AIChE

1993 Marx Isaacs Award Recipient

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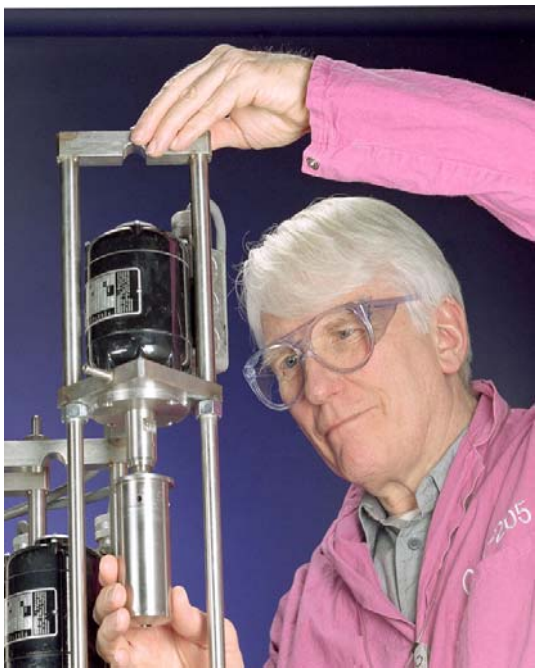

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RALPH LEONARD, 2008 WILSON AWARD WINNER

Congratulations to Ralph Leonard, winner of the Robert E. Wilson Award for 2008. The Robert E. Wilson Award has been presented annually since 1967 by the NED for outstanding chemical engineering achievement in the nuclear industry, and it is the oldest presented by an AIChE Division. The list of winners reads like a Who's Who for the nuclear processing industry. Congratulations to Ralph on his induction into this elite group!

Ralph has been a member of NED ever since he joined Argonne National Laboratory in 1976. For the first five years, he was membership chair. For the next three years, he was a director. In 1989, he started the four-year succession through the positions of vice chair, chair, programming chair, and nominating committee chair of NED.

As programming chair, Dr. Leonard was responsible for the NED program at the August 1991 AIChE National Meeting in Pittsburgh. At this meeting, there was a plenary session on nuclear issues and technology chaired by Martin J. Steindler, and there was an international symposium on reprocessing and waste management coordinated by Ken Plummer and Arlin Olson.

Ralph has made significant contributions to nuclear chemical engineering ever since he joined Argonne, working on various technical programs in the areas of nuclear technology and separation science. These programs include liquid extraction, ion exchange, flowsheet development, and

centrifugal contactor design for nuclear fuel reprocessing and separation of nuclear wastes; uranium dissolution for Mo-99 recovery; sodium technology for fast breeder reactors; tritium and liquid metal technology for the fusion power program; and proof-of-breeding analytical support for the light water breeder reactor. In these various projects, he worked in the areas of material balance, chemical reaction, mass transfer, fluid flow, hydraulics, various chemical separation processes, improved methods for modeling process flowsheets, vibration analysis, equipment design, and remote maintenance. He developed a dimensionless number for liquid-liquid dispersions which is the basis for both a quantitative model for centrifugal contactors and a laboratory test for evaluating solvents. He is the author or coauthor of over 100 articles and reports, most of which have been a result of work at Argonne.

Some of Dr. Leonard's more noteworthy contributions are described below. For his first five years at ANL, he focused on putting the annular centrifugal contactor, which had been invented by George J. Bernstein at ANL, on a firm engineering basis. The annular centrifugal contactor is a (relatively) new tool for carrying out solvent extraction operations; a bank of the contactors is visible in the photograph of Dr. Leonard on the front page. Using this work, ANL (led by Dr. Leonard) supplied centrifugal contactors to DOE sites at Hanford, Los Alamos, Idaho Falls, Oak Ridge, and Savannah River. Oak Ridge National Laboratory (ORNL) used this technology to build additional contactors for themselves and for DOE sites at Savannah River and Idaho Falls. They also worked with the nuclear industry in the United Kingdom and Japan to provide them with annular centrifugal contactors for nuclear fuel reprocessing. The ORNL people provided the contactor technology developed by Dr. Leonard to an American industrial firm (CINC, Carson City, NV) that now manufactures contactors commercially. The smallest CINC unit is a 5-centimeter contactor, a large lab scale contactor which was recently included in the Cole-Parmer catalog.

