

## **2006-2656: THE 2005 WORLD NUCLEAR UNIVERSITY SUMMER INSTITUTE: A NEW FOCUS ON INTERNATIONAL ISSUES IN NUCLEAR ENERGY EDUCATION**

### **Mary Lou Dunzik-Gougar, Idaho State University**

Dr. Dunzik-Gougar is an Assistant Professor in the Institute of Nuclear Science and Engineering at Idaho State University. She holds a joint appointment with the Idaho National Laboratory as an Affiliate Research Scientist. She was part of the Idaho organizing team for the Summer Institute and had key responsibility for the Summer Institute Proceedings.

### **Michael Lineberry, Idaho State University**

Dr. Lineberry is Director of the Institute of Nuclear Science and Engineering for Idaho State University, University of Idaho and Boise State University. He served as lead for the Idaho-based team that organized and ran the WNU Summer Institute.

### **Karen Leibert, Idaho State University**

Dr. Leibert is the Program Coordinator for the Institute of Nuclear Science and Engineering at Idaho State University. She acted as main logistics organizer and jack-of-all-trades for the Summer Institute.

### **Anne Mollberg, Idaho National Laboratory**

Ms. Mollberg is the Educational Programs Group Lead at the Idaho National Laboratory. She lead a team of INL employees to offer many types of support and services for planning and running the Summer Institute.

## The 2005 World Nuclear University Summer Institute: A New Focus on International Issues in Nuclear Energy Education

### The why . . .

The World Nuclear University (WNU) was created in 2003 in a ceremony celebrating the 50<sup>th</sup> anniversary of U.S. President Dwight D. Eisenhower’s famous “Atoms for Peace” speech to the United Nations General Assembly. Four organizations created the founding support for WNU (See Figure 1.): the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency (NEA) of the OECD, the World Association of Nuclear Operators (WANO), and the World Nuclear Association (WNA). The WNU mission is to strengthen the international community of people and institutions so as to guide and further develop:

- The safe and increasing use of nuclear power as the one proven technology able to produce clean energy on a large global scale; and
- The many valuable applications of nuclear science and technology that contribute to sustainable agriculture, medicine, nutrition, industrial development, management of fresh water resources and environmental protection.<sup>1</sup>



**Figure 1.** Logo of the World Nuclear University<sup>1</sup>.

A significant first step toward pursuing the stated mission of this virtual university occurred during six summer weeks of 2005 in Idaho Falls, Idaho. An alliance among the WNU, the IAEA and a team of U.S. institutions produced what we believe to be a significant new approach to education in international issues of nuclear energy. The first annual WNU Summer Institute (WNU-SI) instructed 77 “Fellows” from 33 countries and 5 continents around the world (see Table I.). This select group of upper-level graduate students and young professionals in the nuclear field were instructed on topics ranging from global energy supply and demand to proliferation of weapons usable nuclear material.

**Table I.** Demographics of Summer Institute Fellows<sup>2</sup>

<b>Country</b>	<b>Number</b>	<b>Country</b>	<b>Number</b>
Argentina	2	Italy	2
Armenia	1	Japan	2
Belgium	1	Kazakhstan	2
Brazil	2	Lithuania	1
Bulgaria	1	Mexico	1
Canada	5	Netherlands	1
Chile	1	Romania	1
China	4	Russia	2
Croatia	1	Slovakia	2
Czech Republic	1	Slovenia	1
Egypt	1	South Africa	2
Finland	2	Sweden	4
France	3	Turkey	2
Germany	5	Ukraine	2
Hungary	1	United Kingdom	4
India	4	United States of America	12
Israel	2		

**The how . . .**

The U.S. team of the Summer Institute organizational alliance was supported and led by the U.S. Department of Energy (DOE), and consisted of the Idaho National Laboratory and especially its Center for Advanced Energy Studies (CAES), the Idaho universities through their Institute of Nuclear Science and Engineering, and included the participation of individuals from several other institutions (e.g. the Pennsylvania State University, Pacific Northwest National Laboratory, and the University of Massachusetts - Lowell.)

DOE supported two Penn State emeritus faculty members to tackle organizing the SI curriculum and to solicit Fellow and Faculty participation from WNU headquarters in London. Applications from prospective fellows were accepted from all member nations of the World Nuclear University. The total number of participants was limited by site logistics and the goal of casual exchange among the fellows. Efforts were made to ensure adequate representation from around the world. Expenses per Fellow for the six-week adventure were approximately U.S. \$ 9500 (plus travel), which was provided by the company or country sponsor of the Fellow or by the IAEA (about half of the fellows were supported from each source). Battelle Memorial Institute and the Battelle Energy Alliance (INL administrative contractors) provided funds to allow all of the Fellows to enjoy a variety of social outings on weekends and evenings during the Institute. Much of the Idaho-based team volunteered their time in the early planning days. The INL and

Institute of Nuclear Science and Engineering made numerous in-kind contributions as manpower and services.

