ANS STUDENT CONFERENCE

The new professionals

Being a critical member of the nuclear industry was the theme of the 2016 ANS Student Conference, held March 31–April 3 in Madison, Wis.

When it came to the weather, Wisconsin's capital city did not extend the warmest of welcomes to the 2016 ANS Student Conference. The mercurial Midwestern spring weather offered up a mix of rain, snow, and bone-chilling wind. Inside the comfortable Madison Concourse Hotel, however, the University of Wisconsin at Madison ANS Student Section offered an informative, engaging, and at times riotously lively mix of workshops, panels, and technical sessions. A full schedule of tours, dinners, and keynote speakers was also part of the package.

The theme of this year's student conference, "Being a Critical Member of the Nuclear Industry," was modeled after the four-factor formula for nuclear reactor criticality, $k=\eta f \rho \varepsilon$. It focused on the four factors the UW-Madison Student Section said it believes are necessary for success in the professional world: nuclear opportunities (η), forming a public image (f), professional development (ρ), and entrepreneurship (ε). Organizing the conference with those factors in mind, the UW-Madison Student Section said that its goal was to have attendees recognize that nuclear industry professionals need to have a balance of different skills and attributes in order to succeed.

A great deal of work goes into organizing a successful meeting, and the planning committee for this year's student conference can be commended for putting together an outstanding program. Student attendees were offered a number of opportunities to enhance their academic and professional careers while networking with their peers and industry professionals. A full schedule of technical sessions covered subjects as varied as biology and medicine, fusion energy, thermal hydraulics, nuclear nonproliferation, and aerospace nuclear science and technology, among others.

Fuel cycle, waste management

The session "Fuel Cycle and Waste Management I" featured students presenting papers on the topics of public opinion and the nuclear fuel cycle, recovering uranium from seawater, molten glass melter design, and fuel cycle analysis.

Stephen Clement, a graduate student at Virginia Commonwealth University, presented "Using Multi-Attribute Utility Theory (MAUT) to Incorporate Public Opinion When Choosing Among Nuclear Fuel Cycles." Clement said that his research was part of a nuclear fuel cycle rebranding project at VCU that seeks to develop a branding and communication strategy to ensure that the public is informed on nuclear fuel cycle issues, and to better understand what people's concerns and priorities are when it comes to nuclear energy.

Using MAUT decision analysis, VCU hopes to create a decision-making model for selecting fuel cycle options that incorporates public opinion. The process Clement described begins with identifying stakeholders and the fundamental objectives on which decisions will be based. Identifying the fundamental objectives is

an important part of MAUT, as each alternative decision will be evaluated against those objectives. Clement said that metrics can then be developed to quantify public opinion on the importance of radioactive waste disposal options.

Identifying the fundamental objectives is an important part of multi-attribute utility theory, as each alternative decision will be evaluated against those objectives.

Noting that the use of MAUT analysis has its pros and cons, Clement concluded that the lack of knowledge and fear of nuclear on the part of the public complicates decision-making.

Margaret Flicker Byers, a doctoral student at the University of Texas at Austin, presented an update of a cost analysis on the recovery of uranium from seawater. The recovery process Flicker Byers described is a passive collection technique using an absorbent material. The goal, she said, was not to seek a means of competing with conventional uranium mining, but to provide a "cost ceiling" for comparative purposes.

Flicker Byers said that in testing the uranium absorbent in the field, the material lost 30 percent of its absorption capacity due to biofouling, where the growth of organisms on the material interfered with its ability to take up uranium. The material also degraded, suffering a 14 percent loss of uranium uptake at 18 days, and losing more than 5 percent of capacity in reuse. Testing concluded that in a worst-case scenario, uranium could be recovered from seawater at a cost of $1,000 per kilogram of uranium (in 2015 dollars). The best-case scenario put the recovery cost at $300/kgU. With uranium oxide selling at well below $50 per pound (about $22.5/kg) in recent years, recovery from seawater is still a costly option.

Next, Joseph Cambareri, a senior at North Carolina State University, discussed his research project on interface tracking simulations of molten glass melter designs. Glass melters are used in the vitrification of radioactive waste, and Cambareri's research looks at how the melters can be made more efficient. Using direct numerical simulations and interface tracking in the PHASTA analysis tool, Cambareri studied the action of induced bubbles in melters as a means of increasing circulation in the molten glass. Increasing the circulation through the use of bubbles increased melter efficiency, which could reduce vitrification costs, he said.