As a part of his work to put the annular centrifugal contactor on a firm engineering basis, Dr. Leonard devised a new dimensionless number for coalescing liquid-liquid dispersions, the dispersion number (N_{Di}). The dispersion number can be determined using batch tests on the lab bench under normal gravitational force. It can then be used to predict the throughput for annular centrifugal contactors with high gravitational fields and continuous countercurrent operation. Dr. Leonard has developed a dispersion number test for evaluation of new candidates for solvent extraction processes. The test is now widely used in development work.

After developing a firm engineering basis for the design of annular centrifugal contactors, Dr. Leonard used a contactor to test solvent extraction flowsheets of interest to the nuclear industry. While he was doing this, he improved the reliability of the contactors and reduced their cost by using off-the-shelf motors. To support this effort, he developed a method for using a spreadsheet to calculate the first natural frequency of the motor/rotor assembly. He used box beams to stiffen the contactor support frame, and he used face-mounted motors to make remote maintenance easier. He improved internal contactor hydraulics by making subtle changes in the placement of the interstage lines. In this work, Dr. Leonard has collaborated with several outstanding chemists in the DOE complex, including Phil Horwitz and George Vandegrift at ANL and Bruce Moyer at ORNL.

To analyze the results of the various flowsheets and so to understand where the problems were, Dr. Leonard developed a spreadsheet to do the stage-to-stage calculations, replacing the laborious manual McCabe-Thiele diagrams that had been used in the past. This spreadsheet, called SASSE (Stagewise Algorithm for Stagewise Solvent Extraction), has been published in the open literature and is used in

ANL computer programs to calculate the concentration profile of a solvent extraction flowsheet for various nuclear processes.

During the mid-1990's, Dr. Leonard continued to test new solvent extraction flowsheets being developed by Bruce Moyer at ORNL. One of these flowsheets became the CSSX flowsheet proposed for removing cesium from tank waste at the Savannah River Site. In 2002, the CSSX process was chosen to remove cesium from the tank waste, and two plants, including the Salt Waste Processing Facility, are now being built at SRS based on the CSSX flowsheet using centrifugal contactors.

The success of the CSSX work paved the way for centrifugal contactors to be used in the UREX process, which is a key part of the Global Nuclear Energy Partnership initiative. Since he retired, Dr. Leonard has supported the testing of the UREX flowsheet. In particular, he designed a 24-stage 2-centimeter contactor that was used in a remote-handled facility to process actual dissolved spent nuclear fuel. Ralph continues his efforts to make centrifugal contactors and solvent extraction a very important tool for the nuclear industry. He is currently working on a temperature model for centrifugal contactors and writing a chapter on centrifugal contactors for a book.

Congratulations to Dr. Leonard on winning the Wilson Award. ■

BILL RHODES 2007 WILSON AWARD SPEECH

As reported in our spring 2008 newsletter, Dr. William D. Rhodes received the 2007 Robert E. Wilson Award at the AIChE annual meeting last November in Salt Lake City. Dr. Rhodes, pictured on the front page of this newsletter, was recognized for his contributions to the U.S. Naval Nuclear Propulsion Program, liquid metal fast breeder reactor technology advances, and chemical engineering leadership at the divisional and national level within AIChE. This includes his role as Meeting Program Chair of the very successful 2007 AIChE Spring National Meeting, which he designed to accentuate the role of the chemical engineer in addressing energy security issues such as global warming. He played a key role in the introduction of programming on nuclear hydrogen production into Nuclear Engineering Division programming at AIChE meetings. Bill worked at Savannah River National Laboratory for many years and recently started at the National Nuclear Security Agency. He served as NED chair in 2005.

During his award talk in Salt Lake City, Bill discussed a spectroscopy technique that enabled him to gain molecular-level mechanistic understanding of a catalysis process during his graduate study – Mössbauer spectroscopy. He noted that this was especially appropriate for the Nuclear Engineering Division of AIChE – application of a purely nuclear technique to understand a chemical process. Through a γ-radiation and absorption process, the "health" or state of a nucleus is probed. Since the nucleus is at the heart of an atom, it feels precisely what the state of the atom is. In short, Mössbauer spectroscopy provides valuable information on the oxidation states, magnetic fields, lattice symmetry, and lattice vibrations of chemical compounds (such as metal catalysts), which has enabled great advances in areas such as Fischer-Tropsch catalysts (iron and cobalt).

