

So, what's up with education and R&D?

BY RICK MICHAL

WITHIN THE PAST year, the World Nuclear University completed its first summer session and the Department of Energy announced the opening of the Center for Advanced Energy Studies. Meanwhile, two fledgling nuclear engineering programs—at South Carolina State University and the University of South Carolina—celebrated anniversaries, and a long-existing program at Idaho State University continued its journey by “revitalizing” itself, as a faculty member there proclaimed.

With the nuclear industry undergoing what is often referred to as a renaissance, *Nuclear News* decided to take a look at some of the education and R&D programs being conducted for a glimpse into the expanding world of nuclear technology. Following is what we found.

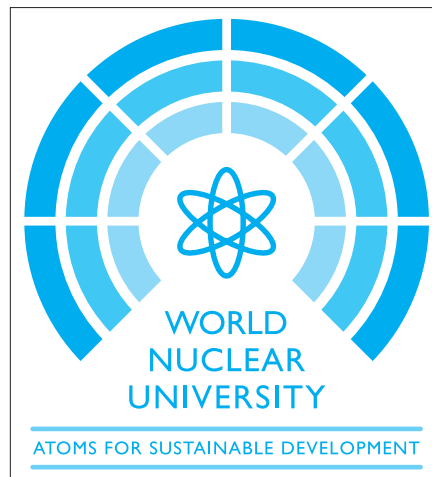
World Nuclear University

The inaugural term of the WNU's Summer Institute ran from July 9 to August 20 and was an unmitigated success, according to Ed Klevans, the institute's chief coordinator.

“The purpose of the institute was to provide promising graduate students and young professionals a unique educational experience aimed at building future global leadership in fields of nuclear science and technology,” said Klevans, professor emeritus of nuclear engineering at Pennsylvania State University (PSU), where he served on the faculty from 1966 to 1998 and was department head from 1987 to 1998. His wife, Deborah, formerly the director of PSU's Outreach Office of Program Development, was also an institute coordinator.

The WNU's institute was hosted by the Idaho Universities' Institute of Nuclear Science and Engineering, in Idaho Falls, in collaboration with the DOE's Idaho National Laboratory (INL), the new Center for Advanced Energy Studies (CAES), and Idaho

Nuclear News takes a look at what is happening with the WNU Summer Institute, the DOE's Center for Advanced Energy Studies, and some university nuclear engineering programs.



WNU's first Summer Institute is a success

State University (ISU), Boise State University (BSU), and the University of Idaho (UI).

The institute attracted 77 participants (out of 146 applicants) who, upon acceptance into the program, became known as WNU fellows. The fellows came from 34 countries and had an average age of 30. One quarter of them were women. The group represented 65 different organizations, and nearly half had or were pursuing a Ph.D. The countries represented by the fellows were Argentina, Armenia, Australia, Belgium, Brazil, Bulgaria, Canada, Chile, China, Croatia, the Czech Republic, Egypt, Finland, France, Germany, Hungary, India, Israel, Italy, Japan, Kazakhstan, Lithuania, Mexico, the Netherlands, Romania, Russia, Slovakia, Slovenia, South Africa, Sweden, Turkey, Ukraine, the United Kingdom, and the United States.

Eight mentors—experienced, internationally diverse, senior-level professionals in the nuclear field—took responsibility for working with groups of 11 fellows. The mentors were Gilbert Brown, professor and coordinator of the nuclear engineering program at the University of Massachusetts–Lowell; Yves Chelet, who spent his career with the French Atomic Energy Commission and held the position of director of the Institut National des Sciences et Techniques Nucleaires, in Saclay, from 1982 to 1995, when he retired; Waclaw Gudowski, who specializes in neutron and reactor physics at Kungliga Tekniska Högskolan, the Royal Institute of Technology, in Stockholm, Sweden, where he has been a professor since 1999; Debu Majumdar, a senior nuclear advisor to the DOE's Idaho Operations Office; Jean-Louis Nigon, chief coordinator of the WNU's Working Groups and former Cogema deputy vice president for research and development; John Sackett, affiliate faculty member in the College of Engineering at ISU and previously an associate laboratory director at the DOE's Argonne National Laboratory (ANL); Bob Seidel, who at ANL led and participated in a range of initiatives to improve nuclear fuel and structural material performance for several reactor types; and Alan Waltar, senior advisor to the DOE's Pacific Northwest National Laboratory, from which he recently retired as director of Nuclear Energy, and a past president (1994–1995) of the American Nuclear Society. A ninth mentor, Ravi Grover, director of the Strategic Planning Group of India's Department of Atomic Energy, stepped in to participate for two weeks when one of the original mentors had to attend to another matter.