Finally, Cem Bagdatlioglu, a graduate student at the University of Texas at Austin, presented "Fuel Cycle Analysis Using Bright-Lite in the Cyclus Simulator." The Bright-lite code, Bagdatlioglu said, offers quick execution and flexibility when used in the Cyclus fuel cycle simulator. He said that Bright-lite has the ability to provide medium-fidelity modeling of reactor operation within a fuel cycle simulator. The code is also a useful tool for handling fuel cycles where the type and composition of fuel varies greatly, he said.

Entrepreneurship

While upon graduation many nuclear science and engineering students will find a job with a large, well-established company, a national lab, or other government organization, some may choose to create their own path, parlaying their research and expertise into a startup company. Universities and labs are incubators for new ideas and technological advancements, and the panel session "Academia to Startup" looked at how those ideas and technologies can be translated into a successful business.

Not all paths to a career in a startup company are the same, and Pete Pappano, vice president of fuel production for X-energy, shared how he became part of an innovative company that is seeking to develop an advanced gas-cooled reactor, the Xe-100. Pappano, who has bachelor's, master's, and doctoral degrees from Pennsylvania State University, said that his background is mainly in materials science, and his early research was in the uses of coal and graphite within the fossil fuel industry. His work with graphite materials led to research into TRISO nuclear fuel at Oak Ridge National Laboratory. Based on his experience with TRISO fuel, Pappano was recruited by X-energy in 2015 to work on the Xe-100, a pebble bed high-temperature gas-cooled reactor.

Pappano said that working for a startup company such as X-energy demands a different mindset. National labs, he said, are primarily interested in research. "Labs would do R&D forever if they could," he said. On the other hand, private companies want to avoid the costs associated with extensive testing in order to reach a desired outcome, which can lead to a fast-paced, results-driven work environment.

Like Pappano, Ross Radel, president of Phoenix Nuclear Labs (PNL) and a graduate of UW-Madison, worked at a national laboratory before becoming part of a startup company. Radel spent three years at Sandia National Laboratories before returning to Madison in 2010 to help his former classmate, Greg Piefer, design and build accelerator-driven neutron generators. That same year, Piefer founded SHINE Medical Technologies as a spin off of PNL. SHINE is currently seeking to build a facility to produce molybdenum-99 using PNL-designed neutron generators.


Radel

Also like Pappano, Radel said he enjoys the fast-paced environment of working in a startup. Having the opportunity to develop new technologies with a team of like-minded colleagues is rewarding, he said, although, he added, there are "less fun" aspects of heading a company such as PNL. These include having to take the time to do all the work that comes with managing a small startup company, such as raising funds and handling financials. Radel also said that as a private company, PNL's deadlines come with real consequences.

Both Pappano and Radel said that being part of a startup comes with long hours, but the rewards are worth it. "It has all been fun," Pappano said of his time at X-energy. "I haven't taken a vacation in a year, but that is because I like the work."

Diversity

The panel session "Diversity in Nuclear Engineering," to paraphrase one audience member's comment, did not look like your typical ANS panel. While dealing with a serious topic, the session was as entertaining as it was enlightening, offering a chance for both the panel members and the audience to share stories, vent, and laugh about some of the more ridiculous aspects of bigotry and prejudice.

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Brinton

Marshall

documented position that racial, ethnic, and gender diversity is inherently valuable in both academia and the workplace. From that starting point, Wilson said that he hoped the panel would help shed light on some of the ways individuals and institutions are not welcoming of diversity and what can be done about it. The panel members included Samuel Brinton, senior policy analyst at the Bipartisan Policy Center and executive director of NuclearPride, which provides a safe and supportive community for those in the nuclear engineering community who identify as lesbian, gay, bisexual, or transgender; Lisa Marshall, director of outreach, retention, and engagement for North Carolina State University; and Brett Rampal, a nuclear engineer at NuScale Power.

While the panel members shared their individual experiences facing prejudice, much of the discussion between the panel and the audience centered around how bias, both conscious and subconscious, manifests itself and how to best react to it. When asked about his threshold for what he considers offensive behavior, Brinton said that thresholds are "very fluid" and that he allows much more flexibility with people who are willing to be thoughtful and respectful.

Rampal, who comes from a Hindu-Jewish background, said that sensitivity to others begins with a questioning attitude. "It is a lot about awareness and realizing that not everybody had the same opportunities or upbringing as you," he said.

Referring to the work she does with K-12 students, Marshall said, "I think we can make an impact through the work we do." For the students she works with who are from low-income and minority communities, that means building a long-term relationship with the students, inspiring them, and letting them know that they can succeed in areas where they may feel like they don't belong, she said.

When it comes to dealing directly with bigotry, the panel members agreed that there is a small percentage of people who will not change their attitudes and will refuse to listen to the concerns of others. Rampal, however, said that he always remains optimistic that people will do the right thing. "I believe in hope," he said.—*Tim Gregoire*