American Nuclear Society

Nuclear Criticality Safety Division Newsletter

Winter 2010

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Editor: Larry L. Wetzel
Website: http://ncsd.ans.org

Message from the Chair

Brad Rearden, *NCSD Chair*

Greetings to the ever-increasing membership of the Nuclear Criticality Safety Division. We had outstanding participation in the ANS Annual Meeting in Las Vegas with standing-room-only sessions, even in large meeting rooms, and sell-out attendance at the NCSD Awards Dinner. It is great to see so many of you attending NCSD functions and continuing the community spirit of NCSD.

I am looking forward to another successful meeting in the summer of 2011 in Hollywood, Florida. Please consider submitting a paper for this conference to share your work with the community.

NCSD is establishing an endowed scholarship to encourage well-qualified students to study criticality safety. We have a goal of raising $60,000 for the permanent endowment. In the next few weeks, more information and a donation page will be available on the NCSD website. Please watch for an announcement and consider making a lasting investment in the future of our community.

The real work of the division is conducted in the committees. If you would like to become more active in NCSD, I strongly encourage you to participate in committee activities. The committee chairs always welcome new faces and new ideas. Currently, we are seeking a replacement chair to lead the Membership Committee, transitioning the role from Darby Kimball who has led that committee for several years and is ready to devote her time to other opportunities. If you are willing to take on this important role, please contact Darby or me for more information.

The International Conference on Nuclear Criticality Safety will be held in Scotland in September. This is the premier global topical meeting on nuclear criticality safety, organized every four years by the Organization for Economic Cooperation and Development Nuclear Energy Agency (OECD/NEA) Working Party on Nuclear Criticality Safety (WPNCS). ANS/NCSD is an affiliated sponsor of this conference, and many NCSD members are providing assistance and serving as technical track leaders. I encourage our members to participate in this event to present your technical work and learn from the global criticality safety community.

In addition to organizing the ICNC, the OECD/NEA WPNCS typically meets once per year to discuss emerging issues in criticality safety, as contributed by each member country. A primary function of the WPNCS is to organize expert groups on specific topics of interest and to coordinate the International Criticality Safety Benchmark Evaluation Project (ICSBEP). The expert groups perform detailed studies of import issues and publish reports documenting their findings. The expert groups evolve over time to meet the changing need of the community. Currently there are five expert groups:

- Advanced Monte Carlo Techniques,
- Assay Data of Spent Nuclear Fuel,
- Burn-up Credit Criticality,
- Criticality Excursions Analyses, and
- Uncertainty Analysis for Criticality Safety Assessment.

In the next few weeks, ANS will be hold elections for national and division positions. We have a strong slate of candidates who have volunteered their time to serve in leadership roles in the division. I encourage each of your to take a few minutes to complete the ballot and have your voice heard in selecting our next round of national and division officials.

Brad Rearden

Chair, Nuclear Criticality Safety Division

Program Committee

Chair: Larry Wetzel

Highlights of the Las Vegas Meeting

There were four sessions at the Las Vegas meeting. There were three sessions with paper, a total of 20 presentations, and the Standards Forum. The presentations given in Las Vegas are available in the NCSD website at http://ncsd.ans.org/site/papers_Las_Vegas_Winter2010.html .

The meeting was very well attended. This was the largest ANS meeting in nearly 20 years. We hope that is an indication of the resurgence of the nuclear industry, but part of the credit must be given to being in Las Vegas. The attendance at the NCSD sessions was up also. The Data, Analysis and Operations sessions have in excess of 100 people, up to 120 people at different points during the sessions.

Large crowd for a NCSD Technical Session

As is our custom during the winter meeting, the Division held its annual awards dinner. The dinner was held at was Joe's Seafood, Prime Steak and Stone Crab which is located in Caesar's Palace. Both the Division's Distinguished Service Award and Technical Excellence Awards were given. The Distinguished Service Award was given to Fitz Trumble. Unfortunately, Fitz was not able to attend and receive his award in person. The Technical Excellence Award was given to Luis Leal.

Socializing before the dinner

Socializing before the dinner

Distinguished Service Award

"For Outstanding Leadership in the Division, including Governance, Program & Education Committees; white papers, International Benchmarking and ANS Standards."