There also were daily lectures by faculty members on a variety of issues “that will influence the future use of nuclear technologies,” according to Klevans. Some lecture titles and the faculty members who presented them included “World Energy Demand and Supply,” by Jan Murray, deputy secretary general of the World Energy Council; “Survey of Nuclear Politics,” by Alan McDonald, of the International Atomic Energy Agency’s (IAEA) Nuclear Energy Department; “Transport of Nuclear Materials and Waste,” by Rod Fisk, president and chief executive officer of Transport Logistics International; “Nuclear Fuel Market,” by Steve Kidd, director of Strategy and Research at the World Nuclear Association (WNA); “Hydrogen Economy,” by Anthony Eggert, associate research director, Hydrogen Pathways Program, Institute of Transportation Studies at the University of California–Davis; and “Perspectives on the Yucca Mountain Project,” by Jon Ralston, a political columnist in Nevada, and Ace Robison, chairman of Robison/Seidler, Inc., a Nevada-based consulting firm specializ-

ing in strategic planning, government affairs, and issue management in the energy, water, environmental management, and education sectors.

In all, 52 faculty members made presentations on 25 different topical areas. Other activities included weekly review sessions in small mentor-led groups to promote sharing of differing perspectives and to discuss major ideas presented by the faculty. The fellows also analyzed case studies in nuclear law, safety culture, nuclear operations, and public communication on nuclear issues.

Field trips were arranged to nearby major laboratory sites, and one trip was made to Nevada to visit the site of the proposed waste repository at Yucca Mountain.

For final projects, the institute’s mentors led teams consisting of seven fellows. These projects dealt with one of three significant nuclear issues with international implications: nonproliferation policy, national energy planning, and radiation therapy facilities for cancer treatment in developing nations. The titles of

some of the final projects were “Electric energy policy challenges of the Peoples Republic of China, 2005–2025,” “Improving the efficiency of Ghana’s radiotherapy programs in cancer control,” and “NPT [Nuclear Non-Proliferation Treaty] Paradigm Evolution.”

According to Klevans, the final projects provided an opportunity for self-directed, intensive teamwork and included the preparation of formal presentations and written reports that were delivered near the conclusion of the institute. A live video conference enabled staff from the IAEA to view the presentations and ask questions.

In addition to a daily schedule, the institute featured a series of lectures on nuclear leadership. These presentations featured Susan Eisenhower, senior fellow and director of programs at the Eisenhower Institute; Zack Pate, cofounder of the World Association of Nuclear Operators (WANO); Geoffrey Ballard, pioneer and innovator of hydrogen technology fuel cell research and founder of Ballard Power; James Lake, associate laboratory director



Fellows, mentors, and staff of the World Nuclear University’s inaugural Summer Institute. (Photo: Bob Seidel/imediaMagic LLC)

for Nuclear Research and Development Programs at the INL and an ANS past president (2000–2001); Rich Hooper, architect of the Additional Protocols to the Nuclear Non-Proliferation Treaty; Demetrius Perricos, past head of operations for the Iraq Action Team, who led the first team into Iraq under Security Council Resolution 687 and is now executive director (acting) of Planning and Operations for the United Nations Monitoring, Verification and Inspection Commission; and Shane Johnson, acting director of the DOE's Office of Nuclear Energy, Science and Technology.

Hans Blix, director-general emeritus of the IAEA, who served as chancellor of the WNU, delivered the closing address and presented diplomas at the institute's conclusion. John Ritch, WNU president, helped in presenting graduation certificates to the fellows.

The WNU was founded on September 4, 2003, in London, in a ceremony commemorating the 50th anniversary of President Eisenhower's historic "Atoms for Peace" speech to the United Nations General Assembly. Founding supporters are the IAEA, the Nuclear Energy Agency of the Organization for Economic Cooperation and Development, WANO, and the WNA.

Funding for this year's summer institute was provided by the DOE, which helped support host site planning and operations, among other things. Fees were paid by other entities in support of the fellows. These entities included 25 corporations,

eight government organizations, two universities that provided full support and one university that provided partial support, two professional associations, and the IAEA, which funded 28 fellows from developing nations and four consultants from India. Also, a Battelle Energy Alliance grant supported recreational activities.

Upon completion of the institute, fellows were asked to note their experiences. One fellow from Germany wrote: "The Summer Institute made it clear that nuclear is more than just an engineering [challenge]—it has economic, environmental, and social implications. Therefore, for the vision to materialize, it is necessary to consider all three dimensions when making management decisions on nuclear projects. For my day-to-day work, this means that the WNU experience serves as a powerful reminder to balance these three dimensions."

