nature and composition of complexes.

LBNL will then use these data for computational models of how the genes controlling these pathways are turned on and off.

Identifying protein complexes

A second grant, to Oak Ridge National Laboratory for $23.3 million over three years, also targets proteins through a proposal entitled, “A Research Program for Indentification and Characterization of Protein Complexes.” Malin Young (8130) brings to the collaboration a unique in-house capability, MS30. This method to probe structure uses mass spectrometry to identify complexes embedded, like raisins in bread, in outer bacteria membranes. The complexes act as a “gatekeeper” for surrounding interactions. To gain structural clues, the complexes have been hooked chemically to their immediate spot in the membrane. This gives researchers a picture of how the assemblies nest there and function in their native state.

Other research partners are Pacific Northwest National Laboratory, Argonne National Laboratory, the University of North Carolina at Chapel Hill, and the University of Utah. The group will examine two microbes: Shewanella oeniensis, known for its ability to transform metals and toxic materials into harmless forms; and Rhodopseudomonas palustris, which absorbs carbon dioxide from the atmosphere and converts it into biomass.

“Success,” Malin said, “will result in a knowledge base that can provide insight into the relationship between protein complexes and their biological function.”

Employee death

Lee Bertram, of Fluid/Thermal Modeling Dept. 8728, died of stomach cancer June 11. He was 60 years old. Lee was a distinguished member of the technical staff and had been at Sandia, serving at both the Albuquerque and Livermore sites, since 1974. He was most recently responsible for computational modeling of solidification phenomena.

He is survived by his wife, Mary Beth Acuff, daughters Anne and Lynne, and two brothers and three sisters.

Recent Patents

Joseph Cesarano III (1843) and Paul Calvert: Method for Free Forming Objects with Low-Binder Sturry.

Raymond Byrne (15211), John Harrington (15252), Steven Eskridge (15212), and John Hurtado (15211): Cooperative System and Method Using Mobile Robots for Testing a Cooperative Search Controller.

Donald King (6424): Thermionic Modules.

Patrick Xavier (15211): Method and Apparatus for Modeling Interactions.

Jeremy Walraven and Edward Cole (both 1739): Thermally Induced Voltage Alteration for Analysis of Microelectromechanical Devices.

Eric Lindgren and James Phelan (both 6313): Method and Apparatus for Optimized Sampling of Volatilizable Target Substances.

Jeffrey Figiel (1126) and Jung Han: Structural Tuning of Residual Conductivity in Highly Mismatched III-V Layers.

Donald King (6424), Bernard Wernsman, and Laurence Sedwick: Chemical Vapor Deposition Techniques and Related Methods for Manufacturing Micronunature Thermionic Converters. Lofar Biog and Gilbert Benavides (both 14184): Large Displacement Spherical Joint.

Timothy Boyle (1566): Tin(II) Alkoxide Hydrolysis Products for Use as Base Catalysts.

Steven Goldsmith (6517): Alpha-Beta Coordination Method for Collective Search.

Shawn-Yu Lin (1743) and James Fleming (14184): Large Displacement Spherical Joint.

Timothy Boyle (1566): Tin(II) Alkoxide Hydrolysis Products for Use as Base Catalysts.

Steven Goldsmith (6517): Alpha-Beta Coordination Method for Collective Search.

Shawn-Yu Lin (1743) and James Fleming (14184): Large Displacement Spherical Joint.

Media for Control of Thermal Emission and Methods of Applications Thereof.

David Haaland (1812): Classical Least Squares Multivariate Spectral Analysis.

Robert Moore (6849): In Situ Formation of Phosphate Barriers in Soil.
Domenici, Bingaman, labs leaders comment on the value of CINT

U.S. Sen. Pete Domenici, R-NM: “Los Alamos and Sandia national laboratories have taken a significant step together to make New Mexico and the world leader centers for the emerging field of nanotechnology. The CINT collaboration represents the ultimate in materials science and should usher in an exciting new age of high technology.

U.S. Sen. Jeff Bingaman, D-NM, who chairs the Senate Energy and Natural Resources Committee: “This funding will help emerging technology that will serve as an engine of growth and innovation. I will continue to work to ensure that this Center continues to get strong DOE support.”

Sandia President C. Paul Robinson: “Creation of the Center for Integrated Nanotechnologies is not just a welcome new initiative in our research and development programs, it is the kick-off for when our Labs to access the field. For several years our scientists and engineers have seen the possibility for ‘atoms-up engineering’—where we will be able to design and fabricate new materials beginning at the atomic level. At the nanometer level one can now ‘see’ individual atoms using new microscopic techniques, and watch the effect of mixing various atoms together, building block by block, to achieve very specific properties and functions. Thus the CINT represents the ultimate in materials science and should usher in an exciting age of high tech applications.”

Los Alamos Director John Browne: “A revolution has begun in science and technology based upon the ability to organize, manipulate, and measure the properties of matter on the nanometer-scale level. The natural for Los Alamos and Sandia to pursue this new field because of the lab’s long traditions of multidisciplinary research to benefit society. In the short term, the new facility should offer new ways to develop sensors, safety, and security measures to support our national deterrent. In the long term, it could change our lives in ways people can’t even begin to imagine.”

Sandia Vice President and Technology Al Romig (1000): “While scientific research around the world is focused on marvels of this incredibly small world, the question of how nanotechnology will impact the world around us remains unsolved. This is where CINT comes in. The New Mexico center has a unique focus on the integration of nanotechnology into the macroscopic world and the question of how nanotechnology can change the way we live.”

Center Director Terry Michalske (1040) explains why CINT is of interest to two laboratories: “CINT will attract some of the brightest scientists from our own laboratories and from around the world. We hope many of them will stay to be part of our exciting community. We also believe that new science will be the seed corn for technology that benefits the labs and stimulates high-tech businesses in New Mexico and elsewhere.”

