

# American Nuclear Society

## Nuclear Criticality Safety Division Newsletter



**Fall 2008**

<http://ncsd.ans.org>

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## *Message from the Chair*

I am both excited and honored to begin my term as Chair of the NCS D – the most energetic and dynamic Division in the ANS! As this newsletter reaches you we are counting down the days to what is possibly the most important event for criticality safety engineers: the NCS D Topical Meeting. This meeting, which is only held every four years, is not only noted for the abundance and quality of papers of interest to the NCS community, but also because it attracts such a large portion of the overall NCS community, allowing us to reconnect with colleagues from around the country, and indeed from around the world. This time around the meeting is being held in Richland, Washington, home of the Hanford site, the Pacific Northwest National Lab, the AREVA fuel fabrication plant, and the Energy Northwest nuclear power plant, amongst others. There are over 75 papers scheduled for presentation, and a full slate of after-hour social activities. I hope to see you there.

The NCS D Pioneer Scholarship continues to be a high priority for the Division. You may recall the scholarship was awarded for the first time in 2008. The primary source of funding for the scholarship is from the Division's share of Topical meeting income, so by attending the Topical you help fund this important initiative. You can also make a direct contribution to the fund in memory of one of the Pioneers.

Our Division continues to hover just over the 800 mark in terms of membership. As Chairs of recent past have noted, participation in our Division by Young Members and Students has increased significantly over the past several years, and this is certainly a trend we intend to work hard to maintain. One method for getting the word out to potential members of all ages is via a brochure that the Membership committee has been developing. That brochure is nearing completion and should be ready for the Winter 2009 meeting.

Speaking of the Winter Meeting, it will be held in Washington, DC at the Omni, and we will have the NCS D Awards dinner that week. I know that it can be hard to travel to the Winter Meeting only two months after the Topical – but I hope you will make a special effort to attend.

Larry Wetzel has done an outstanding job with the NCS D website. If you haven't visited it lately, I encourage you to click over to <http://ncsd.ans.org>. In addition to lots of good information about the Division, there are pictures from recent meetings, the Division's White Papers, and lots more.

Although the national and world economies are suffering, the news for our industry continues to be bright. It isn't just new nuclear power plants that are being planned, but also new enrichment plants, fuel fabrication facilities, DOE facilities, etc – the types of plants that rely on the expertise of criticality safety engineers. I hope you will join us at our upcoming meetings to share in the excitement!

*Rob Frost, NCS D Chair*

**Program Committee**

Chair: Nichole Ellis

**Highlights of the Atlanta Meeting**

Five sessions were held with a total of 25 papers. The sessions were

- Advances in Nuclear Criticality Accident Excursion Analysis
- Integration of Nuclear Criticality Safety into New Facility Design
- Nuclear Criticality Safety Staff and Operations Interface,
- Data, Analysis, and Operations for Nuclear Criticality Safety – I and II

The presentations given in Atlanta are available in the NCSD website at [http://ncsd.ans.org/site/Atlanta\\_summer2009.html](http://ncsd.ans.org/site/Atlanta_summer2009.html).

**Upcoming Meetings (at a glance)**

Dates and locations of upcoming ANS meetings are listed below:

<b>Dates</b>	<b>Location</b>
Sept. 13-17, 2009	<a href="#">Richland, WA (NCSD Topical)</a>
Nov. 15-19, 2009	<a href="#">Washington, D.C. (ANS Winter Meeting)</a>
June 13-17, 2010	<a href="#">San Diego, CA (ANS Annual Meeting)</a>
Nov. 14-18, 2010	Las Vegas, NV (ANS Winter Meeting)
June 26-30, 2011	Hollywood, FL (ANS Annual Meeting)
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)

**NCSD 2009**

**Nuclear Criticality Safety Division Topical Meeting**

September 13-17, 2009

Richland, Washington

<http://www.ncsd2009.com>

**Technical Program**

The following general subjects are proposed for the technical program:

**Realism and Criticality Safety:**

- Input data
- Cross sections
- Modeling
- Accident scenarios

**Applications and Realism:**

- Benchmark selection
- Tsunami and other methods
- Sub-critical Measurements
- Burn-up credit applications

**Robustness in controls:**

- Development of Criticality Controls
- Requirements documents DOE, NRC
- Standards role
- Implementation of Criticality Controls
- Examples
- International experience

**Ready for the Renaissance:**

- Status and scope of GNEP
- Criticality safety needs for the fuel cycle (enrichment, fabrication, transportation, storage and disposal)
- Harvesting existing benchmark data (fuel cycle and nuclear data)
- In-situ measurements
- Criticality safety and engineering design
- Use of computers in operations controls
- People needs, training and education

**Panel discussion:** “Are We Ready?”

**Workshops**

There will be four workshops at NCSD 2009. They are:

<a href="#">Keno (Scale 6)</a>	Sunday 1:00 - 5:00
<a href="#">Tsunami (Scale 6)</a>	Sunday 1:00 - 5:00
<a href="#">DICE (Benchmark Experiment Database)</a>	Thursday 8:00 - 12:00
<a href="#">VISED (MCNP Visual Editor)</a>	Thursday 8:00 - 12:00

**Tours**

LIGO Tour

Date and Time: Wednesday evening (tentative)  
 Cost: \$15

The [Laser Interferometer Gravitational Wave Observatory](#) (LIGO) seeks to detect gravitational waves (ripples in the fabric of spacetime) and the measurement of these waves for scientific research. First predicted by Einstein in his theory of relativity, gravitational waves are produced by exotic events involving black holes, neutron stars and objects perhaps not yet discovered. The facility supports an L shaped ultra high vacuum system measuring 2.5 miles on each side.

B Reactor Tour / Hanford Site Tour

Date and Time: Thursday, 12:30 - 4:30 PM (tentative)  
 Cost: \$25 (includes box lunch)

The focus of this tour will be a visit to [Hanford's B Reactor](#), the world's first industrial-scale nuclear reactor. B Reactor was built during World War II as part of the top-secret Manhattan

Project to develop the atomic bomb. One of three plutonium production reactors built in total secrecy at Hanford during the war, B Reactor produced plutonium for the Trinity test in Alamogordo, New Mexico, on July 16, 1945, and for the atomic bomb exploded on Nagasaki, Japan on August 9, 1945 effectively ending World War II. The reactor was named a national historic landmark last July.

This tour will also include a "drive by" of some of Hanford's various facilities, including the new Waste Treatment Plant (WTP). Construction of WTP began in 2002 with large placements of concrete and structural steel. By September the WTP should be approximately 50% complete. The WTP will be an industrial complex of facilities for separating and vitrifying (immobilizing in glass) millions of gallons of radioactive and chemical wastes stored at the Hanford Site. The five major components of the WTP will be the Pretreatment Facility for separating the waste, the High-Level Waste Vitrification and Low-Activity Waste Vitrification facilities where the waste will be immobilized in glass, the Analytical Laboratory for testing physical and chemical properties of the waste at different stages to ensure the quality of the glass, and the Balance of Facilities which will comprise over 20 various support facilities. Once complete, the WTP will be the largest and most capable facility of its kind in the world.

Preregistration is required for this tour and space may be limited. People who are not US citizens **MUST** get preapproval no later than **July 17th**, 2009. Please contact [Maynard Plahuta](#) for additional details.

#### Areva Tour

Date and Time: Thursday, afternoon (tentative)

Cost: \$15

This tour will visit Areva's nuclear fuel plant in Richland. More details coming soon.

Preregistration is required for this tour and space may be limited. Participation may be limited based on nationality and employer. **All participants** must get preapproval no later than **July 17th**, 2009. Please contact [Maynard Plahuta](#) for additional details.