Michael Crouse accepting the Distinguished Service Award on behalf of Fitz Trumble

Technical Excellence Award

"For Outstanding development of neutron resonance parameters and associated cross sections and data uncertainties."

Luiz Leal receiving the Technical Excellence Award from Jim Mormon.

Darby Kimball after receiving the Best Paper award jointly with James Laird

Deb Hill accepting the Best Paper Award on behalf of James Rendell

The evening concluded with a special award not given by the Division, but since it was a fitting venue, Jim Mormon was presented with a certificate of appreciation for his leadership of the Criticality Safety Support Group (CSSG). Jim chaired the group from October 2008 to September 2010.

The Division would like to thank the generous sponsors who help make the Awards more affordable for those who attended. Thank You!

 Platinum	 Gold	 Silver
C.S. Engineering	Calvin M. Hopper	CTR Technical Services, Inc.
Richard Taylor	URS Safety Management Solutions	Ron Pevey
Nuclear Safety Associates	Dr. Robert Busch	Tom McLaughlin
Westinghouse Columbia Fuels	Longnecker and Associates	Jerry Hicks
Nuclear Fuel Services	Katherin and Sedat Goluoglu	
BWXT Y-12	UNLV Transmutation Research Program	
Paschal Solutions	PPL Susquehanna, LLC.	

The Program Committee now has a new Vice-Chair, Allison Barber. She will be taking over the committee over the next meeting or two.

Upcoming Meetings (at a glance)

Dates and locations of upcoming meetings are listed below:

Dates	**Location**
June 26-30, 2011	Hollywood, FL (ANS Annual Meeting)
Sept. 19 -22, 2011	Edinburgh, Scotland (ICNC 2011)
Oct 30-Nov 3, 2011	Washington, DC (ANS Winter Meeting)
June 24-28, 2012	Chicago, IL (ANS Annual Meeting)
Nov. 11-15, 2012	San Diego, CA (ANS Winter Meeting)
June 16-20, 2013	Atlanta, GA (ANS Annual Meeting)
Nov. 10-14, 2013	Washington, DC (ANS Winter Meeting)

Hollywood Summer Meeting June 26 – 30, 2011

The next national ANS meeting will be held in Hollywood, Florida at The Westin Diplomat. The paper submission process is now open. The deadline is currently extended to January 28, 2011. The Paper Review is February 14th and 15th. Papers are generally accepted up to the Paper Review, but that is up to the Technical Program Chair of the meeting. It is suggested you get your paper in as soon as possible to allow the reviewers time to adequately review your submission.

The proposed sessions for the Hollywood meeting are:

1. **Data, Analysis, and Operations for Nuclear Criticality Safety – Contributed**

   The purpose of this session is to provide a forum for timely presentation of general issues in the area of nuclear criticality safety that are not covered in other special session topics.

   Session Organizer: Larry Wetzel, B&W NOG, 434-522-6580, llwetzel@babcock.com

2. **Nuclear Criticality Safety Standards Forum – Panel**

   Subcommittee ANS-8, Operations with Fissile Material Outside Reactors, meets to discuss various technical and administrative aspects of the approximately 20 national consensus standards under its purview. In addition to status and progress updates by representatives of individual working groups, formal presentations on the technical bases of numerical values such as subcritical limits and experiences with applications of particular standards are solicited. Agenda topics such as new and expanded standards are also encouraged.

   Session Organizer: Davis Reed, ORNL, 865-576-6359, reedda@ornl.gov

3. **Nuclear Criticality Safety Issues Related to Conduct of Operations"**

   The Los Alamos report, LA-13638, "A Review of Criticality Accidents," concluded that conduct of operations issues, ineffective personnel communication, incomplete understanding of abnormal conditions, lack of awareness of criticality hazards, untrained operating personnel, and lack of self-reporting of process upsets, for example, contributed to many of the process criticality accidents. The intent of this session is to share lessons learned between nuclear criticality safety programs related to conduct of operations issues in operations with fissionable material outside reactors.

   Session Organizer: Doug Bowen, LANL, 505-667-5939, dgbowen@lanl.gov

4. **Proper Applications of Benchmarking in Criticality Safety**

   Use of codes and calculational techniques in criticality safety requires proper comparison to experimental values. This session will discuss how new critical experiments are designed, planned and executed and important measurements to be made and data to be collected during critical experiments. The development of benchmark evaluations for incorporation in the International Criticality Safety Benchmark Evaluation Program Handbook (ICSBEP Handbook) from experiments will be discussed. The methods for collapsing differential cross section measurements will be described, and the effect of the cross section collapse assumptions on

criticality safety calculations will be discussed. Advantages and disadvantages of various cross section libraries for criticality safety will be presented.