Center Director Don Parkin: “Nanoscience is breaking down traditional barriers in science. The cross-pollination between physical sciences and biosciences in CINT is likely to produce some of the most dramatic new advances.”

An outside evaluation of the project comes from Jean-Charles Guibert, head of strategic programs and partnerships for France’s Atomic Energy Commission at Grenoble. “The key feature is the strong relation to the Universities of New Mexico’s and Los Alamos’ laboratories and clean rooms. All around the world, you have academic labs working on nano but without application capability, or industrial research sites without strong links to academia. The deliberate inclusion of these links is one basis of the uniqueness of the CINT project.”

One of five Nanoscale Science Research Centers

CINT will be part of the DOE’s network of Nanoscale Science Research Centers. DOE’s Office of Science, which would not this project fall, is the world’s largest supporter of scientific user facilities. These facilities attract scientists and facilities, as well as specialized facilities focused on topics such as combustion research. DOE is adding five nanoscience-related core facilities to the US nanoscience infrastructure. Funds spent on these facilities include $375,000 for initial conceptual design during 2001. Project engineering and design will budget $42.2 million. 26 architectural firms that entered bids to design the core facility, a short list of five has been selected to compete, with a goal of early August for firm selection and beginning of design. Target date for breaking ground of the Los Alamos gateway is April 2004; for the core facility in Albuquerque it is April 2004.

New financial reporting system to be implemented in October

A major revamp of Sandia’s corporate financial reporting system is under way. Scheduled for implementation in October, the initiative is intended to dramatically improve internal customer satisfaction by making it much easier for most customers to access the financial information they need to perform their jobs. The driving desire behind this initiative is that division will take advantage of the new technology to improve customer satisfaction and reduce the time employees spend on finance-related tasks. These new tools will make data entry and creating, distributing, and scheduling financial reports more time on other, more value-added activities. The initiative is a joint effort of the Chief Financial Officer organization and Information Services, comprising several centers managed by Chief Financial Officer Pace VanDevender (9400).

Customer feedback after the Oracle implementation indicated a need for better financial reporting solution. Numerous problems were identified with the current reporting system, and a team was assembled to build a new system from the ground up. The team’s goal is to build a user-friendly financial reporting system that satisfies the common reporting needs of most customers and facilitates meeting any remaining unique reporting needs.

Since current system users should be aware that they will get financial information will likely change in October. Business Objects, the cornerstone of the current financial reporting model, will continue to be available as a reporting tool for those who enjoy the power it delivers. However, the current reporting templates that most customers use today will not work with the new system.

A suite of new standard reports designed with user易ures will be dynamically refreshed each weekend for every Sandia organization, project, subprogram, program, and task. These reports are intended to replace the capability provided by the current Business Objects templates. These reports will be generated as PDF (Portable Document Format) files for easy viewing via a web-based customer interface. In addition, each report will have an accompanying data file containing the data behind the (Continued on page 10)
JCEL
(Continued from page 1)

"It's a very architecturally pleasing office facility," says project manager Jim Dawson (10824), "designed to attract and retain top researchers."

The $28.8 million building — the figure includes design, user equipment and project management — will consist of three towers composed of eight 20-person suites and a director’s suite, all access-controlled and sound-attenuated for top-secret work. The project, west of Bldg. 897, is funded by NNSA through the ASCI program.

Said Sandia President Paul Robinson, opening the ceremony, "Ten years ago, the US conducted its last nuclear test, and we were challenged: can you guarantee performance, reliability, and safety of US weapons without testing?" referring to the Stockpile Stewardship program. "This facility is a key oasis on that journey.

Glorying in "living in interesting times" — a condition generally mentioned as a problem — Paul said: "JCEL will involve science and computing at the highest level ever done in history, and raise the level of computing worldwide in engineering in the 21st century. We will reshape engineering design done at Sandia and in the US."

Paul Yarrington (9230) praised the "remarkable progress" of the JCEL project. "The JCEL facility will provide," he said, "that great infrastructure that enabled talented people to do important work." The architectural plan, by Atkins Benham Inc. out of Oklahoma City, is designed to meet DoD’s Antiterrorism Force Protection Construction Standard. Cynthia Figueroa-McCleer (10853) serves as planning and project development contact.

In accordance with DOE’s environmental awareness program, the building is constructed of environmentally friendly materials. Some of the design features include semiporous pavers to absorb water instead of encouraging run-off, light-colored brick to decrease heat gain, the use of easily replenishable woods, and mastics that demonstrate low out-gassing.

John Zepper (9143), manager of production computing and host of the ceremony, says the modeling and simulation work in the ASCI program will be further enabled by JCEL. "It will pull together 9200 [computing science] and 9100 [engineering science], enable closer collaboration, and faster development of ASCI codes."

Mike Zamorski, DOE’s Kirtland Site Area Director representing local federal staff, said, "It’s nice to be associated with a vibrant enterprise."

Bio fuel cell
(Continued from page 1)

"The results of this work will have a profound impact on our nation’s security and potentially our economic prosperity."

GOLDEN CHAIN GANG shows muscle at JCEL groundbreaking, from left, Mike Vahle, John Zepper, Tom Bickel, Bill Reed, Paul Robinson, Mike Zamorski, and Paul Yarrington. (Photo by Bill Doty)

How the bio-microfuel cell works
The bio-microfuel Cell works similarly to a battery. The main difference is that a battery is a "closed" system; its lifetime is fixed by the amount of reactants packaged inside it. The fuel cell is an "open" system, which means that its fuel is supplied on a semi-continuous basis and can be renewed by changing or refilling the fuel tank. By tapping into a plant or animal, the Bio-Microfuel Cell seeks to incorporate a "fuel tank" that refills itself.

