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Paul Felsher, Editor

Message from the Chair

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Greetings! One of the best things about being part of the Nuclear Criticality Safety technical community is being able to share in the celebration of successes and accomplishments among our colleagues. This year we have seen two first-of-a-kind criticality experiments performed in the U.S. Sandia National Laboratories achieved criticality in their Burnup Credit Critical Experiment assembly on July 24,2002 and has since provided the first measured data on the worth of the fission product rhodium. On October 17, 2002 Los Alamos National Laboratory achieved criticality on an experiment conducted using the Planet assembly device that provides data for the first experimental determination of the critical mass of neptunium. I want to extend my congratulations and appreciation to the teams that envisioned and brought to fruition these experiments. These are wonderful accomplishments especially in today's economic and political environment.

Over the past decade many members of our Division have actively worked to systematically identify and document 'Experimental Needs' to achieve our nation's programmatic goals. Although needs have been identified, the cost associated with experimental programs is often the leading factor in pursing alternative approaches to validation, i.e., attempting to validate against codes rather than experiments, extrapolating the range of applicability of existing experimental data, etc. All of these are technically credible approaches, but the degree of risk is directly related to the extent and care with which they are used. The necessity for experiments to complement and verify calculations using advanced computational and modeling tools is well established. However, as I am sometimes reminded by the trials and tribulations of my own work and those related to me by the dedicated group working to develop a standard for code validation (ANS-8.24), this is one area where the devil is truly in the details as to what the right mix is! Which are the right experiments to do? Is this data appropriate for my application? How do I determine/verify the area of applicability? What is the best way to determine bias? What is a safety margin? And so on. Based on my work with the OECD/Nuclear Energy Agency's (NEA) Working Party on Nuclear Criticality Safety (WPNCS), the questions are generally the same both nationally and internationally and the responses are more tailored to the application than they are to nationality. Personally, I have never heard the question, 'Do we really need experiments anymore?', debated in an international environment. The overarching concern shared by the international criticality safety community is the preservation of the *capability* to perform measurements when needed. The diverse capability of a facility like the Los Alamos Critical Experiments Facility is truly a national treasure.

I believe that our Division plays a key role in providing a positive venue and forum for technical exchange among criticality safety professionals. The ANS-8 standards are an invaluable resource coordinating and codifying the practices of the nuclear criticality safety professional community. Further, our Division through its Education Committee and its commitment to actively engaging in the ANS Mentor program and the Public Information and Policy is a positive influence in terms of cultivating and communicating the value of our profession. My goals in my short tenure as Chairman are to support the established goals of our Division, seek out individuals with a strong commitment to the criticality safety profession to fill key leadership roles in the Division and promote open communication with Division membership. I'd like to have every member of our Division feel part of the technical community and get value from their membership. I endorse continuing and promoting local meetings of Division members as initiated by Bob Wilson. I invite any member with a desire to contribute to contact me. There is an initiative involving the development of Division white papers that could use some volunteer help. Take advantage of the resources available through Division membership and make your own contribution, get involved…pass it on!

Neptunium Criticality Achieved

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A full-controlled criticality of the element neptunium was achieved in late September at Los Alamos National Laboratory's Technical Area 18 using a six kilogram nickel-clad neptunium sphere in combination with approximately 60 kilograms of enriched uranium.

The experiment was conducted using the "Planet" assembly device at the Los Alamos Critical Experiments Facility or LACEF. The neptunium and enriched uranium assembly was constructed at TA-18's Critical Assembly and Storage Area-One, and mounted on the "Planet" device. The actual criticality was controlled remotely to assure the safety and security of the experiment.

The experiment has yielded preliminary data that show the critical mass of neptunium is actually less than previously predicted. Following additional experimentation, the data will eventually pinpoint the element's exact critical mass, something that has not been determined before in the United States.

Neptunium is an element produced as a by-product of nuclear power generation. Prior to this experiment, the critical mass of neptunium was only estimated with computer models from data based on earlier experiments using much smaller amounts of the element in less than optimal configurations.

"The results of this experiment are of interest to scientists working in the fields of nuclear safeguards, nuclear nonproliferation and criticality safety," said Steve Clement of the Laboratory's Advanced Nuclear Technology group, part of the Nonproliferation and International Security Division. "While the actual criticality was achieved in about four days, this experiment has been in the works for 12 years, so on many levels, it's a major accomplishment."

Neptunium is a man-made actinide metal, grayish in color, which lies on the periodic table of elements between uranium and plutonium. The isotope of neptunium used in this first criticality experiment was neptunium-237. The element has other isotopes that are very short lived, but neptunium-237 has an extraordinary long half-life of two million years. The International

Nuclear Criticality Safety Division (2002-2003)

Officers

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Vice Chair:	James Baker, jbaker@lanl.gov
Secretary:	Kevin Reynolds, reynoldskh1@oro.doe.gov
Treasurer:	Christa Reed, christareed@att.net

Executive Committee and Committee Chairs

2003 Jerry McKamy, Membership, jerry.mckamy@eh.doe.gov
2003 Lon Paulson, Education lon.paulson@gnf.com
2003 Valerie Putman, Honors and Awards, vputman@inel.gov
2004 Mark DeHart, Program Committee, dehartmd@ornl.gov
2004 Paul Felsher, Publications, paul.felsher@juno.com
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2005 Keyes Niemer, kaniemer@dukeengineering.com
2005 Bonnie Rumble, brumble@nisyscorp.com

Atomic Energy Agency approved monitoring neptunium in 1999.