## Washington, DC Meeting

### **Tuesday Afternoon**

**Highlights from the NCSD2009 Topical Meeting**, sponsored by NCSD. *Session Organizer:* Mikey Brady Raap (PNL) This session includes presentation highlights from the NCSD2009 Topical Meeting, September 13–17, 2009. The selected papers will address the following technical subject areas: Realism in Benchmark Selection and Modeling Assumptions; Realistic Safety Margins; Robustness in the Development of Criticality Controls; Realism in the Application of the Double Contingency Principle; and Criticality Safety Needs to Support the Global Renaissance of Nuclear Power, including training, education and workforce needs. The papers for this session will be listed in the final program.

**Wednesday Morning****Next Generation of Nuclear Criticality Safety Professionals****Embedded Topical on**

- What the NCS World Offers to Young Professionals, Larry L. Wetzel (*B&W NOG-L*)
- Providing Nuclear Criticality Safety Analysis Education Through Benchmark Experiment Evaluation, John Darrell Bess, J. Blair Briggs, David Nigg (*INL*)
- Nuclear Criticality Safety Curriculum for Engineering Students, Jesse McBurney-Rebol, Fred Gunnerson (*Univ of Idaho*)
- Training Next Generation NCS Engineers at the Y-12 NSC, C. F. Haight, J. J. Lichtenwalter, R. C. Robinson (*B&W Y-12 Technical Services*)
- MCNP Variance Reduction Techniques: What to Use When, and How, James Laird (*Univ of Michigan*), Darby Kimball (*Bechtel National*)

**Wednesday Afternoon****Data, Analysis, and Operations for Nuclear Criticality Safety—I,**

*Session Organizer: Nichole Ellis (Ellis Nuclear Eng)*

- SCALE TSUNAMI Analysis of Critical Experiments for Validation of  $^{233}\text{U}$  Systems, Donald Mueller, Bradley T. Rearden (*ORNL*)
- On the Accuracy of the Differential Operator Monte Carlo Perturbation Method for Eigenvalue Problems, Jeffrey A. Favorite (*LANL*)
- Criticality Benchmark Analysis of Water-Reflected Uranium Oxyfluoride Slabs, Margaret A. Marshall, John Darrell Bess (*INL*)
- Gad Rod Worth Evaluation for Criticality Safety Analysis of the RAJ-II BWR Bundle Shipping Package, Tanya Sloma (*GNF*), Peter Vescovi (*Westinghouse*), John Zino (*GNF*)
- Statistical Noise for Nuclear Criticality Safety Specialists, Dennis Mennerdahl (*E Mennerdahl Systems*)
- Authorization Basis Requirements and Safety Classification for Criticality Accident Alarm Systems, Mark A. Joseph (*B&W Y-12 Technical Services*)

**Thursday Morning****Nuclear Criticality Safety Standards–Forum.**

*Session Organizer: Thomas P. McLaughlin (Consultant)*

**Thursday Afternoon****Data, Analysis, and Operations for Nuclear Criticality Safety—II,**

*Session Organizer: Nichole Ellis (Ellis Nuclear Eng)*

- Criticality Safety Control Strategy at the MOX Fuel Fabrication Facility, James Bazley, Michael Shea, Robert Foster (*Shaw AREVA MOX Services*)
- MCNP5 Criticality Benchmark Validation for Uranium and Plutonium Metal Systems Using ENDF/B-VII.0, Christopher Aaron Geiser, Qi Ao (*GE Hitachi Nuclear*)
- Incredibility of a Nuclear Criticality Accident, Jerry Lichtenwalter, Frank Sweeney, James L. Byrd (*Y-12*)
- Neutronic Isolating Media for Degraded Spent Fuel Storage in Casks, Benjamin T. Baranko (*Nuclear Safety Associates*)

## San Diego Call for Papers

The 100 word summaries for the San Diego meeting are provided below. Take a look and consider submitting a paper on one of the topics. If you have a paper that does not fit into one of the specific topics, you can submit it in the Data, Analysis, and Operations session. If you have topics you think would be good for future meetings, email them to [Larry Wetzel](mailto:Larry.Wetzel).