The fuel cell is made up of the anode/proton exchange membrane/cathode stack. Fuel oxidation and oxygen reduction take place at the anode and cathode respectively, with the aid of catalysts incorporated into the electrodes to facilitate the reactions. The proton exchange membrane separates the oxidation and reduction reactions and allows using the electrons released at the anode during the oxidation reaction in an external circuit, while the protons are transported through the membrane to complete the circuit inside the fuel cell. Electrons are received back again from the external circuit at the cathode, where they react with the protons and oxygen atoms to produce water. In the case of the Bio-Microfuel Cell, the fuel is glucose. When a glucose molecule comes in contact with the catalyst, it splits into two by-product molecules, releasing two protons and two electrons. Sandia researchers are looking at using two different types of catalysts for oxidizing glucose — one made of the enzyme glucose oxidase and one made of a precious metal, such as platinum or an alloy of it.

The researchers would also like to develop catalysts that would allow harvesting more protons and electrons from the by-products produced in the first oxidation reaction. In principle, one should be able to harvest 24 electrons from glucose by using the appropriate catalysts.
A two-year-long investigation of Bldg. 807 has provided no scientific validation that a current health hazard exists in the building.

The results of three independent studies completed in recent months echo the results of earlier evaluations of the building by Sandia’s industrial hygiene staff; they also uncovered no scientific evidence of a current health hazard.

The examination of Bldg. 807 has been the largest building health investigation ever conducted at Sandia, says Lynn Jones, a member of the Center for Epidemiological Research at the Oak Ridge Institute for Science and Education at the Center for Epidemiological Research at the Oak Ridge Institute for Science and Education — as well as the earlier studies, the Management Action Team (MAT) leading the Bldg. 807 investigation has made some decisions, says Lynn:

- First, the building’s first floor will remain vacant for the time being.
- The concern prompted a series of studies of the health problems of the individuals and the environmental health of the building, all part of an investigation overseen by the MAT and advised by an Employee Advisory Team that included concerned employees and their managers.

A summary of these studies follows. More information, including raw data from the studies, is available at the Bldg. 807 Health Advisory website (www.sandia.gov/health/advisory/index.html).

**Voluntary medical evaluations**  
In early 2000, Sandia’s medical staff conducted individual voluntary health screenings of about 22 current and former Bldg. 807 occupants. A local medical toxicologist advising Sandia’s medical team noted that the exams indicated a wide variety of diagnoses with no pattern of health symptoms suggesting specific occupational or toxicological origins, and no unusual diagnosis or cluster of diagnoses were identified. As part of the exams some employees were tested for mercury; results were normal for all tested. These findings set the stage for the epidemiology studies conducted.

**Summary of the investigation**  
The Bldg. 807 investigation began in late 1999 when some 50 current and former residents of the building expressed concerns about health symptoms they were experiencing (Lab News, May 5, 2000). The majority of those people who expressed concerns are current or former Center 15400 employees, and many of those had worked on the first floor’s northwest quadrant.

At the time the symptoms seemed to be grouped in two general categories — neurological and respiratory problems. The concerns were first reported to employees in the Jan. 28, 2000, Sandia Daily News.

**Impact video magazine debuts on Sandia’s internal TV network**  
Everyone wants to make an impact. And Sandians now have a new way to do just that. Video Services Department 12610 has launched its new video newsmagazine, Impact, designed to showcase the broad scope of Sandia’s work — in the laboratory and in the community. And Impact producer Dave Sparks is looking for new stories to tell.

The first edition of Impact, featuring several three-and-a-half-minute magazine-style stories, is being broadcast on internal Sandia TV monitors around the Labs throughout the month of August. And you can watch it directly at your own desktop by visiting the Video Services web site at www.sandia.gov/Impact/div126000/div1260000012610.html.

**Decisions based on the investigation**  
Based on the results of the three latest studies — an independent building health assessment by private consulting firm IHI Environmental, an epidemiological study by the University of New Mexico’s Health Sciences Center, and an epidemiological study of DOE sickness-absence data by the Center for Epidemiological Research at the Oak Ridge Institute for Science and Education — as well as the earlier studies, the Management Action Team (MAT) leading the Bldg. 807 investigation has made some decisions, says Lynn:

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(Continued on next page)
An epidemiological study by doctors at the University of New Mexico's Health Sciences Center completed in December suggests that current occupants of Bldg. 807 experience certain “symptoms of concern” no more frequently than Sandia’s employees who never occupied the building. Former occupants of the building as a group seem to experience somewhat higher rates of health symptoms than members of the current or former occupant groups.

UNM’s final report is available at www.sandia.gov/health/advisory/index.html. Dr. Karen Mulloy, principal investigator, and Dr. William Lambert led the study for UNM’s Program in Occupational and Environmental Health.

To design the study, the UNM team held focus group discussions with concerned employees and managers and members of Sandia’s health and safety staff. Four “symptom groups of concern” were identified via the focus groups and medical literature reviews: peripheral neuropathies, fatigue, cognitive impairment, and respiratory complaints. Within each symptom group were numerous individual symptoms.

Three population groups were then compiled from Sandia rosters: current 807 occupants, former 807 occupants, and current and former Sandia employees who never worked in Bldg. 807.

Randomly selected members of each group were surveyed — a total of 715 people. The mailed questionnaires asked each responder to answer questions based on his or her personal experience or observation. The study, as well as demographic information, UNM kept all responses confidential. Trained UNM questionnaire administrators telephoned those who did not respond to the mailed questionnaire.

Less than half of those selected (49.2 percent) participated, limiting UNM’s ability to draw meaningful statistical conclusions. Nevertheless, the study does add to the body of information about Bldg. 807, says Dr. Mulloy.

According to UNM’s analysis of the survey data, statistically significant differences were not observed between current occupants and never occupants for prevalences of any of the symptoms of concern. In addition, the survey findings rule out several symptoms of concern as important health hazards.

Prevalence was higher, however, in former occupants versus never occupants for a few symptoms, says Mulloy.

For example, slightly significant differences were observed in the data for dizziness and numbness or tingling in hands or numbness or tingling in feet.