**The what . . .**

The intent of the SI was to provide a curriculum not found in traditional universities, where the emphasis is necessarily on the more tangible technical aspects of nuclear science and engineering. A typical day for a WNU-SI Fellow consisted of topical lectures each morning of the five-day work week, and afternoons devoted to group discussions, case studies, and preparation of a final report on one of three topics.

Lecture topics were categorized in the areas of the Global Setting, International Regimes, Nuclear Industry Operations, and Technology Innovations. A more detailed listing of lecture content is provided in Table II.

**Table II.** WNU Summer Institute Lectures

Category	Topic	Authors/Presenters*
Global Setting	The Global Environmental Crisis – Climate Change	H. H. Rogner, Ferenc Toth (IAEA)
	The Global Environmental Crisis – Clean Water Shortage	Charles Vorosmarty (University of New Hampshire)
	World Energy Demand and Supply	Jan Murray (World Energy Council)
	Nuclear Technology in Sustainable Development	Werner Burkart (IAEA), Alan Waltar (PNNL)
	Survey of Nuclear Politics	Leonard Bond (INL), Alan McDonald (DOE/IAEA)
International Regimes	Nuclear Law – Principles, Role and Safety	Carlton Stoiber (ISNL), Wolfram Tonhauser (IAEA)
	Nuclear Law - Liability	Patrick Reyners (NEA)
	Nuclear Law – Non-proliferation and Nuclear Security	Laura Rockwood (IAEA), Carlton Stoiber
	Radiological Protection	Abel Gonzales (ARN), John Greeves (Talisman International. LLC), Ted Lazo (NEA), Sylvain Saint-Pierre (WNA)
	Nuclear Waste Management	Abel Gonzales, John Greeves, Ted Lazo, Sylvain Saint-Pierre, Charles McCombie (Arius)
	Nuclear Waste Management and Decommissioning	Alain Bucaille (PIR), Abel Gonzales, Ted Lazo
	International Safety Standards and Global Safety Culture	Sig Berg (INPO), Ken Brockman (IAEA), Louis

		Mampaey (WANO), Fred Tollison
	Transport of Nuclear Materials and Waste	Rod Fisk (Transport Logistics International, Inc.)
	Global Regimes for Emission Control	Edwin Aalders (IETA)
	Non-Proliferation and Prevention of Nuclear Terrorism	David Beck (SNL), Rich Hooper (IAEA), Tom Shea (PNNL), Richard Nishimura (AECL)
Nuclear Industry Operations	Nuclear Fuel Market	Steve Kidd (WNA)
	Industry Economics	Nicole Dellerio and Didier Beautier (AREVA)
	Comparative Risk Assessment	Robert Budnitz (LLNL)
	Excellence in Management and Operations	Mike Sellman (Nuclear Management Company)
	Knowledge Management	Yanko Yanev (IAEA)
	Public Communications	Ann Bisconti (BRI) and Scott Peterson (NEI)
Technology Innovation	Advance Nuclear Fuel Cycle	Philippe Pradel (CEA), John Sackett (ISU), Robert Benedict (INL), Massimo Salvatores (CEA)
	Next Generation Nuclear Reactors	Ralph Bennett (INL), Jacques Bouchard (CEA), Mikhail Khorochev (IAEA)
	Hydrogen Economy	Anthony Eggert (UCDavis)
	Space Applications of Nuclear Power	Stan Borowski and Robert Cataldo (NASA), Bruce Schnitzler (INL)
	Controlled Fusion	Michael Campbell (GA), Ned Sauthoff (Princeton University)

UCDavis – University of California – Davis  
 AECL – Atomic Energy of Canada Ltd  
 PNNL – Pacific Northwest National Laboratory  
 ARN – Autoridad Regulatoria Nuclear, Argentina  
 ISNL – International School of Nuclear Law  
 BRI – Bisconti Research, Inc.  
 LLNL – Lawrence Livermore National Laboratory  
 CEA – Commissariat à l’Energie Atomique  
 NASA – National Aeronautics and Space Administration  
 GA – General Atomics  
 NEA – Nuclear Energy Agency  
 IETA - International Emissions Trading Association  
 NEI – Nuclear Energy Institute  
 INPO – Institute of Nuclear Power Operations  
 PIR – Philippe d’Iribarne’ Research

Faculty for the Institute were drawn from around the world to share their expertise in all aspects of the global nuclear enterprise. The home organization of the Faculty lecturers assumed the expenses for time and travel, and none of the lecturers received an honorarium from WNU. Institutions represented by over 50 Faculty lecturers are listed in Table II.