The discovery of this technique by German graduate student Rudolf Mössbauer in the early 1950's opens the curtain to reveal the true essence of scientific research. During his study of the nuclear resonance absorption of γ-radiation, he struggled with an obscure effect that stubbornly did not want to vanish. At the time, it was taken as a given that lowering the temperature of an absorber (iridium) would decrease the overlap of the Doppler-broadened emission and absorption lines, increasing

transmitted intensity; however, the opposite effect was observed - by about one part in 10,000. Mössbauer spent over a year thinking that something was wrong with the sign due to instrumentation error, and he painstakingly addressed every possible source of error. After finding none, he slowly realized that if the γ-emission recoil energy is smaller than the energy of lattice vibrations, a quantum mechanical situation occurs: A number of emission or absorption events occur without exchange of recoil energy (recoil-free events). This situation is rare and occurs detectably in only a few elements, most notably iron and tin. The frequency of these events increases with temperature reduction. (Most experiments in this field are now performed at liquid nitrogen or helium temperatures.)

Mössbauer's new understanding led to his first publication, which established a theoretical interpretation of the experimentally observed phenomenon. After 20 minutes of reading the issued copy of his first publication, he jumped up from his chair when he realized that he had overlooked a most spectacular (and simple) Doppler shift experiment which might have already been executed by someone who read his publication. So he quickly built a rotor-type velocity spectrometer, using tooth-wheels from a toy shop in Heidelberg, to give a few different velocities (over a range of a few centimeters per second) to compensate for this effect. These experiments showed the (now) expected phenomenon in full beauty, and Mössbauer published his results in an obscure journal (*Die Naturwissenschaften*) to gain more time for future exploration. He didn't gain much time, though: He received more than 200 requests for reprints immediately after publication. In concluding his remembrance of this series of events in the foreword of *Hyperfine Interactions* 13 (1983) 3-4, he notes "I hope that we all will continue to have fun in lifting, little by little, mother nature's important – and not so important - secrets. Perhaps we are in for other surprises." Mössbauer earned the 1961 Nobel Prize in physics for his discovery. ■

2008 Annual Meeting: Philadelphia

This year, in celebration of AIChE's centennial, the AIChE Annual Meeting will feature special sessions that both highlight chemical engineering innovations over the past 100 years and look into the future. It will also include 15 Core Programming Areas and 17 Topical Conferences focused on the latest developments in areas ranging from core chemical engineering fundamentals to emerging technologies in energy, sustainability, pharmaceuticals, bioengineering and nanotechnology. Nearly 5000 attendees are expected to attend over 750 sessions scheduled for this year's meeting. Featured events include the following:

- Presentation of the 60th Institute Lecturer, "The Rise and Realization of 'Molecular' Chemical Engineering," by Mark Davis, Warren and Katharine Schlinger Professor of Chemical Engineering, California Institute of Technology
- Danckwerts Lecture, "Incremental Identification of Reaction and Transport Models," by Wolfgang Marquardt, Chair of Process System Engineering, AVT, Aachener Verfahrenstechnik
- Professional Progress Award Lecture, "Synthetic Biology in Pursuit of Low-Cost, Effective Antimalarial Drugs," by Jay Keasling, Professor of Chemical Engineering, University of California, Berkeley
- AIChE Centennial Convocation with keynote speaker Bob Brown, President of Boston University, and invited speaker Mayor Michael A. Nutter of Philadelphia

In celebration of AIChE's first 100 years, Centennial events have been planned throughout the meeting. NED urges all members not to miss this once-in-a-century event!

The meeting will be held in historic Philadelphia, the city of AIChE's founding. The meeting will run from Sunday, November 16th, through Friday, November 21st, at the Pennsylvania Convention Center, Loews Philadelphia Hotel and the Philadelphia Marriott Downtown. NED is planning an extensive program for this meeting. Summary information on NED-related portions of the program is provided below. For information on registration, the complete technical program, and other details on the meeting, visit the web page at http://www.aiche.org/Conferences/AnnualMeeting/index.aspx.

Philadelphia Skyline

Also, the Chemical Heritage Foundation has launched a web site recognizing the AIChE Centennial, *Innovation at Work: Chemical Engineers in Action*. The site includes information on chemical engineers' contributions to energy, the environment, materials and much more. You can visit the web site at http://www.chemicalengineering.org/.