The higher prevalences of these symptoms among former occupants do not correlate well with prevalence of other reports of peripheral neuropathies, however, says Mulloy.

“With peripheral neuropathies you typically see numbness in all the extremities along with other red flag symptoms, not just numbness in the hands or numbness in the feet or in just one hand or foot,” she says.

In addition, the prevalences of symptoms associated with cognitive impairment do not fit well with models of high solvent or heavy metal exposure, she says, which usually include fatigue, peripheral neuropathy, and mood disorders.

Mulloy’s team concludes that a clear case definition (clusters or concentrations of symptoms that would support a more detailed epidemiological study) that is “biologically plausible” did not emerge from the study. It also concludes that the data do not provide a clear enough picture of a pattern of disorders to warrant more rigorous statistical studies of relationships between the neurological symptoms among former occupants.

The epidemiology studies were necessary to determine whether the current occupants’ experience was different among different groups of employees,” says Dr. Larry Clevering (3300). “These studies suggest that the neurological and respiratory symptom experience was similar in all groups.”

**Private firm finds nothing unusual in its Bldg. 807 assessment**

HII Environmental, the private industrial hygiene firm hired by Sandia to conduct an independent assessment of Bldg. 807, reported to Sandia in November that its analysis of air and surface samples from the building revealed nothing that would prevent the building from being occupied.

HII’s final report is available at www.sandia.gov/health/advisory/index.html. HII conducted a literature search to identify suspect toxins that might trigger the health symptoms of concern, then sampled air, carpets, walls, internal surfaces of HVAC ducts, and other building materials for metals, inorganics, organics, and biotoxins (such as active and latent molds, fungi, and allergens). The analysis focused on toxins that are associated with long-term health consequences.

The variety of measurements for all contaminants were well below occupational exposure limits and published guidelines. Samples from a few rooms on the first floor indicated the presence of surface and airborne latent (non-viable) mold spores in elevated concentrations, but none were of mold varieties considered to be toxigenic. Although no good mold-dose-response rate medical data exist, HII found no evidence in the medical literature that inhalation of spores had resulted in long-term neurological damage in a patient.

The HII study also sought forensic evidence, such as settled dust samples that might provide clues about past human exposures to toxins. Although the availability of telling historical evidence was limited because of past cleaning and renovation, the sampling turned up nothing that HII considered unusual or unhealthy for a building of comparable age, background, and building materials.

**Filter bank renovation:** Sandia’s facilities organization renovated and upgraded the building’s induction ventilation air intake system. Removed filters were preserved and sampled as part of the HII study.

**Follow-up sampling and analysis:** Sandia’s industrial hygiene team conducted follow-up samples from the building based on direction provided by the external HII study and the MAT. Filter samples were collected from discolored portions of the concrete walls and pipes above ceiling tiles in the north-west quadrant of the first floor to address lingering concerns about mold growth.

These samples indicated that very few spores were present, and mold varieties that were detected were low toxicity.

**UNM epidemiological study:** The University of New Mexico’s Health Sciences Center conducted an epidemiological study beginning in summer 2001 to compare prevalence rates of selected symptoms experienced by groups of individuals who now occupy Bldg. 807, who previously occupied Bldg. 807, and who have never occupied the building. For more see “UNM study finds no ‘cluster’ of symptoms among current or former 807 occupants.”

**DOE epidemiological study:** The University of New Mexico’s Health Sciences Center conducted an epidemiological study beginning in 1991 to compare prevalence rates of selected symptoms experienced by groups of individuals who did not work in Bldg. 807 from 1991 to 2000, based on Labs rosters. The study concluded that current and former Bldg. 807 occupants compared to a control group of Sandia employees who did not occupy Bldg. 807 from 1991 to 2000 did not show significant differences.

**Independent building health evaluation:** In February 2001, Sandia selected HII Environmental, a private environmental consulting firm, to perform an independent assessment of the building’s health. The team conducted a comprehensive assessment of Bldg. 807. HII’s analysis revealed no current hazards that would prevent any portion of the building from being occupied.

In 1999, Sandia contracted with the Center for Epidemiological Research at the Oak Ridge Institute for Science and Education examined the prevalence rates of reported neurological and respiratory health symptoms for current and former Bldg. 807 occupants compared to a control group of Sandia employees who did not occupy Bldg. 807 from 1991 to 2000.

The study concluded that current and former Bldg. 807 occupants had similar rates of absence from all causes, from neurological disorders, and from respiratory disorders compared to employees who did not work in Bldg. 807 during the ten-year time period. The study’s final report is available at www.sandia.gov/health/advisory/index.html.
Bldg. 810 Nag goads coworkers into miserly energy habits, thinks we can save gazillions of kilowatt hours

Who is this Energy Nag guy anyway, and what’s his problem?

By John German

John: The Nag wants to know if we are going to proceed with a Sandia energy article before the cold weather hits? Summer is, clearly, our peak energy usage and the Nag believes we can save several gazillion kilowatt hours if awareness is raised in the near term. Realistically, the Nag.

Sheesh! What is it with this guy? You suggest to him, offhand, that his project to save energy by encouraging (a charitable term for what The Energy Nag does) his neighbors in Bldg. 810 to adopt a few energy habits might make a nice feature in the Lab News that would possibly encourage people in other buildings to do the same. Next thing you know, The Nag is, well, beginning to irritate you.

I first became aware of The Nag several months ago when he appeared at my office door in Bldg. 810 and said, and I quote, “Hi! I’m an eco-czar.” Apparently in reference to my two 60-watt desk lamps, and walked away. I turned around, and he was gone. But I recognized that voice. The voice of reason. It got me thinking.

30 percent wasted

The United States is an energy-gluttonous country. We consume 20-25 million barrels of oil a day, more than half of that imported. That’s not including the energy we use that is generated from coal, natural gas, nuclear, hydro, and other renewables.

The average individual American uses 350 million BTUs per year (or roughly half that). The average Japanese, British, or French citizen uses roughly half that.