In addition to the regular classroom presentations, there was a series of Lectures on Nuclear Leadership. These lectures occurred in the late afternoon and were open to the general public. Topics were of more general interest, offering insight into what it takes to be a leader in the industry, and were presented by international nuclear statesmen/women: Susan Eisenhower (Eisenhower Institute), James Lake (INL), Rich Hooper (IAEA), Demetrius Perricos (IAEA and the United Nations), Geoffrey Ballard (General Hydrogen), and Zack Pate (U.S. Navy and INPO). Other distinguished visitors to the Summer Institute include U.S. Senators Larry Craig and Michael Crapo.

A most valuable feature of the Institute was the provision of a group of seven Mentors, who attended all of the lectures and met on a daily basis with their assigned groups of Fellows. The Mentors were senior, experienced people from the various sectors of the nuclear industry, including government, industry and academia. They stayed in Idaho Falls with the Fellows, and also took part in the SI planning and follow-up efforts. It was in the Mentors' small group environment that the Fellows had further opportunities to learn more of each other, discuss lecture topics, and worked collaboratively on the assigned case studies addressing legal issues, safety culture and public communications.

Approximately one third of the way through the 6 weeks, each Fellow also became part of another small group to work on a final project chosen from several options. Each group prepared a formal written report and gave a presentation to the entire body of Fellows in the final week of the Institute. These projects were not a run-of-the-mill class assignment. In keeping with the goal to educate the participants about international issues of significant impact, the multi-national student groups researched, debated and proposed actions to address issues with far-reaching political, technical and social consequences. Descriptions are given in Table III.

An indication of the interest surrounding the Fellows project work is the fact that all presentations on the PACT project were viewed live by a number of scientists at the IAEA headquarters in Vienna, Austria, followed by an opportunity for questions and answers between the two locations.

The Idaho organizational team arranged for three technical tours, showcasing the world class facilities at the Idaho National Laboratory. Highlights of the INL tours were the Experimental Breeder Reactors – I and II, the Fuel Conditioning Facility, and the Advanced Test Reactor. The Institute closed out in Las Vegas, Nevada, with a tour of Yucca Mountain and a final banquet that included talks by Dr. John Ritch, Director General of the World Nuclear Association (the administrative parent of WNU), and Dr. Hans Blix, Director General-Emeritus of the IAEA.

**Table III.** Final Project Abbreviated Descriptions<sup>3</sup>

<p><b>Final Report Topic 1: National Electrical Energy Policy Development</b></p> <p>Assume you have been assigned to a government task force of a specific country to devise a national electrical energy policy. (Your team will choose a country from among those on a list that will be provided.) The policy you develop should include, but not be limited to, a consideration of nuclear power. The scenario you devise should be based on information that can be obtained from various databases, several of which are listed below. In addition, the team should state any other assumptions necessary to complete the project.</p>
<p><b>Final Report Topic 2: A New Nuclear Energy Paradigm to Minimize Nuclear Proliferation Concerns</b></p> <p>Given input from initial deliberations at the IAEA and elsewhere, draft a global nuclear infrastructure proposal, capable of full implementation by the year 2020, that would allow all nations to enjoy the benefits of nuclear energy while at the same time substantially reducing or even eliminating the related threats of nuclear weapons proliferation by either national or sub-national groups.</p>
<p><b>Final Report Topic 3: Programme of Action for Cancer Therapy (PACT)</b></p> <p>Fellows working on the PACT project will be given data about four different countries, each on a different continent, from which to choose. After deciding which country's needs to address, the team will have the opportunity to gather more data and information and then determine what is the most appropriate next step for that country in providing adequate radiotherapy for the diagnosis and treatment of cancer. Based on your research, your team will write a proposal to the IAEA requesting funding for the initiative your team recommends.</p>

**The result . . .**

The enthusiasm for this event was evident from the earliest stages of planning and spread as though contagious through the many organizers and participants. The Fellows, from which the truest measure of the Institute's success can be obtained, were resoundingly positive about their experience. In casual conversations with the Fellows and through more formal evaluation tools, several themes recurred. First, and foremost, was the opportunity to develop relationships with other young people in the field from around the world, becoming part of an international network of peers and experts. Secondly, the Fellows who did not have formal education in nuclear science or engineering, and even some of those who did, were surprised at the breadth of international nuclear issues. In their words, "We had no idea!" Related to the second point, there was general agreement among the Fellows that the expertise and experience of the presenters was quite impressive. They were honored with the "big name" professionals who clearly wanted to take part in the Summer Institute and take time to share their knowledge.<sup>2,4</sup>

