



Message From the Chair By Joseph Green
"Safety in Numbers"

In my last message as NISD Chair, I wanted to address recent numbers of science and engineering (S&E) graduates in relation to the impending rapid growth of the nuclear sector and the implications that this seeming disconnect might have on safety.

What prompted me down this path was the widely touted book "The World is Flat"¹ by Thomas Friedman. I highly recommend it for anyone interested in information technology's impact on global business and the highly politicized issue of outsourcing. One chapter points out the changing global demographics of S&E education and characterizes it as a "perfect storm" brewing on the horizon for American business. Geopolitics aside, decline in the US S&E workforce is certainly worthy of concern.

As with any argument, one needs to dig for some statistical ammunition. Table 1 below shows recent numbers of doctorate degrees awarded by US institutions in selected fields of study². (I'm not snubbing the electrical, civil or environmental disciplines – just limited by space.) The marked drop (-78%) in nuclear engineering PhD's is troubling and in general the one-word conclusion I reach from the table is "stagnation" at best, and perhaps something stronger when put in perspective of population and GDP growth over that same time period. An immediate riposte would be that "doctorate" degrees are only one indicator. I agree, and therefore Table 2 provides some "not-too-recent" numbers for selected BS and MS degrees^{3,4}. The pattern however is unfortunately not dramatically changed.

Since my intent here is not to be all "doom and gloom," there is encouraging news of late, particularly in the nuclear field. According to NEI, undergraduate enrollments in US nuclear science and technology programs increased to nearly 1800 last year⁵. That reversal is indeed a positive indicator for the future of nuclear and clearly the result of hard work by many ANS members throughout the universities, laboratories and industry.

This recent change is of course tied to the industry's positive record in delivering ever-greater amounts of electricity safely and the ever-growing promise of new US nuclear construction. That promise is growing palpable with each passing day and news release. With over twelve Combined Operating License applications being considered, Early Site Permits and Design Certifications moving forward, and many international new build prospects, the need for ever-greater numbers of nuclear-trained workers is clear.

We are all well aware of the current demographics of the nuclear workforce. An industry which boomed in the 60's, 70's and 80's will see a sizeable number of retirements in coming years. The large scale integral test facilities and programs investigating one aspect of nuclear safety or another seem a thing of the past. Have we adequately captured this knowledge base and are we vigorously pairing up those with the experience and understanding with those just entering the workforce to ensure a smooth transition for the future? We must also recognize that such knowledge and experience in nuclear safety cannot be transferred overnight. It will take time and perseverance.

The conflux of existing workforce demographics, the somewhat stagnant numbers shown in the tables below and potential rapid industry growth in the near term need not create a "storm" if we plan accordingly. Bridging the knowledge gap between those leaving and those entering the nuclear workforce must be one of NISD's, and indeed ANS's, prime objectives as we move forward in a resurging industry. Indoctrination in lessons learned from the past, adherence to defense-in-depth, and an overall questioning nuclear safety culture are necessary steps.

With that, I'd like to switch gears and convey to you some recent NISD activities. First, you will see later in this newsletter an update of our division policy statement #24 on international nuclear safety standards last issued in 1993. It still requires approval by the Board of Directors in June, but has been approved by the NISD Executive and Public Policy Committees. Many thanks to all involved with the updated statement to re-emphasize the ANS commitment to international safety standards.

Next, I want to bring to your attention the work of the Honors and Awards Committee led by Jan van Erp. Dr. Chauncey Starr will be the recipient of the NISD George C. Laurence award given in Reno, NV this June. Dr. Starr's exceptional dedication and leadership to the nuclear safety arena are truly one of a kind.

Also, you'll note the growing strength of NISD in the number of papers to be presented at the Reno, NV meeting this June. Over 30 summary abstracts were received and reviewed. Special thanks to the highly-dedicated NISD Program Committee and Dana Powers and Ray Gallucci in particular for organizing the sessions on clad embrittlement and fire modeling respectively.