Next year's summer institute will be held July 8–August 18 in Sweden. The institute will be hosted by the Swedish Center for Nuclear Technology, Sweden's Royal Institute of Technology, and France's Commissariat à l'Énergie Atomique. After five weeks in Sweden, the WNU fellows will take a week-long technical tour of France, visiting several of that nation's top nuclear fuel cycle, nuclear research, and nuclear power facilities.

The deadline for receipt of fellowship applications for the 2006 summer institute is December 5, 2005. The WNU's Web site is at <world-nuclear-university.org>.

Continued

Education Briefs

A SPECIALTY IN NUCLEAR POWER TECHNOLOGY has been added to the online curriculum of Bismarck State College (BSC). The college, in North Dakota, offers two programs devoted to nuclear power. One program offers an associate in applied science degree in nuclear power technology, while the other offers a certificate (but no degree) in the technology. BSC's partnership with Energy Providers Coalition for Education, a consortium of human resources and training executives from utilities, associations, and unions nationwide, helped launch the online nuclear power technology program last year. Another online program, devoted to electric power technology, was started in 2001. The college's Web site is at <www.bismarckstate.edu>.

THE NRC DOCKETED K STATE'S LICENSE RENEWAL APPLICATION

in October. Kansas State University, in Manhattan, Kans., has requested that it be allowed to operate its reactor, a TRIGA Mark II design rated at 1250 KWt, for another 20 years. In an October 6 *Federal Register* notice, the Nuclear Regulatory Commission explained that Kansas State's operating license expired on October 16, 2002, but that because an application for renewal was filed by the university on September 12, 2002 (and supplemented on December 22, 2004, and July 6, 2005), the current license is not deemed to have expired until the license renewal application has been finally determined. The NRC said it was satisfied with the information submitted by Kansas State in support of license renewal, and that the application is acceptable for docketing. A public hearing on this matter could be held by the NRC if requested by Kansas State or any interested party. In the event that no request for a hearing is made, the NRC, upon completion of its application review, could renew Kansas State's operating license without further notice.

CAES

In June, Energy Secretary Samuel Bodman announced the formation of the Center for Advanced Energy Studies at the INL. Leonard Bond, CAES director, said the new entity will eventually have four “thrust areas”—education, research, training, and energy policy—focusing on a broad spectrum of advanced energy studies.

Through CAES, the INL will connect with regional and national universities to conduct on-site research, classroom instruction, technical conferences, and other activities in order to establish a world-class academic and research institution.



Bond

The goal is to become a research hub much the same as the Oak Ridge Affiliated Universities (ORAU) consortium in Tennessee. (ORAU, established in 1946, consists of 91 doctoral-granting university members and 11 associate members that are located in 28 states, plus the District of Columbia, Puerto Rico, and the United Kingdom.)

Bond explained that CAES’s management is now in the process of establishing a research agenda, one that will include such items as the advanced fuel cycle and next-generation nuclear plants. “We have a number of faculty and adjuncts around the lab who have real fuel-cycle expertise,” he said. “We’ll be working to strengthen and grow those capabilities, and we’ll also include some proliferation-resistance issues as well.” Other areas of interest are sure to include high-temperature reactor materials, instrumentation and controls, and diagnostics.

Because CAES is still a “virtual” organization, Bond said, a target on the horizon is to construct an actual bricks-and-mortar building. That new facility, which should be built at a cost of \$14 million in the next few years, will house the four CAES thrust areas, along with four colocated and collaborating INL centers, one devoted to space nuclear, another to fuels, a third to materials, and the fourth to modeling and simulations.

Bond said that CAES is to get its own budget for 2007 (currently, it is operating through INL funding), and that researchers will soon be coming to start work there. “Over the next 12 months, we’re going to be developing things and getting faculty engaged in programs and opportunities as seems appropriate,” he said.

An initiative in which CAES is engaged with Idaho’s three research universities—ISU, UI, and BSU—is called the 2 + 2 bachelor’s degree scholarship program. Under that program, nuclear engineering students will spend their first two years at one of the universities and their final two years in

Idaho Falls, attending classes at University Place (a joint campus) while working as interns at the INL. At the end of the program, the students will receive degrees from their universities, as CAES will not be a degree-awarding institution. The first 2 + 2 class—a pilot for the program, with scholarship funds from the Areva Group and the DOE—started this fall with six students—four from ISU, one from BSU, and one from the UI. Bond said that the program is expected to grow to a dozen students next year.

Not all of CAES’s research will be nuclear focused. Other areas of interest will be hydrogen issues, carbon sequestration, clean coal, water management, synthetic fuel generation, and energy policy. Bond said that CAES would strive to be involved in a mix of activities, with half of the research devoted to nuclear technology and the other half to other energy issues.