Session Organizer: Jerry Hicks, DOE-AL, (505) 845-6287, jhicks@doeal.gov

5. **Improvements in NCS Controls**

   One of the objectives of NCS is to establish controls that are not likely to fail. This includes utilization of technology, training, and changes in equipment design to make the mesh the controls with the normal operations. The objective is to make it easy to do it right and hard to do it wrong. In this session, papers should focus on how NCS controls have been improved or developed to improve the robustness of the controls. Specific examples would be beneficial.

   Session Organizer: Sandi Larson, NSA, 865-483-8247 sandi.larson@nuclearassociates.com

ICNC 2011, Edinburgh, Scotland, September 19 – 22, 2011

The draft technical program is available for ICNC 2011. The full details of the meeting can be found at www.icnc2011.com . The Call for Papers is out and can be seen by clicking here.

Submission of Abstracts:

Review of the abstracts will be made by the ICNC International Technical Programme Committee which has been established in collaboration with the OECD Nuclear Energy Agency (NEA) Working Party on Nuclear Criticality Safety (WPNCS).

- Abstracts to be submitted on-line to: www.nea.fr/science/meetings/ICNC2011/index.html
- Abstract submission will open on 1 November 2010, closing on 28 February 2011.
- Authors will be notified of acceptance of their presentations by end of March 2011.
- Authors are asked to use the abstract and paper templates provided at the website and indicate which element of the Technical Programme below best describes the content of their paper. Detailed instructions to authors are also available at the website.

The technical program has been divided into 9 areas. They are:

Programme Area Issues

1. **Development of Standards and Assessment Methodology**

   - guides, standards, handbooks,
   - general methodology developments for fuel fabrication, storage, reprocessing, transport, decommissioning etc.
   - ‚special' methodology developments, e.g. for fuel fabrication & transport of advanced reactor fuels >5w/o enrichment, risk informed methods,
   - optioneering studies/methods

- consistency of safety margins, integration with overall facility safety cases, „fit-for purpose' safety cases

2. Operational Practise

- practical considerations in the implementation of criticality control
- selection of methods of control, measurement techniques, compliance issues
- operator training, human factors, criticality audits and inspections
- lessons learnt from operating experience, incidents

3. Criticality Codes and Nuclear Data

- improved user interface/checking tools
- testing of new codes & data
- improvements to nuclear data
- identification of experimental needs

4. Criticality Experiments new evaluations of existing experiments

- new experiments
- future programmes

5. Uncertainty Analysis

- derivation of code/nuclear data bias and its uncertainty
- sensitivity analysis, selection of representative validation benchmarks
- assessment of manufacturing/operational uncertainties

6. Analysis of Criticality Accidents and Incidents

- modelling of criticality excursions
- analysis of causes of accidents/incidents,
- lessons learnt for emergency response planning
- accident detection and alarm systems: adequacy/omission studies

7. Burnup Credit modelling issues, code development, validation

- application & implementation, bounding assumptions, burn-up measurements, compliance issue
- future uses, e.g. disposal, new build

8. Waste Management Issues waste inventories, variability, characterisation requirements, special issues

- design of waste packaging, design of waste packaging processes,
- assessment of retrieval/conditioning/packaging/surface storage operations

- design of disposal facilities, assessment of disposal operations, assessment of post-closure phase

9. **Professional Development Issues**

   - maintaining/building capability, national programmes, core competencies, training programmes
   - international coordination/collaboration
   - meeting future challenges, e.g. new build

Washington, DC Winter Meeting October 30 – November 3, 2011

The winter meeting will be held in Washington, DC at the Omni Shoreham Hotel. The proposed sessions for the meeting are:

1. **Data and Analysis in Nuclear Criticality Safety**

   The purpose of this session is to provide a forum for timely presentation of general issues in the area of nuclear criticality safety that are not covered in other special session topics.