Finally, it was my honor and privilege to serve as NISD

Table 1 - Doctorate Degrees Awarded by US Institutions

| Area | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Mechanical | 1,025 | 1,052 | 1,022 | 1,022 | 855 | 864 | 953 | 827 | 814 | 853 |
| Nuclear | 105 | 113 | 103 | 96 | 76 | 98 | 75 | 64 | 75 | 59 |
| Chemical | 708 | 798 | 767 | 776 | 674 | 725 | 729 | 705 | 648 | 723 |
| Engineering | 6,008 | 6,309 | 6,115 | 5,924 | 5,330 | 5,321 | 5,505 | 5,076 | 5,278 | 5,776 |
| Science | 20,528 | 20,932 | 21,117 | 21,354 | 20,603 | 20,645 | 20,043 | 19,512 | 20,011 | 20,499 |

Table 2 - Miscellaneous Statistics

| Group | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|------------------------------|--------|--------|--------|--------|------|--------|--------|------|------|------|
| BS - Nuclear ³ | | | | 222 | 199 | 159 | 120 | 195 | 166 | 219 |
| MS - Nuclear ³ | | | | 160 | 142 | 133 | 145 | 130 | 132 | 154 |
| BS - Chemical ⁴ | 6,391 | 6,708 | 6,977 | 6,721 | | 6,219 | 6,088 | | | |
| MS - Chemical ⁴ | 1,369 | 1,416 | 1,345 | 1,372 | | 1,352 | 1,368 | | | |
| BS - Mechanical ⁴ | 15,141 | 14,509 | 13,806 | 13,363 | | 13,109 | 13,160 | | | |
| MS - Mechanical ⁴ | 4,368 | 4,009 | 3,756 | 3,551 | | 3,378 | 3,472 | | | |



Chair this year. In 1996, then NISD Vice-Chair Gail Marcus urged me to "get involved" as the division webmaster and newsletter editor. Ten years later, it appears I've run the gamut and I can state in no uncertain terms that I've thoroughly enjoyed the trip. I'd like to end my term by again encouraging more members to "get involved" with ANS and NISD.

References:

1. Friedman, Thomas, "The World is Flat," Farrar, Straus and Giroux, 2005.
2. Science and Engineering Doctorate Awards 2004, National Science Foundation
<http://www.nsf.gov/statistics/nsf06308/pdf/nsf06308.pdf>
3. Nuclear Engineering Academic Programs Survey, 2004, Oak Ridge Institute for Science and Education,
<http://www.ornl.gov/orise/pubs/brief56.pdf>
4. Science and Engineering Degrees: 1966-2001, National Science Foundation, <http://www.nsf.gov/statistics/nsf04311>
5. NEI Website:
<http://www.nei.org/index.asp?catnum=3&catid=1295>

Message From the Vice-Chair By Charles Martin

Last month I spoke to the Washington, DC Local Section on the potential role of nuclear power to help us all meet the demands of sustainable development. It has been very satisfying to feel that not only can we make a contribution to the power mix, but that we might even be a critical technology which must be developed to enable development to continue, and that only through the use of nuclear power, can the lofty goals of sustainable development be realized for the many developing countries around the world. Unfortunately, despite a few notable exceptions such as have been noted at recent ANS National Meetings, the large body of environmental organizations around the world do not yet embrace nuclear power. But world population continues its rapid growth, though it does appear that there is some moderation in the rate of growth; and virtually every objective of the sustainable development community is closely linked to abundant, cheap, reliable, and non-polluting energy. Fission and fusion energy can meet this need. Yes there are some challenges. I would commend to you the following report by the Department of Energy Basic Energy Sciences, which is available from their web site at http://www.sc.doe.gov/bes/reports/files/PSNE_rpt.pdf.

Certainly more can and should be done with solar and energy efficiency, but it seems to me that only nuclear can provide the ultimate solutions. This seems compelling to me, and I believe it is only a matter of time before this will become obvious to even the rank and file environmental groups. Once this occurs, I also believe they will begin to work with us to find the best solutions to the challenges we face regarding security, safety, and waste disposal.

My greatest fear is that a safety failure due to poor maintenance or under staffing will negate the gains we have made in the last several years. I strongly, and I cannot understate this, encourage the work by the Nuclear Regulatory Commission on the subject of safety culture as it is this somewhat ephemeral concept that is implicated in virtually every event. It should be evaluated as objectively as possible and used to tailor the depth and frequency of reviews in specific technical areas. Some have

suggested that trying to educate the public on the real risks associated with nuclear accidents, as opposed to the perceived risks would go a long way to mitigate the need for the breadth and depth of the regulatory process. This may be in the long run, but in the near term, almost any significant accident could undo all of our recent progress. As such, I would call for a safety culture process as rigorous as can be made practical. Then we should assess whether the process so conceived would have likely prevented the most significant of our past events, to include Davis Bessie.