South Carolina State University

In October 2002, a nuclear engineering program for undergraduates was established at South Carolina State University (SCSU), one of only two university nuclear engineering programs to be established in the United States in more than 20 years. That first year, four students were enrolled in the new program at SCSU, a historically black university located in Orangeburg, S.C. This year, as the program celebrates its third anniversary, 12 students are enrolled.

SCSU’s program is offered in partnership

with the University of Wisconsin (UW). Students in the program take the majority of their classes at the South Carolina campus, but they must also travel to the UW campus, in Madison, Wis., to take reactor physics and other courses that involve the use of UW’s research reactor.

Of the four students who started in the program in 2002, two have graduated, according to Kenneth Lewis, dean of SCSU’s College of Science, Mathematics and Engineering Technology. Of those two graduates, one has gone on to get a master’s degree in nuclear engineering from UW, while the other is working toward that goal.

Lewis reported that SCSU is constantly improving its program. One new faculty member added to the staff is an expert in reactor theory, while another new instructor has a specialty in thermal hydraulics. SCSU wants to match curricula with UW so that students are taught at the same level in the same course material at both campuses. Toward that end, some UW lectures are broadcast directly through distance learning to students on location at SCSU.

The SCSU program’s big draw is nuclear power, of course, because South Carolina is home to seven power reactors, a commercial fuel fabrication facility, a low-level waste disposal facility, and the DOE’s Savannah River Site. But work is under way to broaden the scope. For example, the university has recently obtained two grants—one from the state and the other a federal subsidy—to purchase more than \$100 000 in equipment to set up an applied radiation



SCSU’s nuclear engineering group: Left to right: Yvonne Johnson, junior, nuclear engineering major; Aundrie Blanchard, senior, nuclear engineering and biology major; April Hutton-Moorer, recruitment and outreach coordinator, nuclear engineering program; Kenneth Okafor, associate professor, nuclear engineering program; Kenneth Lewis, dean, College of Science, Mathematics and Engineering Technology; Shadia El-Teleaty, adjunct professor, physical science; Wagih Abdel-Kader, assistant professor, physical sciences; Deidra McCray, junior, nuclear engineering and civil engineering technology major; Rheila Dantzler, administrative specialist, nuclear engineering program; Slavica Grdanovska, sophomore, nuclear engineering major; and Jamika Harris, freshman, nuclear engineering major. (Photo: SCSU/Rolando Davis)

sciences laboratory that will operate in conjunction with UW. Also, SCSU has received funding from the DOE's National Nuclear Security Administration to establish a nuclear chemistry/radiochemistry program.

Setting up SCSU's program was a personal goal for Bill Magwood, former head of the DOE's Office of Nuclear Engineering, Science and Technology. Magwood, an African American, considered the program "his baby," according to April Hutton-Moorer, nuclear engineering recruitment and outreach coordinator at SCSU. While incoming students were inspired by Magwood's achievements in the industry, their level of enthusiasm has been retained even though Magwood is no longer with the DOE. That, Hutton-Moorer said, is because of the work done by Lewis to improve the program by adding instructors and obtaining financial grants.

Today, the university is actively recruiting students into the nuclear engineering program. Lewis said he recently sent out letters to alumni chapter presidents across the country to have them spread the word about SCSU's program. "We specified some criteria for the kind of students we're looking for," he said. "And we want the word out that we have scholarships available in radiochemistry, as well as in nuclear engineering."

SCSU's program currently has four

women among its 12 students. All are citizens of the United States except for one, who is from the Republic of Macedonia. All of them are eagerly eyeing the job market, according to Lewis. "You know, there's such a positive future for nuclear engineers because so many people in the industry are retiring," he said. "It is like there are employers standing around waiting for us to graduate students so they can hire them."

University of South Carolina

Like SCSU, the nuclear engineering program at the University of South Carolina (USC) is new, having officially started in fall 2003, one year after then Energy Secretary Spencer Abraham announced the birth of the two programs.

Unlike SCSU, which provides an undergraduate program, USC offers a graduate program in nuclear engineering. Students matriculating through the program can earn master of science, master of engineering, and doctor of philosophy degrees, with their research expected to be in the general areas of reactor design, reactor safety, material applications, and other applications.