   Session Organizer: Larry Wetzel, B&W NOG, 434-522-6580, llwetzel@babcock.com

2. **ANS 8 Standards Forum**

   Subcommittee ANS-8, Operations with Fissile Material Outside Reactors, meets to discuss various technical and administrative aspects of the approximately 20 national consensus standards under its purview. In addition to status and progress updates by representatives of individual working groups, formal presentations on the technical bases of numerical values such as subcritical limits and experiences with applications of particular standards are solicited. Agenda topics such as new and expanded standards are also encouraged

   Session Organizer: Davis Reed, ORNL, 865-576-6359, reedda@ornl.gov

3. **Lessons Learned in NCS, "What Happened and What We Learned" –**

   Some of the most valuable information comes as a result of a problem someone experienced. Organizations conduct investigations, establish corrective actions and issue Lessons Learned documents, but they quite often do not go outside the organization. The sharing of those Lessons Learned throughout the NCS community could prevent a serious event elsewhere.

   Session Organizer: Larry Wetzel, B&W NOG, 434-522-6580, llwetzel@babcock.com

4. **Recent Criticality Safety Activities at Y-12**

   Criticality safety engineers at Y-12 are challenged to run the WWII-era-designed uranium processing operations safely. Recently, a state-of-the art facility HEUMF has been built and is operational for storing HEU securely. Extensive criticality safety work has been undertaken for the ORR along with transferring and storing HEU. Innovative criticality safety work is underway

to support the design work of UPF, which will replace the existing uranium processing facilities. Criticality safety engineers also support the design of many innovative nuclear shipping packages. This session will present different aspects of the innovative and creative criticality safety work that is performed at Y-12.

Session Organized: Pran Paul, Pran Paul, Ph.D., (865) 241-5164, paulp@y12.doe.gov

5. **Determination of Overall Likelihood for NCS Accident Sequences –**

The NCS community in both NRC and DOE regulated facilities are familiar ANSI/ANS-8.1 standard which stipulates fissile material processes must be demonstrated safe under both normal and credible abnormal conditions. Practicing criticality safety engineers also must ensure at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. Current regulations (10CFR70 or 10CFR830) stipulate that credible NCS accident sequences be demonstrated "highly unlikely" visa vis quantitative and/or qualitative risk assessment methodologies. The purpose of this technical session is to provide a forum to share how this determination is made. Considerations include, but are not limited to, how facilities assess total probability of the initiating event and how the credible accident sequences are "mitigated" to acceptably low risk levels by applying neutronic parameter controls (e.g. IROFS, TSR).

Session Organizers: Lon Paulson (NCSD), GE Hitachi Nuclear Energy (910) 819-5460, lon.paulson@ge.com

The paper submission for the Washington meeting will open this summer.

Education Committee

Chair: Katherin Goluoglu

The Education Committee had another busy and productive year. The Realism in the Assessment of Fissionable Material Operations Outside Reactors white paper has been approved. A white paper on Integrating Nuclear Criticality Safety into Design is being worked on by the committee, and a white paper on Criticality Accident Alarm Systems and Immediate Evacuation Zones is also in the works. The very contentious white paper on Proper Implementation of the Double Contingency Principle has been permanently removed from the Education Committee list of white papers to be worked on. Standard ANS-8.1 is being revised; hopefully all the comments and questions received during the committee's debate over this white paper will be addressed by the ANS-8.1 Working Group in the new revision!

Since most of the existing white papers were last revised more than three years ago, they will be revisited and revised if necessary. Although the Education Committee meets twice a year during ANS National Meetings, please do not wait to send in comments/suggestions/questions about the existing or potential white papers.

Finally, we are always looking for good topics for tutorials and workshops that would benefit the criticality safety community.

Education Committee is working on white papers on "Integrating Criticality Safety into Design" and "Criticality Accident Alarm systems and Immediate Evacuation Zones". The following table shows a list of white papers currently published by the NCSD.

The current white papers are listed below and they can be viewed and downloaded at the White Paper webpage.