Energy analysts guess that 30 percent or more of our energy consumption in the US is wasted as motorists idle in cars behind empty offices. We waste cars idling in lots, and no perceptible savings can be measured. And no perceptible pain, we stop bothering them.

So next thing you know, I’m buying two new desk lamps with 10-watt halogen bulbs. They are just as bright, and I like the color of the light better.

I wrote The Nag an e-mail, telling him what I had done, confessing that I also had begun to replace some of my 40- to 100-watt incandescent light bulbs at home with 13-watt compact fluorescents.

The Nag informed me that I was behind the curve. Hundreds of people in Bldg. 810 had already been affected by The Nag’s brand of denial.

Carping for kilowatts

You see, The Nag has been ranking his 250 Bldg. 810 neighbors since last summer — via mass e-mails, an online newsletter aptly named “The Nag Rag,” and uninvited office visits. If they adopt some simple and painless habits, he pleads, they could make a huge difference in the amount of energy the Labs uses. (See “The seven habits of those who want The Nag to stop bothering them.”)

Working with Bldg. 810 building operator Bob Washington (10844-5) and Sandia’s site-wide energy manager Ralph Wrons (10823), The Nag has kicked kilowatts where no one has kicked before, and compiled statistics on the building’s energy usage since he began his eking campaign. Here are some results:

During June 2002, Bldg. 810 saved 65,000 kW-hours of electricity, a 20 percent decrease from the previous June, enough to power about 100 Albuquerque homes. That’s about $3,500 in savings for one month from one building, says Ralph.

During July 2002, the building saved 80,000 kW-hours, a 20 percent decrease from the same previous July. “With very minimal squelching and no perceptible pain, we’ve cut back by about 41,000 kW-hours per month (on average) since The Energy Nag started nagging,” says The Nag. “Not bad, but there is much more nagging yet to come.”

A national security issue, yes

The Nag, who has other important work to do, doesn’t annoy his neighbors for glory or money. He thinks it’s the right thing to do, for the well being of the nation, our environment, and the Labs, he explains.

“It is a national security issue, yes!” he says. The US spends $90 billion a year defending the Persian Gulf waterways, and more than one-third of US oil comes from there, he says.

“It is highly unlikely that terrorists originating in the Middle East would attack America directly if, somehow, oil wasn’t involved,” he adds. “They know that our responses — political, military, and economic — are severely limited by our dependence on that part of the world.”

In addition, electricity generation pumps carbon dioxide, a greenhouse gas, into the atmosphere at alarming rates, not to mention “sulfur dioxides and nitrogen oxides of various flavors to tarnish the chrome off trailer hitches,” he says. “If global warming is real, the costs to the US population’s health will be enormous. Asthma, heart failure, etc. are much less tolerable when it’s hot.”

Saving energy is good for the Labs, too, he says. He estimates conservatively that if everyone at Sandia would conserve wherever possible, the Labs’ monthly power bill would drop at least $70,000 per month on average.

Huge (with sarcasm) sacrifices

The ingredients of The Nag’s campaign include information, frequent and timely (often condescending) reminders, a cup of sarcasm, a pinch of guilt, and a reward system paid for by Div. 5000 management (a periodic burrito breakfast for Bldg. 810 residents called “The Energy Nag Feed Bag”).

He’s a bit like Dr. Seuss’s character The Lorax (come to think of it, he looks a bit like The Lorax), mixing his info-minders with warnings about the future.

Here’s an example of a recent reminder from The Nag to Bldg. 810 residents:

“PLEASE turn off your computer and other peripherals at the end of the day. The POWER STRIP on-off switch is the best way to do this. Yes, The Nag knows that it will require the MAS-SIVE effort of bending down (using your knees, not your back) and throwing the switch. My goodness, what HUGES sacrifices we are asked to make for our country!”

And another:

Late Friday on his appointed rounds, The Nag de-electrified some 30 kW of lights, computer screens, copiers, two boiling coffee pots (day-old burned coffee provides such a pleasant aroma), and one space heater, apparently in use because the local thermostat setting was low enough to freeze the building resident to the floor chair. All of this was a summer evening when both sides of Bldg. 810 were occupied only by a rare human and occasional cockroaches.

The Nag estimates that something like 2,000 kW-hours of electricity (and a metric ton or two of atmospheric CO2) were forgone (or is it “forwent”?) by the simple expedient of turning these damned things off for the weekend.

Wouldn’t you like to be a nag, too?

Annoying? Yes. And The Nag wants you to join him in one of the few ways you can act inten tionally irritate your coworkers and get away with it.

“The idea is to get lots of other little Nags to germinate around the lab and do the same thing,” he says. “The Nag estimates that we could EASILY save $100,000 per month at Sandia on energy (only 8 percent of our total energy consumption — YIKES), and maybe twice that.”

The Nag’s online newsletter is available at http://www-irn.sandia.gov/esh/p2/nag.htm. It is updated when he has another reason to be particularly peeved at his coworkers’ energy habits.

The Lab News promises, with help from Ralph Wrons, to provide information and numbers (with any luck, daily and weekly numbers) about energy consumption at Sandia during the coming months.

The Nag will make sure of it.

Next issue The Nag on saving energy at home, plus “Dear Nag” letters to The Energy Nag.
Chuck Loeber’s history of the nuclear weapons complex, Building the Bombs, is his gift back to the system

By Ken Frazier

It started as a natural outgrowth of his job responsibilities as an engineer helping to manage the sprawling DOE nuclear weapons complex — newly hired employees needed to know some history. But what began as a job requirement quickly became a hobby and a passion, and now it has resulted in publication of a book, Building the Bombs: A History of the Nuclear Weapons Complex.

As an engineer helping to manage the sprawling DOE nuclear weapons complex, Chuck Loeber had plenty of things to keep him busy. But what started as a job requirement evolved into a hobby and a passion, and now it has resulted in the publication of a book, Building the Bombs: A History of the Nuclear Weapons Complex.