NED Sessions

NED is sponsoring three technical sessions, as follows:

- Session 14001: Chemical Engineering Advances in the Nuclear Fuel Cycle
- Session 14002: Engineering Applications of Radioisotopes
- Session 14003: Progress toward Energy Sustainability and Security

AIChE Centennial Topical Conference

NED is participating in Topical Conference H, the AIChE Centennial Topical on Chemical Engineering Research and Technology, with the following session:

- Session TH023: A Celebration of Chemical Engineering Contributions to Nuclear Technology

Hydrogen Topical Conference

NED is also sponsoring Topical Conference 8, Hydrogen Production for a Hydrogen Economy (T8). Sessions are listed below.

- Session T8001: Advances in Thermochemical Cycles

- Session T8002: Catalysts and Membranes for Thermochemical Cycles
- Session T8003: High Temperature Materials and Systems for Application to Hydrogen Production
- Session T8005: Hydrogen Production Economics and Process Design
- Session T8006: Advances in Electrolytic and Thermochemical Processes
- Session T8007: Advances in Alternative Thermochemical Cycles
- Session T8008: Advances in Hybrid Thermochemical Cycles
- Session T8009: Centralized Hydrogen Production on a Massive Scale

Fusion Topical Conference

Also, NED is cosponsor, with the Research and New Technology Committee, of a topical conference on International Fusion Energy Technology (Topical G), with the following sessions:

- Session TG001: Fusion Energy Technology Overview – Plenary
- Session TG002: Fusion Fuel Cycle and Hydrogen Processing
- Session TG003: Fusion Energy Environmental Impacts
- Session TG005: Fusion System Engineering

Joint Sessions with Environmental Division

Finally, NED is cosponsoring the following sessions with the Environmental Division:

- Session 09001: Advanced Oxidation and Reduction Processes for Environmental Applications I (Liquid Phase)
- Session 09002: Advanced Oxidation and Reduction Processes for Environmental Applications II (Liquid / Gas Phase)
- Session 09022: Contaminant Transport and Site Remediation I
- Session 09023: Contaminant Transport and Site Remediation II ■

2009 Spring National Meeting: Tampa

The 2009 AIChE Spring National Meeting will be held in Tampa, Florida, for the first time. The meeting is set for Sunday, April 26th, through Thursday, April 30th, 2009, at the Tampa Convention Center, pictured at right. A wide range of subjects relevant to the current needs of industry will be offered; also, the Global Congress on Process Safety will cover the critical needs of process safety practitioners more broadly and deeply than any other conference.

Tampa Convention Center

NED is working to develop our spring meeting sessions to attract young professionals and others who are new to the nuclear industry. We are especially targeting people in the commercial nuclear industry. NED is planning the following technical sessions at Tampa:

- Nuclear Process Chemistry (six sessions)
- Environmental Factors Associated with Management of Nuclear Materials
- Nuclear Facility Operations
- Advances in Nuclear Fuel Processing and Nuclear Waste Management

Other highlights of the 2009 meeting include the following:

- The 5th Global Congress on Process Safety, featuring the 24th CCPS International Conference, the 43rd Loss Prevention Symposium, and the 11th Process Plant Safety Symposium
- The 21st Annual Ethylene Producers Conference
- 12th Topical Conference on Refinery Processing
- 9th Topical Conference on Natural Gas Utilization

There will also be topical conferences on Distillation, Microreactor Engineering, and Sustainability. For current information on the spring meeting, please check the AIChE spring meeting web page at http://www.aiche.org/Conferences/SpringMeeting/index.aspx. ■

Tampa Bay at Sunrise

AIChE Elections

2008 is an election year for the AIChE Board of Directors. You may have seen the candidate profiles in the July issue of *Chemical Engineering Progress*. Profiles, key dates, and other election information are also available on the web at http://www.aiche.org/election. Ballots will be mailed on Tuesday, September 2nd, and you will be able to vote on the web starting that same day. Paper ballots must be received at AIChE Headquarters by October 7th. Results will be announced on Monday, November 17th, at the business meeting in Philadelphia. ■

NED Help Wanted

NED recently announced several opportunities for service in Division leadership. See the items below for information on the open positions. If you're interested in any of these positions, please contact NED Chair Dan Lambert at (803) 819-8466 or by e-mail at dan.lambert@srnl.doe.gov.

New Student Awards Chair Appointed

Thanks and congratulations to Supathorn Phongikaroon, our new Student Awards Chair. Supathorn is with the University of Idaho at Idaho Falls and can be reached at (208) 282-7937 or

phonst@if.uidaho.edu. He is responsible for planning the student award program and encouraging students to present papers at our NED sessions.