The nuclear engineering graduate program at USC, which is located in Columbia, started with six students in 2003 and has grown to a total of 32 students today, according to Abdel Bayoumi, the pro-

gram's founder and director. The reason for that rapid increase, he said, is that USC offers distance education, which the university has used since the late 1960s. About



Abdel Bayoumi

half of the nuclear engineering enrollment consists of off-campus students who receive their classes through several delivery mechanisms, such as closed-circuit television or computer downloading. Many of them are already practicing engineers, located across the country in states such as Texas, Ohio, Georgia, and North Carolina. The majority, of course, come from South Carolina.

Bayoumi said that recruiting for the program isn't difficult. First, South Carolina is a hotbed of nuclear activity. Second, the program's advisory board goes above and beyond the call of duty to promote it. The board's chair is a retired Navy admiral, and among the board members are high-level executives of organizations such as Duke Energy, Progress Energy, Southern Nuclear, SCANA, Westinghouse Electric Company, and the Savannah River National Laboratory. The DOE also has representatives on the board. All board members take part in

promoting USC's program at their own organizations and by sending out pamphlets.

Of the 32 students in the program, eight are Ph.D. candidates and 24 are pursuing master's degrees; five are female; 26 are Caucasian, three are African American, one is Hispanic, and two are foreign nationals; and all but one are U.S. citizens.

The students are involved in several fields of research, the major area being nuclear power. The second area is the production of isotope materials for medical use, and the third is hydrogen production and hydrogen use.

Bayoumi said that faculty resources could limit the program's expansion, because the program is part of USC's Mechanical Engineering Department, where only five faculty members have backgrounds in nuclear engineering. "There are only so many people we can advise for a master or Ph.D. dissertation," he said, "and we must be able to sponsor their research."

Idaho State University

While nuclear engineering programs at two universities in South Carolina have started up in the past few years, the program at ISU has some miles on it. Although it's been around since the 1950s, longevity has not always equaled prosperity, according to Michael Lineberry, director of ISU's Institute of Nuclear Science and Engineering. There have been lean years, he said, as most nuclear engineering programs in the country have experienced. Today, however, the total of 25 students enrolled in ISU's program at least equals the highest number at any time since the program began.

Those 25 students are about evenly divided in number between the university's undergraduate and graduate programs, said Lineberry, who added that ISU wants to keep expanding nuclear engineering opportunities on the campus. This "revitalizing" of the program, as Lineberry put it, is done through aggressive recruiting of prospective students.



Lineberry

ISU does this, in part, by sending them to ANS meetings. "We try to engage students in things, ask them to go to committee meetings, and get them involved with mentors," he said. "As far as

For an in-depth look at the Idaho universities' 2 + 2 scholarship program, see the interview with Idaho State University's Mary Lou Dunzik-Gougar, assistant professor of nuclear engineering, in the December 2005 issue of Nuclear News.

student affairs, I think we're as engaged in ANS national meetings as any university in the country. It works very well for us. It's a principal event for our students and the principal recruiting tool for us."

ISU's nuclear engineering program is unique in that it is separate from the nuclear science and health physics programs at the university. Whereas nuclear engineering is part of ISU's College of Engineering, the latter two programs are part of the school's Physics Department in the College of Arts and Sciences. This means, for example, that any research involving accelerator applications is headed by the Physics Department. The bottom line is that the number of ISU students involved in nuclear technology is much greater than the 25 enrolled in nuclear engineering. In fact, the number of students in ISU's health physics programs is 30 (all master of science), making it one of the largest such programs in the country.

Of the 10 students in ISU's nuclear engineering graduate program, seven of them are engaged full time in research at the INL. Of the 15 students in the university's undergrad program, four are involved in the 2 + 2 scholarship program, a product of the Idaho universities and the INL's CAES. The scholarships were provided by the Areva Group and the DOE. Lineberry said that the 2 + 2 program, which also includes students from UI and BSU, involves the use of INL scientists as adjunct professors for special elective courses. The students undergo six-month practicum assignments during which they work closely with the scientists.

Lineberry is excited about the DOE's move to make the INL the nation's premier laboratory for nuclear energy research, development, demonstration, and education. The DOE selected Battelle Energy Alliance to lead the INL project (announced by the DOE on November 9, 2004). That alliance includes Battelle, BWX Technologies, Washington Group International, the Electric Power Research Institute, the Idaho University Consortium (IUC—consisting of ISU, UI, and BSU), and the National University Consortium (NUC—consisting of the Massachusetts Institute of Technology, Oregon State University, North Carolina State University, Ohio State University, and the University of New Mexico).

Lineberry said that the IUC and the NUC will work to engage other universities in the United States and around the world in recognizing the INL and CAES as a focal point in the advancement of education in nuclear science and technology. "The universities are poised to play a role in the INL's research," he said. "All of this is still very much in the growing stage, but the universities surely want to be active in the research, not only with their faculty but with graduate students." **■**