Executive Committee

Division Officers	
• **Chair:** Brad Rearden, Phone: 865-574-6085, Oak Ridge National Lab • **Vice Chair:** Doug Bowen Phone: 505-667-5939 Los Alamos National Lab	• **Treasurer/Finance:** Sedat Goluoglu Phone: 865-574-5255, Oak Ridge National Lab • **Secretary**: Allison Barber Phone: 505-301-7426 Sandia National Lab, Inc

Executive Committee		
Through June 2011:	**Through June 2012:**	**Through June 2013:**
• Julie G. Ezold Phone: 865-574-9594 Oak Ridge National Lab	• Jerry Hicks Phone: 505-845-6287 DOE, Albuquerque	• Chris Robinson Phone: 865-574-8509 BWXT Y-12, LLC
• David P. Heinrichs Phone: 925-424-5679 Lawrence Livermore National Lab	• Deborah A. Hill, Phone: (+44) 1772 764359 National Nuclear Laboratory	• Adolf Garcia Phone: 208-526 4420 DOE, Idaho
• Larry L. Wetzel Phone: 434-522-6580 Babcock & Wilcox - NOG	• Ronald E. Pevey Phone: 865-974-7573 University of Tennessee	• Nick Brown Phone: 423-753-0209 Nuclear Fuel Services

NCSD Executive Committee Meeting Summary

The executive meeting at the ANS Winter meeting in Las Vegas, NV discussed many important topics. All the executive members were in attendance. A large debate going though ANS National is over giving students the opportunity to vote in national elections. Because students can be elected for division positions (secretary and treasurer), however, they have been unable to vote for those positions. While there is also a separate issue of students gaining national voting rights.

There is a new clarification on the awards that each division gives out each year. The honors and awards committee will be reviewing these classifications and determining if our awards have been classified as the division sees appropriate. The topic of endowed scholarship was discussed. Rob Frost would like to have something setup on the NCSD website to provide a simplified and more direct way of donating money to the Pioneers Scholarship. There would be an option for levels of sponsorship, for example, $25 for young professional all the way up to $125 for senior members of the division. NCSD is also considering visually tracking the donations on the website with a donation thermometer. The goal endowed scholarship is $60,000.

In all around division news:

- Membership committee needs a successor to take over Darby Kimball's position as chair.
- The publications committee needs a volunteer to take over the News Letter.
- The Honors and Awards committee suggested the scholarship needs for advertisement to get more applicants.
- Is there still a need for the Realism Committee, if you think so let the chair know.
- Don't forget about ICNC 2011 in Edinburgh, Scotland.
- The ANS Student Conference will be hosted by Georgia Tech in Atlanta, GA in 2011 and they are looking for volunteers to be judges for the technical tracks.
- NCSD will be having a Nuclear Criticality Evaluation Workshop at the ANS Annual Meeting in Hollywood, FL.

Of Interest

Scholarship Drive

Rob Frost

After the passing of Libby Johnson, the possibility of establishing an NCSD Pioneer Scholarship was first considered. The scholarship was established to encourage and heighten student interest in the field of nuclear criticality safety, while also honoring those whose work continues to serve as the basis for our profession. The first scholarship was awarded in 2008.

NCSD's only sources of income are the small allotment we get from headquarters, what we earn on our topical meeting every 4 years, and surplus income from the awards dinner. The Pioneers Scholarship has been supported on a pay-as-you-go basis through generous donations from our members and by allocating money from our general fund. Unfortunately, this has led to uncertainty in year-to-year availability of funds. The Executive Committee voted last year to establish an endowment for the Pioneer Scholarship to ensure that the scholarship can continue to be awarded in the future. Most of the large divisions have endowed scholarships. A Special Committee was formed to lead this effort, and has determined that the endowment would best represent the Division if it were created through contributions from the Division

members. In order to make the process as easy as possible, a page will be created on the NCSD website where contributions can be made online via credit card. We will display total contribution amounts to date and compare to our goal. We will also honor contributors on the website unless they ask to remain anonymous. We expect the website to be operational in time for a fundraising kickoff in March or April. Watch for the announcement!

NCSP Workshop

Adolf Garcia

The U. S. Department of Energy will sponsor a technical workshop on Friday, July 1, 2011 in conjunction with the American Nuclear Society Annual Meeting in Hollywood Florida. This workshop will highlight the progress made over the past year in the six technical elements of the National Nuclear Security Administration (NNSA) Nuclear Criticality Safety Program (NCSP). Workshop will encourage audience participation and request for input to help the program stay on the most effective path

> The mission of the NCSP is to provide sustainable expert leadership, direction, and the technical infrastructure necessary to develop, maintain, and disseminate the essential technical tools, training, and data required to support safe, efficient fissionable material operations within the United States Department of Energy.