Finally, I would like to propose that the Division consider taking a lead role in capturing some of the safety lessons of the past. Perhaps we can offer a series of professional development seminars at ANS National Meetings focused on transferring these lessons along with the results of the large body of safety testing experiments. I will be working with many of you over the next several months in an effort to organize and present this material. If you would like to be part of this effort, please contact me at charlesm@dnfsb.gov.

Honors & Awards Committee By Jan Van Erp

The 2006 George C. Laurence Pioneering Award for Nuclear Safety will be presented to Chauncey Starr during the upcoming ANS annual meeting in Reno, NV (Tuesday June 6, 2006 at the ANS national awards luncheon). Members of ANS and in particular members of NISD, are urged to attend this event which will honor one of the truly great statesmen of nuclear science and technology. Dr. Starr's accomplishments during a long and fruitful career are numerous and are recognized world-wide, as may be illustrated by the following brief biography:

- **Dr. Chauncey Starr was the founding President, and later Vice Chairman of the Electric Power Research Institute. After serving for more than a decade, he was appointed President Emeritus, the position he currently holds. From 1967 to 1973 he was Dean of the UCLA School of Engineering and Applied Science, following a 20-year industrial career, during which he served as Vice President of Rockwell International and President of its Atomic International Division.**
- **Dr. Starr received an electrical engineering degree in 1932 and a Ph.D. in physics in 1935 from Rensselaer Polytechnic Institute in Troy, New York. He received honorary Doctorate Degrees from Rensselaer Polytechnic Institute, the Swiss Federal Institute of Technology, and Tulane University.**
- **For his work in the peaceful uses of atomic power, he received the Atomic Energy Commission Award (1974), the Walter H. Zinn Award (1979) as well as the Henry D. Smyth Award, 1983 as a pioneer in the field. He received a Distinguished Contribution Award from the Society for Risk Analysis in 1984. The United States Energy Association selected him as the 1990 recipient of the United States Energy Award for exceptional contributions to energy and to international understanding. Dr. Starr received the 1992 Rene Dubos Environmental Award for his contributions to the understanding of the interactions of energy and the environment.**
- **In November 1990, Dr. Starr was awarded the U.S. National Medal of Technology. He was chosen for his outstanding career in industry and education, including his founding and leadership of EPRI, and major contributions in nuclear power, risk assessment, and energy studies.**
- **Dr. Starr is a member and past Vice President of the National Academy of Engineering, and a founder and past President of**



the American Nuclear Society. He is also a member and past Director of the American Association for the Advancement of Science, a Foreign Member of the Royal Swedish Academy of Engineering Sciences, and an Officer of the French Legion of Honor.

Program Committee By Dana Powers

The Nuclear installation Safety Division will sponsor six sessions at the June 2006 Reno meeting. All the Division's sessions will be held in one of the larger meeting rooms at the hotel – Custer I. The sessions promise to be exceptional, with such notable features as:

- Our first session on mathematically modeling of fire will be held. We plan to host sessions on fire safety regularly at future national meetings. This first session looks to be a most interesting kick-off to this area of continuing safety interest.
- We have outstanding participation from European authors at this meeting. Notable contributions will be made in the session of high burnup fuel Tuesday morning. The latest of the QUENCH tests from the Karlsruhe laboratory will be presented. Advances in modeling zirconium alloy oxidation will be presented. One of these papers may well be a “best paper” for the meeting.
- Novel approaches to definitions of cut sets will be presented in the PRA session.
- A new electrical cable insulation that does not produce hydrogen chloride gas in fires will be described.
- First efforts to define alternate source terms for MOX fuel will be described.

Altogether, the following Reno NISD sessions look to be very good this year.

- Emerging Topics in Nuclear Installations Safety, Mon. p.m.
- Clad Embrittlement Criterion for Revised 10 CFR 50.46 Design Basis Accidents, Tues. a.m.
- Alternative Source Term Applications to Improve Power Reactor Safety Analysis–Papers/Panel, Tues. p.m.
- Probabilistic Risk Assessment, Wed. a.m.
- Mathematical Fire Modeling and Its Application to Nuclear Power Plants, Wed. p.m.
- Nuclear Installations Safety: General, Thurs. a.m.