Chuck’s book is his “gift back to the system.” On Friday, July 26, Sandia received 2,400 copies of the book, and by the following week every Sandia manager and above had a copy. Most of the remaining copies will be used by Sandia’s training activities such as the New Hire Orientation Program, the Weapons Intern Program, and Military Liaison classes. In addition, 2,600 copies were sent to the other seven sites in the nuclear weapons complex and to DOE. A few hundred of Sandia’s copies are not available for sale at the National Atomic Museum.

Although officially a Sandia “SAND report,” Building the Bombs isn’t a technical manual. It is an attractive hardback book, published on high-quality enameled paper, filled with interesting color illustrations and historical photographs. But it’s the content and approach that make it special. This book is written to be read.

Although it is comprehensive — Chuck starts with Albert Einstein’s theory of relativity and ends with the current post-Cold War era of maintaining deterrence without nuclear testing — it’s not exhaustive. Chuck directs those having a deeper interest in any of the topics to the references at the end of each chapter and his 10-page bibliography.

Instead, in a brisk 198 pages of main text, Chuck offers a series of short sections, some only a few paragraphs long, quickly covering the most important highlights of the history of the nation’s nuclear weapons complex — a much understudied and perhaps under-appreciated aspect of the nation’s technological and political history.

“There are many 800- or 1,000-page books on each of the major DOE production [and laboratory] sites,” Chuck says. Unfortunately, few people have the time or interest to wade through so much detail. “My book is brief enough that hopeful generations of people will read it.” He says he “tried to take the essence” out of each topic of importance and present it in readable form. In addition to the abundant illustrations, every couple of pages there is a short boxed vignette, some interesting detail or anecdote.

Chuck ends his book as he says he always ends his presentations. When he would state the content and present it in readable form. In addition to the abundant illustrations, every couple of pages there is a short boxed vignette, some interesting detail or anecdote.

Example: About the rivalry that developed in the 1950s between Los Alamos and Lawrence Livermore labs: “A Los Alamos scientist once joked that the levels of classification were ‘confidential,’ ‘secret,’ ‘top secret,’ and restricted all of a sudden ‘hide from Livermore.’

The succinct form and style is a natural outgrowth of the book’s origins: an evolving series of live presentations about the nuclear weapons complex that Chuck began giving in the mid-1980s as part of a week-long orientation program for new employees. Chuck’s travel to corporate headquarters around the country and meetings with corporate representatives, associations, and labs already participating in the MentorNet effort are 3M, Alcoa, AT&T, Cisco Systems, DuPont, Ford Motor Co., Hewlett Packard, IBM, Intel, Microsoft, Motorola, National Science Foundation, Optical Society of America, Oracle, Plantronics, SAP Labs, Schlumberger, SPIE, (The International Society for Optical Engineering), Texaco, and Lawrence Berkeley, Lawrence Livermore, and Los Alamos national labs, as well as NASA’s Ames Research Center. Applications for the 2002-03 program year opened Aug. 1. For more information or to register, go to www.MentorNet.net or contact: Diane at dmkozela@sandia.gov 284-3280, if you have any questions.

MentorNet comes to Sandia: You can be an online mentor to women science students

Sandia has signed up as a participant in the MentorNet online program for the upcoming academic year (open enrollment for mentors started Aug. 1).

MentorNet is a six-year-old online mentoring program designed to pair professional mentors — male and female — with students seeking advanced degrees in science and engineering.

MentorNet mentors (and women alike) involved with last year’s program reported spending an average of 20 minutes a week communicating with their mentees, whether via letters, e-mail, phone, or face-to-face meetings.

Some of the corporations, associations, and labs already participating in the MentorNet effort are 3M, Alcoa, AT&T, Cisco Systems, DuPont, Ford Motor Co., Hewlett Packard, IBM, Intel, Microsoft, Motorola, National Science Foundation, Optical Society of America, Oracle, Plantronics, SAP Labs, Schlumberger, SPIE, (The International Society for Optical Engineering), Texaco, and Lawrence Berkeley, Lawrence Livermore, and Los Alamos national labs, as well as NASA’s Ames Research Center. Applications for the 2002-03 program year opened Aug. 1. For more information or to register, go to www.MentorNet.net or contact: Diane at dmkozela@sandia.gov 284-3280, if you have any questions.

CHUCK LOEBER with his book about the nuclear weapons complex. (Photo by Bill Doty)

And Chuck kept getting requests for his history briefings, which Sandia supported him in fulfilling. “I am very thankful to Sandia for allowing me to go to the other sites to share this story,” Chuck says. His book, one chapter on views and mostly in my head, says. Then while recovering from surgery for prostate cancer in August 1998, “I decided to start committing the story to paper.”

Over the next three years, in the evenings or on weekends as his time and energy allowed, he continued writing at home. “It was a labor of love,” says. “It began to take shape as a book, Building the Bombs.”

MentorNet is a six-year-old online mentoring program designed to pair professional mentors — male and female — with students seeking advanced degrees in science and engineering. MentorNet has signed up as a participant in the Student Summer Intern Program, or after they’ve graduated. When you start college in college was like, and how helpful it would have been for you to have a mentor that worked in the field you were interested in?"

Some of the corporations, associations, and labs already participating in the MentorNet effort are 3M, Alcoa, AT&T, Cisco Systems, DuPont, Ford Motor Co., Hewlett Packard, IBM, Intel, Microsoft, Motorola, National Science Foundation, Optical Society of America, Oracle, Plantronics, SAP Labs, Schlumberger, SPIE, (The International Society for Optical Engineering), Texaco, and Lawrence Berkeley, Lawrence Livermore, and Los Alamos national labs, as well as NASA’s Ames Research Center.

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Some essence and flavor of the book can be gained just from the chapter titles: Einstein and Oppenheimer, Atomic Era, and Cold War. The title of each chapter is simply the name of the chapter. “I often got at the essence and present it in readable form. In addition to the abundant illustrations, every couple of pages there is a short boxed vignette, some interesting detail or anecdote.