Although funded by the NNSA, the products of the NCSP are widely used by criticality safety professionals on a global scale, including codes, cross sections, benchmarks and training tools. This workshop will include update on recent developments in the following technical program elements of the NCSP. A detailed agenda for the workshop will be published in the program for the ANS Meeting.

Analytical Methods

The Analytical Methods element provides for the development and maintenance of state-of-the-art analytical capability for the processing of nuclear data and the radiation transport analysis needed to support nuclear criticality safety evaluations, including training and assistance to the user community.

Information Preservation and Dissemination

The Information Preservation and Dissemination element preserves primary documentation supporting criticality safety and makes this information available for the benefit of the technical community. **The** NCSP internet website (http://ncsp.llnl.gov) is the central focal point for access to this information.

Integral Experiments

The Integral Experiments element maintains a fundamental capability for the DOE NCSP to be able to perform critical, subcritical, and fundamental physics measurements. This program element also supports maintaining a fundamental nuclear materials handling capability which enables hands-on nuclear criticality safety training programs for the DOE NCSP and other government agencies.

International Criticality Safety Benchmark Evaluation Project

The purpose of International Criticality Safety Benchmark Evaluation Project is to identify and evaluate a comprehensive set of criticality safety related experimental benchmark data; evaluate the data and quantify overall uncertainties, compile the data into a standardized format, and formally document the work.

Nuclear Data

The Nuclear Data element includes the measurement, evaluation, testing, and publication of neutron cross-section data for nuclides of high importance to nuclear criticality safety analyses. The NCSP coordinates of nuclear data activities by fostering a strong collaborative effort among all of our national and international resources in this highly technical area.

Training and Education

The Training and Education element continues to offer hands-on training courses and to identify and develop training needs and resources in areas where no suitable materials exist. The primary purpose of the T&E element is to maintain the technical capabilities of criticality safety professionals and provide for the training and education of people entering the criticality safety discipline from related scientific fields.

The Professional Engineer License: How Do You Get One?

Rebecca Steinman PhD, PE, Advent, a Tetra Tech Company

Nuclear energy is finally experiencing resurgence. However, engineers under the age of 40 have little experience with designing and building a new nuclear power plant. Less than 5% of newly degreed nuclear engineers become licensed professional engineers (PEs). In fact, only a very small group of practicing engineers, approximately 10% of the four-million U.S. engineers, has demonstrated through education, experience, and examination the ability to meet the minimum requirements necessary to protect the health, safety, and welfare of the public, i.e., obtained a PE.[1] What level of confidence does this give the public that the next generation of nuclear power is going to continue the excellent safety record of the current generation of plants?

For many young engineers, the question of whether or not to pursue licensure often boils down to whether or not their employer supports their effort to obtain their PE versus an advanced degree, and whether or not obtaining their PE will result in immediate benefits, such as a promotion or increase in salary. The fact of the matter is that an advanced degree and a PE license are both valuable, but in different ways. An advanced degree fills the role of increasing technical knowledge in a specific engineering discipline. However, the role of a PE is to ensure that practicing engineers maintain a minimum acceptable level of competence and ethical duty necessary to protect the health, safety, and welfare of the public. In the past, many practicing nuclear engineers have gone their entire career without having to obtain a professional license to perform their daily job duties. However, a change in attitude towards nuclear licensure may be on the way.

The National Society of Professional Engineers (NPSE) recently released a statement saying that the nuclear energy industry should require a PE to supervise all engineering design, operations, and maintenance decisions.[3] This statement was also provided to the Blue Ribbon Commission's Reactor and Fuel Cycle Technology Subcommittee of the US Department of Energy.[3]

Additionally, many states already have or are proposing very strict laws prohibiting the use of the words "engineer" or "engineering" in a company name or any advertisement without that company or association having a PE on its full-time staff. Nevada, for example (NRS 625.520 1 (a) (3)), imposes restrictions using variants of the term "engineer" in any solicitation for engineering work in that state

(such as a job title on a business card if you are not licensed and your card is distributed to the public as a solicitation for work) unless it is disclosed that "the person is not qualified, registered or licensed to practice professional engineering in this state."[4] Without this disclosure, someone can give the impression that they are legally able to provide engineering services when they are not legitimately entitled. The bottom line is that if the public has to rely on their safety being provided by the lowest bidder, that chosen individual/contractor is legally bound to be at least minimally qualified (as evidenced by the PE process) to provide a product that will ensure public safety.