The full Meeting Program may be accessed at:

<http://www.ans.org/meetings>

Session planning for Winter 2006 Annual Meeting (Albuquerque, NM) is underway. In addition to our general sessions of Reactor Safety, Probabilistic Safety Assessment and Nuclear Installations Safety, the following special sessions have been proposed:

- Safety Aspects of Siting Nuclear Facilities
- Safety Aspects of Reprocessing Spent Nuclear Fuel
- Mixed Oxide Fuel Fabrication Facility Construction and Fuel Utilization: Safety and Licensing
- Control Room Habitability: Technical and Regulatory Lessons Learned
- Fire Safety Modeling for Nuclear Facilities
- International Research Reactor Safety Assurance
- Software Safety for Digital Electronics in Nuclear Safety Systems

- Generic Safety Issue 191: PWR Containment Sump Performance and Analysis
 - Pebble Bed Modular Reactor Safety and Licensing
 - Yucca Mountain Licensing Program: Next Steps Forward
 - Emerging Topics in Nuclear Installation Safety Technology
- The flyer for an important NISD topical meeting is provided as the last page in this newsletter.

Scheduled NISD Meetings

All NISD members are welcome to attend the following NISD committee meetings at the June 2006 Meeting in Reno:

- Executive Committee: Monday June 5th, 5:00pm-8:00pm
Shasta 2
- Program Committee: Sunday June 4th, 7:30pm-11:00pm
Nevada 3

The Executive and Program Committees invite NISD members to express their interest in serving on those committees, particularly by participation in one or both of the indicated meetings.

Members may also wish to attend the Honors & Award Luncheon on Tuesday June 6th, 11:30am-1:00pm in the Reno Ballroom. Tickets can be purchased in advance or on-site at the ANS Registration Desk for \$45.

Saul Levine Memorial Scholarship Fund

The NISD recently established a Saul Levine Memorial Scholarship Fund, to be used to support the graduate education of worthy nuclear engineering students. Award of this scholarship is pending further donations. Tax-deductible donations to the Saul Levine Memorial Scholarship Fund may be made by personal check, made out to American Nuclear Society. Please, mark on the check: "for the Saul Levine Memorial Scholarship Fund". Send it to:

American Nuclear Society
Attention: Sharon Kerrick
555 North Kensington Avenue
LaGrange Park, IL 60526 USA

Raymond DiSalvo Memorial Scholarship Fund

David Lartonoix is a recent recipient of a DiSalvo Scholarship for use during the 2005-2006 academic year. Mr. Lartonoix is a student at the University of Illinois-Urbana/Champaign. Additional information for this award can be accessed at <http://nisd.ans.org> (Scholarship).

International Nuclear Power Reactor Safety Standards

The ANS Public Policy Committee has approved Position Statement 24. It will be submitted to the Board of Directors for approval in June of 2006. The current version is provided as follows:

Experience gained from the operation of nuclear power reactors over the past fifty years has demonstrated that, when operated properly, this energy source provides safe, reliable, and environmentally acceptable electrical power for society. Yet as the 1986 Chernobyl accident demonstrated, unsafe practices can have



substantial cross-border impacts. Nuclear safety is a matter of international importance. A significant event anywhere in the world today will affect the operation, regulation, and public perception of nuclear power everywhere. Therefore, ANS supports the establishment and implementation of international standards for all aspects of nuclear power plant safety.

ANS believes that consistent application of such standards can provide a high level of safety. The ultimate responsibility for ensuring safety, however, rests with the operator of the nuclear power plant in rigorously applying these standards. An effective and independent regulatory authority is also essential to ensure that high standards are set and rigorously applied.

ANS supports the development and maintenance of international safety standards formulated with the participation of all stakeholders. International standards should support and be consistent with the recognized principles of nuclear safety. These principles include establishing and maintaining effective and multiple defenses to protect individuals, society, and the environment from radiological hazards and instituting all reasonable features and practices to; prevent and mitigate the consequences of accidents, demonstrate that the radiological consequences of hypothetical accidents fall within prescribed and acceptable limits, and ensure that the risk of accidents with high radiological consequence is acceptably small. To enhance nuclear safety worldwide, ANS supports the exchange of information among all affected parties, including designers, operators, regulators and the public.

ANS is committed to working with those international organizations, such as the International Atomic Energy Agency, engaged in the development and implementation of international nuclear safety standards. ANS will critically review proposed standards, provide technical expertise, and communicate the benefits of resulting international standards to the public and to the appropriate regulatory agencies. ANS also supports the implementation of safety principles and practices globally, including transferring the relevant knowledge and know-how to others as appropriate.