Example: About the rivalry that developed in the 1950s between Los Alamos and Lawrence Livermore labs: “A Los Alamos scientist once joked that the levels of classification were ‘confidential,’ ‘secret,’ ‘top secret,’ and restricted all of a sudden ‘hide from Livermore.’

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Atomic anchors to quicken computer boot-up

Simple method may improve catalysts, nanodevices

By Neal Singer

A new method developed at Sandia National Laboratories and Pacific Northwest National Laboratories (PNNL) may improve the performance of catalysts and nanodevices.

The technique eliminates the present-day hurdle of metal atoms clustering together into three-dimensional islands when deposited on oxide surfaces. These thick bumps of metal — similar to water beads on a waxed car — are a problem because they produce poorly crystalized metal films. These films are relatively weak, require inefficiently large amounts of material, and produce more heat because more electricity is needed to produce variations in magnetic fields.

The new method achieves crystallinity with only a few atomic layers. Its inherent structural strength should also produce greater durability in electronic and computer memory.

How does the process work?

The findings may have the most immediate bearing on magnetic tunnel junctions, slated for use in next-generation computer memory. MRAM, or magnetic random access memory, stores information in a nonvolatile fashion, meaning the information is not lost when the computer is turned off. As a result, MRAM promises a day when computers would boot up instantly, making entire memories immediately available for use.

Financial reporting

(Continued from page 4)

report. If desired, this data file can be downloaded into Microsoft Excel and Access, as well as Business Objects, for more extensive data analysis and manipulation.

A communications effort aimed at providing a smooth transition to this new reporting system began in May and is scheduled to continue through November. Public information sessions and group presentations are being offered. A series of e-mail notifications providing more details about the new system are being sent to all Business Objects license holders. Everyone who uses financial-related information in his or her job is strongly encouraged to attend an information session and learn about the benefits provided by this new reporting system.

Requests for group presentations, suggestions, or questions about this project should be submitted to the Management Reporting Support Office (e-mail “MRSD”) at 845-8180. More information on this project is available at http://cfo.sandia.gov/finan/mrfs/FRS.htm. This item was provided by Gwen Pullen and Duane Garrison of Project Accounting & Reporting Dept. 10511.

Key benefits of new financial reporting system

• Customer input is driving design of a new suite of standard reports.
• Report requirements are driving design of the new financial data warehouse.
• Standard reports will be automatically generated off-hours.
• Technical managers and financial analysts will be able to view standard reports in a web-based friendly environment without having to use Business Objects.
• A data file that can be easily downloaded into Microsoft Excel and Access, as well as Business Objects, will accompany standard reports.
• Financial analysts will be able to devote more time to providing value-added analysis and less time to creating, distributing, and scheduling reports.
• Purchase Order commitment reporting will include a fiscal year split for purchase orders that have a limitation-of-obligation placed on them. 

THE ESSENTIAL REACTION — The transition occurs when the impacting cobalt atom is close to where two oxygen atoms, part of two OH groups, touch. 

sandwiched between layers of magnetic metal, such as cobalt or nickel-iron. When current flows through the device, the magnetic orientation of the two metal layers can be switched, resulting in different values of the tunneling current. This creates an environment in which “bits” of computer memory can be stored.

To achieve ferromagnetism, it was thought that thick layers of the top metal must be made. Obviously, thinner layers that require lower currents to switch the direction of magnetic fields would be more desirable.

In 2000, Sandia solid-state theorist Dwight Jenison (1114) approached Scott Chambers, a chief scientist at PNNL, with a theory that the presence of hydrogen — in effect, water fragments — would enhance the binding of metals to oxide surfaces. Dwight calculated that under those conditions, certain metals would form flat films on sapphire (a phase of aluminum oxide).

Using a special synthesis technique he created, Chambers and postdoctoral fellow Tim Droubay produced an atomically flat film of cobalt on hydroxylated sapphire. They found, as Dwight had suspected, that the cobalt accumulated in layer-by-layer fashion, rather than clustering to form islands.

“Cobalt’s interaction with oxide is so weak that it would normally ball up when deposited,” says Dwight. “However, by changing the surface of the oxide, Scott discovered that cobalt atoms can cause the release of a hydrogen gas molecule and the cobalt atoms then become oxidized themselves — that is, they link up with the newly available oxygen and end up strongly bound within the top layer of the oxide. These are the anchors.”

These metal atoms, embedded at scattered points within the top layer of the oxide, amount to about one anchor for every ten oxygen atoms in the top layer. These in effect bind other metallic atoms to themselves and to each other just above the oxide surface, forming a crystalline metallic layer.

Many advanced technologies rely on strong interfaces between metals and oxides,” said Chambers, lead author of the Science paper. “These findings may provide the molecular insight industry needs to create better materials for microelectronics and sensors.

The new technique uses equipment already in place in chip manufacturing plants.

“For industry, a solution may be as simple as exposing the thin aluminum oxide films to a low pressure of water vapor before adding a final cobalt layer,” said Chambers. The entire process may be done at room temperature, while it is often important to avoid high temperatures in manufacturing. PNNL postdoc Tim Droubay and Chambers with the experiments. Dwight, who first found which chemical reactions would be energetically favorable, collaborated at Sandia with Thomas Matheson (1114), who has long experience in first-principle-based diffusion and reaction studies, and in computing critical reaction barriers. Their theoretical calculations predicted some and validated other experimental results. Some of these calculations required work on Sandia’s most powerful computers.

The calculations provided insight into what reaction is taking place, where it occurs, the energy barrier for it to happen, and the time needed for completion versus the time for arriving cobalt atoms to lose energy while in contact with the surface. If the reaction occurred slowly, the rapidly diffusing cobalt atoms would first find a growing island. However, because hydrogen molecules are being made, the reaction can be on the order of tens of a picosecond. This is well before the arriving cobalt atoms can assume the temperature of the substrate.