Rene Sanchez and David Loaiza, both of Advanced Nuclear Technology, were primarily responsible for the successful criticality, along with a team that included Clement, Robert Kimpland, David Hayes, Peter Jaegers, Charlene Cappiello, Bill Myers, Ken Butterfield, Charles Hollas, Charles Goulding, Joetta Goda, Eric Sorensen and a support team of special nuclear materials custodians and others.

"Fabrication of the sphere was completed about 18 months ago here at Los Alamos," said Sanchez. "Since then we've been in planning, getting permission from the Department of Energy to do the experiment and taking care of security issues. Once all that was in place, it took about four days to do the technical operations of the experiment. It could not have been accomplished without the hard work and determination of the whole team, NIS management and the NNSA Office of Los Alamos Site Operations."

"After working together as a team for so many years doing something and wondering 'Is it ever going to happen?' it was such a great feeling to actually bring it together," said Loaiza. "The people here at TA-18 are just amazing, excellent people."

The work was done to support the DOE's Criticality Safety Program and the National Nuclear Security Administration's Nonproliferation Program and Emergency Response Program.

So-called "bare" criticality is achieved when sufficient mass of fissile material is present to sustain a nuclear chain reaction without any reflective materials. The neptunium criticality was achieved in a "low power" state, where the overall radioactivity is kept relatively low, at about 300 millirem per hour, and no significant heat or fission byproducts are created.

Since the neptunium sphere alone was not of sufficient mass to sustain the nuclear reaction, it was placed in the center of several thin nested shells of enriched uranium configured in an upper and lower half, with the neptunium sphere located in the lower section. The uranium in this case helps drive the system aiding in the neptunium's ability to sustain the chain reaction. The two halves of the assembly were placed in the "Planet" device, one half above the other, a safe distance apart. During the experiment, measurements are taken as the lower section is raised and brought closer and closer to the upper section until sufficient mass of fissile materials is present and criticality is achieved. Since the reactivity of enriched uranium is well established the critical mass of neptunium can be readily calculated from the experiment's resultant data.

"LACEF is the only operational general purpose critical mass laboratory in the Western Hemisphere. It is the only facility in the United States where this kind of experiment could be done," said Clement.

The team plans to continue with further experiments using a variety of reflecting materials. This will enable the scientists to determine the critical mass of neptunium under a variety of conditions, as that mass can vary depending on the amount of neutrons reflected or absorbed by materials surrounding the nuclear material.

The nickel-clad neptunuim sphere is shown resting in the lower half of the assembly surrounded by the shells of enriched uranium that make up the upper half of the experiment. Photo Credit: Los Alamos National Laboratory

Program Committee

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The ANS Summer Meeting is scheduled for June 1-5, 2003 in San Diego, CA. The NCSD sessions are below.

Data, Analysis, Operations for Nuclear Criticality Safety - Contributed. This session is the general session for NCSD papers, which do not fit any other session topic. Session Organizer: Richard Taylor, (865) 482-8086, rtaylor238@comcast.net Chair: Dennis Tollefson, (865) 576-4281, tollefsonda@y12.doe.gov Alternate Chair: R. Chris Robinson, (865) 574-8509, ycr@y12.doe.gov

Nuclear Criticality Safety Standards Forum – Panel. Session Organizer: Tom McLaughlin, (505) 667-7628, tpm@lanl.gov Chair: Tom McLaughlin, Alternate Chair: John Schlesser, (803) 952-3385, john.schlesser@wxsms.com

Determination of Overall Likelihood for NCS Accident Scenarios Under 10CFR70 - Panel. Session Organizers: Lon Paulson, (910) 675-5460, Lon.Paulson@gnf.com and Robert Frost, (423) 610-0249, Robert.Frost@nuclearassociates.com, Chair: Charles Robinson, charles.robinson@nuclearassociates.com

Nuclear Criticality Safety Issues for First Responders – Contributed. **Session Organizer:** Kevin Reynolds, (865) 574-7580, reynoldskh1@oro.doe.gov, Chair: Kevin Reynolds, Alternate Chair: Ed Kendall, (865) 574-8647, kendallfe@y12.doe.gov

Criticality Safety Issues in Transportation Packaging – Contributed. **Session Organizer:** Robert Frost, (423) 610-0249, Robert.Frost@nuclearassociates.com, Chair: Michael Corum, (423) 743-9141, Michael.Corum@nuclearassociates.com, Alternate Chair: Robert Frost

ANSI/ANS-8.1 Clarification

In response to an inquiry regarding the term "unlikely", the ANS Steering Committee recently released a clarification for ANSI/ANS-8.1–1983, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*. The clarification was published in the January, 2003 issue of *Nuclear News* and is also expected to be available at the ANS Standards Subcommittee 8 web page (www.xsms.com/ans).

NCSD 2003 Election

Bob Wilson,
Nominating Committee Chair,
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As a volunteer organization, the NCSD is wholly dependent on members assuming responsibility for success to be possible. We fortunately have a long tradition of talented people stepping up and keeping us going. This process needs to continue as new people come into the division, present papers, organize sessions, serve on committees and get nominated for officer positions. The nominating committees generally look for reliability, competence and diversity in seeking candidates. We would particularly encourage new members to get involved in tasks for the division.

Among the executive committee candidates in the upcoming NCSD elections are two off-shore members. We would appreciate it if each voter would include one of these among their three choices. It is a division objective to have off-shore participation in our governance.

Slate for 2003-04 election is as follows:

Chair: Jim Baker

Vice Chair/Chair Elect: Christa Reed

Secretary: Ellen Saylor
Kevin Kimball

Treasurer: Kevin Reynolds
Harry Felsher

Executive Committee (2003-2006):
Bill Lee
Tom Burns
Fitz Trumble
Jerry Hicks
David Ericsson
Dennis Mennerdahl*
Jim Gulliford*
* Indicates International member
(vote for 1 of these if possible)