Potential Changes To The NISD Newsletter Distribution

The ANS HQ Staff is considering methods to enhance the exchange of information between the various divisions. For example it has been suggested that as a division's biannual newsletter becomes available it be added to that division's website and a notice (including the appropriate division link address) inserted in the next monthly ANS "Notes & Deadlines", which is distributed electronically. Each division would then have the option for further distribution. For example the NISD could employ one of the following:

- Continue the hardcopy distribution to all NISD members, or
- Send an electronic notice to those members having e-mail addresses, plus hardcopy only to those members not providing e-mail addresses.

The NISD Executive Committee will consider these potential changes in procedures at the June 2006 meeting in Reno. All NISD members are welcome to express their opinions on this item before that meeting to any Executive Committee member (see listing at the end of this Newsletter).

NISD Website

The NISD Website may be accessed directly at <http://nisd.ans.org> or indirectly at <http://www.ans.org>.

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International Topical Meeting on Nuclear Safety and Technology of Hydrogen Production, Control, and Management

An American Nuclear Society Embedded Topical Meeting

June 24 – 28, 2007 --- Boston, Massachusetts



NST-H₂

Overview

In February, a proposal by the Nuclear Installation Safety Division (NISD) for an International Topical Meeting on the Nuclear Safety and Technology of Hydrogen Production, Control, and Management (NST-H₂) was accepted by the Screening Committee of the American Nuclear Society. Specifically, the topical will be organized using the ANS Class III embedded topical meeting format during the Annual Meeting of the American Nuclear Society (ANS) in Boston, Massachusetts, June 24 – 28, 2007. The NST-H₂ Topical will be led by NISD with Fuel Cycle and Waste Management (FCWMD), Thermal/Hydraulics (THD) and Environmental Sciences (ESD) Divisions as co-sponsoring divisions. Discussions are ongoing between ANS and the Nuclear Energy Agency (NEA), the European Nuclear Society, and nuclear agencies of Pacific Rim nations on coordination and participation. David Henderson, of the U.S. Department of Energy's Office of Nuclear Energy, Science and Technology, and its Nuclear Hydrogen Production Program, has agreed to be the General Chair.

The Topical will provide unique opportunities to research & development, safety, program planning, and regulatory professionals for discussing progress, status, experience, and near-term goals in hydrogen production, control and management based on nuclear systems. Because hydrogen is a common link, nuclear safety and technology themes will be highlighted in the both the nuclear production and control, as well as in the nuclear waste processing and management areas.

Papers on domestic and international experiences shall be solicited. The goal for this embedded meeting is 70 to 80 papers with approximately two thirds expected from the nuclear production and control areas, and one third from the nuclear waste and management areas. Both technical paper sessions and panel sessions are anticipated, with opening and closing plenary sessions.

The Call for Papers will go out in mid-2006. We tentatively plan for summaries to be due by January 5, 2007 with author notification later in the month. CD ROM proceedings will be available at registration during the June Annual Meeting.

The Technical Program Committee has been established but seeks additional members for paper solicitation and session leadership (contact Kevin O'Kula at kevin.okula@wsms.com; phone: 803.502.9620).

The following is a tentative list of technical tracks in which the meeting will solicit summaries and full papers:

- 1. Nuclear Production Technology Options: Status and Progress**
 - U. S. Program
 - Pacific Rim Programs
 - European Programs
 - Other
- 2. Nuclear Safety and Technology Development: Status and Progress**
 - Advanced Electrolysis
 - Thermochemical Cycles
 - Steam Reforming
 - Fusion-Based and Advanced System Production
 - Integrated and Co-Generation Systems
 - Balance-of-Plant
- 3. Environmental Aspects of Nuclear-Based Hydrogen Production**
- 4. Economic Perspectives**
- 5. Computer Code Development for Safety and Process Optimization**
 - Analytical Software Development
 - Process Control and Programmable Logic Software
 - Experience with New Generation Software
 - Software Quality Assurance
- 6. Hydrogen Control in Nuclear Power Plants**
 - Experience
 - Issues
- 7. Storage and Control Research and Development**
 - Getter Technology
 - Other Systems – Active and Passive
- 8. Waste Processing and Storage Safety**
 - Hydrogen Control in Waste Processing Facilities
 - TRU Waste Drum Management
 - Worker Safety Issues
- 9. Regulatory Perspectives and Safety Culture**
 - Risk-Informing Paradigms
 - Chemical Industry Lessons Learned
 - IAEA, NRC and DOE Perspectives