Says Dwight, “Either the experimental result would be impossible to explain. However, here we have a wonderful joining of theory and experiment.”

Although the experiment was conducted using cobalt, Dwight’s calculations predict the method also would be effective for iron and nickel, two other metals under consideration for MRAM, as well as metals such as copper, ruthenium, and rhodium. The latter two have applications in catalysis.

Staci Maloof of PNNL contributed to this article.
BUNKS, student loft style, oak, desk, chairs & shelves, very good condition. $450. Barnhill, 928-4361.

WOMEN’S MOTORCYCLE BOOTS, like new, $150 pair, Ely. 893-6310.

TOYOTA CELICA, Pock, Deck & electric, & Ep-hard handle, hardly used. $2,200. Hunt, 917-9132.


SHELLS, outdoor, metal, 32-in, very good shape. $150. Schaud, 540-2111.

WOODEN WINNOWING BOARD, old wood, 4’ long, 1’ wide, 1/2” thick. $250. Fesler, 821-0396.

BARN WOOD, 2x4x20. $3 per board. $600 total. Bredin, 585-7677.

BREEDING BOX, #3, 32” high, $120. Ely. 893-6310.

CENTRAL AIR CONDITIONING, 230V, 10,000 BTU. $2,000. Hudgens, 856-2694.

CAMPERS SHELL, Brahma, for short-bed comfort, $2,900. Jojola, 332-2720.

WASHER & DRYER, Kenmore, excellent condition. $1,400. Reese, 281-3960, email for pictures, 97K miles on original 4.3L V6, good condition, includes utilities included. Jojola, 332-2720.

4 (FOUR) CUBICLE, ready for use, only $150 each. Ready to be picked up from 2:30 to 4:00 today. Reeder, 254-2254.

SWING SET, 16-ft. long w/center supports, approx. 58,175 miles, bids accepted $250. Stern, 291-0607.

STUDENT LOFT STYLE BUNK BED, oak, desk, 4 drawer chest, $125. Poulter, 291-0607.

TIRES, wheels, 33x12.5x15, BFG tires, 10x15, PTP, $10ea, $50 per set. Hintz, 921-0658.

SOLAR EQUIPMENT, 80-gal. tank, phase change storage, $500. Shuping, 707-4619.

DIAMOND, 11-in diameter, $50. Treml, 275-5477.

ANTIQUES, mainly furniture, call for descriptions. Kiro, 255-0890.

35mm & flash, $140. Ginn, 286-4425.

S 392 V8, PTO winch, 4 fuel tanks, air conditioning, strong engine, new clutch/battery, of publication unless changed by holida...
Follow a map to create a healthier you
¡SALUD! programs tailored to helping Sandians be healthy, stay healthy all year long

By Iris Aboytes

An apple a day keeps the doctor away. If you eat sweets, you can get diabetes. If it tastes bad, it’s good for you. These statements are common misconceptions, or are they? For Sandians, the facts are readily available. Call ¡SALUD!, Sandia’s program dedicated to helping people be healthy.

Recently employees in three departments at Sandia turned body fat into a competition. They wanted to lose body fat, not just weight. Their work environment includes those wonderful vending machines. According to one participant, “Those vending machines call your name as you go by.” They notified ¡SALUD! of their intentions, and the competition officially began.

Each person’s body fat was measured by caliper. According to ¡SALUD!, body fat is lost when a caloric deficit is created, which means you need to take in fewer calories than you expend. There are two ways to do this: dieting and exercising. Unfortunately, when one loses weight it’s often not just body fat; muscle is lost as well. By engaging in resistance exercise, you can help spare the muscle loss.

Their ultimate goal was to get a little healthier. Coworkers began riding their bikes at noon, some were walking, others were making it a point to eat healthier. When the vending machines called, they were certain they had called their opponent’s name and not theirs.

For three months, they heckled each other in their attempt to gain the upper hand (more energy and weight loss). Little by little the beaming and energetic attitude emerged. By the way, the competition with the three departments was so successful that another competition among the three departments began Aug. 1 with different participants.

Why not set up a body fat competition in your own group? ¡SALUD! can help you with the logistics. ¡SALUD! also offers a number of other health-related programs. For example, Sept. 11 brought an elevated level of stress to the workplace. ¡SALUD! has provided a variety of stress management programs for several organizations. Initial stress map assessments (15 minutes) are offered to explain the map and its purpose. When the maps are completed and returned, a report is compiled identifying strengths and areas of possible improvement. ¡SALUD! follows up monthly with interventions to meet your needs.

For a complete list and descriptions of the programs offered check out http://www.im.sandia.gov/HR/health. Whether you prefer to fly solo or with a group, ¡SALUD! is there to help tailor your needs.

Remember! A healthier you not only increases your quality of life and productivity, but lowers your disease risk factors. Author William Temple simply states, “Health is the soul that animates all the enjoyments of life, which fade and are tasteless without it.”

Twenty girls visit Sandia as part of Girl Scout Fair Play Science Program

A: As I pull flawlessly through the Eubank gate this morning and head south, only to wait in line due to the delay in vehicle searches at Gate 10, I wonder if there is a possibility to address these searches as was done with the base gates. I would think an acceptable solution would be to double up the security staff at Gate 10 and have two teams searching two vehicles at the same time, just as what was implemented at the base gates.

A: Thank you for your inquiry regarding traffic delays at Gate 10. Vehicles testing positive for explosives caused the delay. Since the end of May, the ProForce procedures have been revised to help address the traffic congestion for the future. In addition, modifications to the gate are being evaluated and changes are made as necessary. While increasing staffing at the gates would be an option, we are not currently staffed with sufficient Security Police to allow this. However, please keep in mind, that if a vehicle does test positive for explosives, traffic through Gate 10 will be redirected to ensure the safety of employees and customers.

— Al West (3100)