Membership Chairs

In order to focus on increasing NED membership, we are looking for people to encourage colleagues, coworkers and friends to join NED. We especially want to increase the participation of people working in academia and the commercial nuclear industry, two areas which are currently underrepresented in NED. If you are working in academia or the commercial nuclear industry, please consider volunteering to help. With NED's growth in new areas, including hydrogen generation and fusion, and with a nuclear renaissance in our country building steadily, this would be a good time to broaden our membership base and invite people to join NED.

Representative for CTOC, AIChE Board

NED is also seeking one or more experienced members to serve as our representative to the AIChE Chemical Technology Operating Council and the AIChE Board of Directors. For more information on CTOC, see http://www.aiche.org/About/WhoWeAre/Structure/ChemicalEngineeringTechnology.aspx. This is an excellent opportunity for a current or former NED officer to serve at the AIChE national level, although all qualified applicants will be considered.

Young Professionals Chair

We are also looking for someone to develop and lead an NED program to support young professionals. Young Professionals groups are committed to building a network that supports young engineers' transition to the working world, both before and after graduation. ■

NED Participating in 2008 Annual Student Conference

NED is participating in the Student Career Workshop at the 2008 AIChE National Student Conference in Philadelphia, November 14th through 17th (Friday through Monday). The matrix on the last page of this newsletter shows the career workshops and the day and times for each. The exact room locations have not been determined yet but will be announced before the conference. AIChE and NED invite all chemical engineering students to this conference, and we look forward to meeting you in Philadelphia. ■

NED Position Paper on Reprocessing and Nuclear Energy Policy

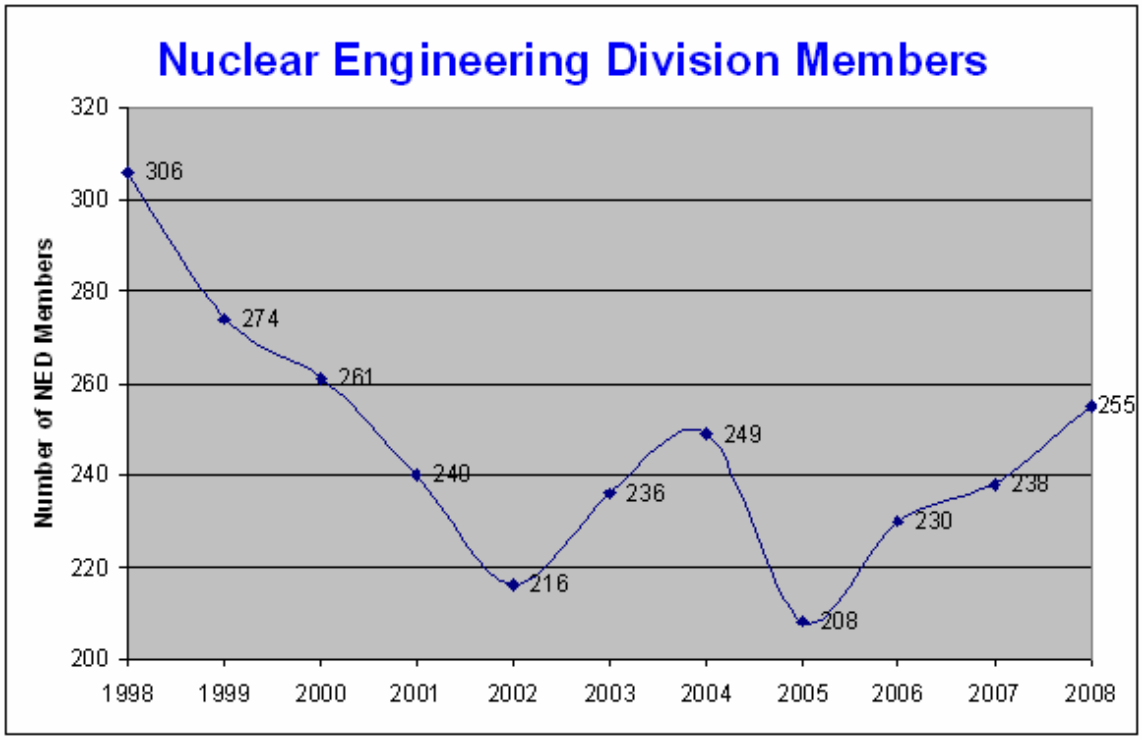
Arlin Olson is still working to put together a position paper regarding U.S. nuclear energy policy as a whole. AIChE and ACS presently have a joint recommendation addressing all forms of energy. The new paper will address sustainability and the federal nuclear waste repository in promoting nuclear energy. A new administration will be installed soon, and it is important to provide facts and education to the new decision makers.