Perhaps you are wondering how one becomes licensed as a professional engineer. To become licensed, engineers must typically complete an ABET-accredited, four-year degree; pass the Fundamentals of Engineering (FE, also referred to as the Engineer-in-Training (EIT)) exam; work under the direction of a PE for at least four years; pass the PE exam; and be approved for licensure by their state's licensure board.

The FE exam is an eight-hour, closed-book exam administered by the National Council of Examiners for Engineering and Surveying (NCEES) in April and October of each year. The exam is 180 multiple-choice questions that cover a broad scope of engineering topics that are designed for students nearing the end of an engineering degree program. The exam is split into a morning session (120 questions) of general engineering scope that everyone takes and an afternoon session (60 questions) that is specific to one of seven engineering disciplines (chemical, civil, electrical, environmental, industrial, mechanical, and "other"). Although a person may apply for and take the FE exam at any time, the highest pass rate is when the FE exam is taken during an engineering student's senior year. The average pass rate for first-time FE exam takers drops from 75% to 52% for those waiting just two years after college to take the FE exam.

The PE exam is also an eight-hour exam designed to test your competency to perform tasks in a specific engineering discipline. The Nuclear PE exam is administered by the NCEES in October of each year. This discipline-specific exam enhances the opportunity for nuclear engineers to qualify for a PE license; since taking the exam in an alternative discipline, such as mechanical or electrical engineering, could be more difficult. However, the Nuclear PE exam is in danger of being discontinued if the number of applicants taking the exam does not increase. The exam currently consists of 80 multiple-choice questions covering the following five broad categories: power systems; fuel and waste management; radiation protection/shielding/interactions of radiation with matter; criticality/kinetics/neutronics; and measurements and instrumentation. This exam is currently an open-book exam, which means that exam takers are allowed to bring in any number of their own personal bound reference materials for use during the exam. (Note: For security reasons, the NCEES is currently discussing a limit of 15 reference books being allowed into the PE exam. Additionally, NCEES places restrictions on the type of calculators that can be used on the PE exam.)

Although all FE and PE exams are now administered by the NCEES, the exact process for applying to take either exam depends on the state in which you work since part of the process is being approved to sit for the exam from your state board. In general, states require an application to be submitted with appropriate proof of education and applicable references to be submitted for board review and approval several weeks prior to the NCEES registration deadline. General information about the exam registration process for each state and updated information about registering through the NCEES site is available via

http://www.ncees.org/Exams.php. NCEES opens registration for the April exams in January and the October exams in July, and closes registration sometime in March and September, respectively. You must already have your state board's approval to sit for the exam when you register with NCEES.

In addition to the exam application, many people choose to participate in exam preparation courses or order exam study guides to aid in exam preparation. The American Nuclear Society (ANS) offers a study guide, published in CD-ROM format, containing over 500 pages of information pertaining to PE registration, the FE exam, the PE exam, suggested references to prepare for the exam, and sample problems with solutions. This study guide can be purchased from ANS at http://www.new.ans.org/store/i_690025. ANS also offers a one-day Nuclear PE exam preparation workshop in conjunction with the society's annual meeting in June of each year.

If nuclear engineers are to be among the engineering decision-makers in the future, they need to follow a path to obtaining a PE license. There is a considerable sense of pride derived in qualifying for a PE license and considerable respect for those that have a PE license from associates and the public in general. Passing scores are typically easier to achieve earlier in your career, but it is never too late to apply for and pass the requisite exams.

References:

1. "Gulf Oil Spill and the Role of Professional Engineers", Larry Jacobson Executive Director NSPE, June 29, 2010
2. Transcript of the August 31, 2010 meeting of the Reactor and Fuel Cycles Technology Subcommittee of the Blue Ribbon Commission on America's Nuclear Future, pg 323-325 available at http://brc.gov/Reactor_Fuel_Cycle_Technology_SC/docs/Aug_30-31_Mtg/0831musc.pdf
3. "PE Licensure and America's Nuclear Future", available at http://newsmanager.commpartners.com/nspeupdt/issues/2010-09-22.html
4. http://www.leg.state.nv.us/NRS/NRS-625.html#NRS625Sec520