The subjects of greatest interest to the Fellows were: world energy supply, the nuclear fuel cycle (both current state and research for advances), next generation reactor systems, nuclear safety culture, communication with the public, and public understanding. Many Fellows indicated that additional information on reactor design and technology would have been helpful early in the Institute, especially for those without formal nuclear education or those just needing review. It was also suggested that less time be allotted to lectures on nuclear law and non-proliferation.<sup>2</sup>

### **A look forward . . .**

Within the nuclear engineering education community, we have heard a range of opinion expressed about the value of the World Nuclear University, since the concept was first proposed a few years ago. Let us focus on the U.S. nuclear engineering faculty for purposes of illustration. Quite frankly, a considerable number of U.S. colleagues with whom we have talked over the past two years are skeptical about the future of the WNU. Just as surely, there is a considerable number of U.S. nuclear engineering faculty that believe that there is an important niche role that a WNU can fulfill. This group includes, not surprisingly, the authors and all of the faculty members who were active in the first summer institute (Klevans from Penn State, Waltar formerly of Texas A&M, Brown of U. Massachusetts-Lowell). It certainly includes faculty members who were initial supporters of the concept (Waltar, again, Klein of Oregon State and Burchill of Texas A&M).

The appropriate niche role, we conjecture, is for WNU to address in some meaningful way nuclear power issues that are not normally part of curricula in the traditional nuclear engineering programs. Most of the topic areas undertaken in the 2005 summer institute were undertaken with this in mind. Idaho State University may not be a good example because of its small present size, but at our institution we do not cover many of the topics taken up in the summer institute. These topics include nonproliferation, material control and accountancy, international norms of nuclear safety, nuclear law, transportation, and others. Even where we do cover certain of these topics, the coverage is not extensive and generally not from an international perspective.

However, even if one concedes that there is a need for WNU to fulfill a role in the global mission of nuclear engineering education, the summer institute is only a first step. To succeed of course, WNU must go beyond the summer institute, and with the broad involvement of the world nuclear engineering community, put together a full range of products that meet the need. Preliminary discussions are proceeding, led in the U.S. education community by Dr. Waltar, but the outcome at this point is not clear.

During the 2005 summer institute we were struck by the willingness of those who had agreed to present material to travel great distances in order to participate, even if their participation was only for a few hours, or a day. By any measure, the faculty recruited to do this were people of great accomplishment in their fields, and one need only look over the roster of 'faculty' to reach this conclusion. At the same time, it seems unfortunate that, for example, the former head of nuclear energy R&D in France came to talk for only



a couple of hours. A way should be found to take greater advantage of the fact that the most senior statesmen and women in the global nuclear enterprise were willing to participate, to increase their contact-time with the Fellows. Arranging for in-depth presentations and interactions at local and regional universities around the host site would be one way to do this, but we did not pursue this in 2005 and the summer timing would have made that difficult in any event.

### **Closing thoughts . . .**

The purpose of the WNU Summer Institute is to provide a unique educational experience aimed at building future global leadership in the fields of nuclear science and technology.<sup>1</sup> Both organizers and participants agree that the 2005 WNU Summer Institute served that purpose quite well. However, the success of the Institute will be truly realized as the Fellows progress in their careers and make decisions that shape the future nuclear industry. Admiral John Grossenbacher, Director of the Idaho National Laboratory, stated it quite succinctly when addressing the Institute Fellows, “Don’t underestimate the effect you can have as individuals. We’re looking for new leaders. If you don’t do it, who will?”

### **Bibliography:**

1. World Nuclear University web page (<http://www.world-nuclear-university.org>)
2. ”World Nuclear University 2005 Summer Institute Final Report”, M.L. Dunzik-Gougar, J. Hill-Hancock, D. Klevans, E. Klevans, K. Leibert, M. Lineberry, D. Majumdar, A.S. Mollberg, J. Yankeelov, Prepared for the U.S. Department of Energy, Office of Nuclear Energy, Document no. INL/EXT-05-00811, December, 2005.
3. Proceedings of the World Nuclear University-Summer Institute, July – August, 2005.
4. WNU Summer Institute Panel Session at the American Nuclear Society Winter Meeting, Washington, D.C., November, 2005.