Arlin is interested in getting your comments on nuclear energy policy and on related topics for input to this position paper. Please contact Arlin at (208) 522-4076 or by e-mail at alolson5@cwomc.com to submit your comments and ideas. ■

You're Invited to Join AIChE and NED

NED members are encouraged to invite coworkers to join AIChE and NED. Current and prospective members may get in touch with anyone on the NED contacts list below for more information. Also, you can join via the web at http://www.aiche.org/JoinNow/. NED membership is still only $10 per year!

NED membership has risen significantly in the last three years, after dropping for several years since 1998. See the graph below for membership data over the last ten years. ■



NED Web Page

For more information on NED and related topics, visit the NED web page. In addition to details on material covered elsewhere in this newsletter, you can find NED bylaws and history, recent newsletters, links to various web sites of interest, and much more. Links for the NED and AIChE home pages are provided below.

- NED: http://www.aiche-ned.org/
- AIChE: http://www.aiche.org/

See elsewhere in this newsletter for links for meetings and numerous other topics. ■

Is Your Contact Information Current?

Whenever we make our electronic distribution for the NED newsletter, a dozen or more are returned because of invalid e-mail addresses. If you or an NED colleague did not receive this newsletter via the initial electronic mail message, please make sure that your contact information and other personal data

in AIChE's system are up to date when you renew your membership for 2009. If you wish to go ahead and update now, you may call AIChE at (800) 242-4363, or you can update the data on the web at https://www2.aiche.org/solutionsite/default.aspx?tabid=41&aicheskin=AICHE. You'll have to create a user ID and password if you haven't done so already. ■

Contributions to Newsletter Welcome from All NED Members

NED welcomes contributions from all members for future editions of this newsletter. Potential topics include the following:

- Profiles of outstanding members
- Industry news
- News from your college
- News from your company
- Local section news
- DOE site news
- Relevant political or regulatory developments
- Engineers' Week activities
- Any other topics of potential interest to your fellow members

Please send your contributions to editor Keith Hampton at the e-mail address listed below. ■

NED Contacts

Chair: Daniel (Dan) P. Lambert, dan.lambert@srnl.doe.gov, Savannah River National Laboratory, Building 999-W, Aiken, SC 29808, (803) 819-8466.

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Vice Chair, Energy Programs: Steven R. Sherman, Steven.Sherman@srnl.doe.gov, Savannah River National Laboratory, Building 773-42A, Aiken, SC 29808, (803) 725-8725.

Vice Chair, Environmental Programs: George S. Goff, georgeg@lanl.gov, Los Alamos National Laboratory, J514, Los Alamos, NM 87545, (505) 664-0337.

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MATRIX FOR STUDENT CAREER WORKSHOP

Below is the matrix for the sessions at the Student Career Workshop discussed on page 9. ■

2008 AIChE Annual Student Conference, Philadelphia							
Career Workshops (All Saturday afternoon, 11/15/08)	Room (TBD)	Time					
		1:00 - 1:25	1:30 - 1:55	2:00 - 2:25	2:30 - 2:55	3:00 - 3:25	3:30 - 3:55
Dining Etiquette for Young Professionals	A				25 min		
Networking Skills	A						25 min
Job Search Strategies	A		25 min				
Speed Network to Learn about Process Development Careers	B	75 minutes total			75 minutes total		
Management Careers for Chemical Engineers	C	50 minutes total			50 minutes total		
Green Collar Careers for the Chemical Engineer	D	50 minutes total			50 minutes total		
Chemical Engineering in Nuclear Science and Technology	I			25 min			25 min
Challenges and Opportunities in Particle Technology for Industry and Academia	F	25 min		25 min			25 min
Interviewing in the Energy Sector: Careers in Traditional and Alternative Fuels	G	25 min	25 min	25 min	25 min	25 min	25 min
Panel Discussion: What Is a Chemical Engineer's Job like 5 Years After Graduation?	E				25 min		
Graduate School vs. Job	H	25 min	25min				
Money Management	I		25 min	25 min			
Internships and Co-ops	I					25 min	25 min