### 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:** Nichole Ellis, Ellis Nuclear Engineering LLC, (803) 381-3710, [ellis\\_9899@msn.com](mailto:ellis_9899@msn.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:** Tom McLaughlin, LANL-retired, (505) 667-7628, [tpm@pobox.com](mailto:tpm@pobox.com).

### 3. Computational Advances in Criticality Safety Analysis - Contributed

In recent years, new features have been added to the computational tools that have been used for criticality safety analysis. The features include overall improvement both in the computational and user-friendliness aspects. The session should provide exposure to other computational tools for criticality safety analysis besides MCNP and KENO. The session should include, but not be limited to, new computational tools, the new features of the widely used computational tools, user experiences using the computational tools, limitations and enhancement requirements, and validation and benchmarking of the computational tools.

**Session Organizer:** Pran Paul, Y-12, [paulp@y12.doe.gov](mailto:paulp@y12.doe.gov).

### 4. Hazard Analysis of Nuclear Criticality Safety Evaluations Tutorial I - Contributed

This two part tutorial will feature methods commonly used to identify criticality accident scenarios in nuclear operations for disposition in criticality safety evaluations. The strengths and weaknesses of various hazard analysis techniques will be discussed. Principles of using these methods will be presented and various examples will be provided of reasonable application of the methods to plant nuclear operations. Instructors from several NCS programs will participate.

**Session Organizer:** Bob Wilson, EM, (303) 236-3666, [Robert.wilson@emcbc.goe.gov](mailto:Robert.wilson@emcbc.goe.gov).

**5. Hazard Analysis of Nuclear Criticality Safety Evaluations Tutorial II - Contributed**

This two part tutorial will feature methods commonly used to identify criticality accident scenarios in nuclear operations for disposition in criticality safety evaluations. The strengths and weaknesses of various hazard analysis techniques will be discussed. Principles of using these methods will be presented and various examples will be provided of reasonable application of the methods to plant nuclear operations. Instructors from several NCS programs will participate.

**Session Organizer:** Bob Wilson, EM, (303) 236-3666, [Robert.wilson@emcbc.goe.gov](mailto:Robert.wilson@emcbc.goe.gov).

***Education Committee***

**Chair: Sedat Goluoglu**

The white paper on the Definition of a CSE Specialist has been superseded by the standard, *ANSI/ANS-8.26-2007: Criticality Safety Engineer Training and Qualification Program*. The education committee requested removal of the white paper and the executive committee approved.

The Nuclear Criticality Safety Evaluation white paper has been posted for external comment for 60 days. The authors have addressed all comments, and the education committee has approved the final version. The education committee will submit the white paper to the executive committee for final review and approval.

The current white papers are listed below:

<b>Whitepaper Topic</b>	<b>Primary Author(s)</b>	<b>Activity</b>
Education Committee Overview	Paulson	Revised 6/06 (Rev 0)
Successful NCS Mentorship Program	Rumble	Revised 6/06 (Rev 0)
Acceptable Evaluation of NCS	Paulson/Felsher	Revised 6/06 (Rev 0)
Nuclear Criticality Accidents In The Workplace: Fact Sheet	Taylor	Revised 6/06 (Rev 1) Minor Revision (4/09)

## Executive Committee

### Division Officers

- |                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                              |
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| <ul style="list-style-type: none"> <li>• <b>Chair:</b><br/><a href="#">Robert Frost</a>,<br/>Phone: 423-610-0249,<br/>Nuclear Safety Associates</li> <li>• <b>Vice Chair:</b><br/><a href="#">Brad Rearden</a>,<br/>Phone: 865-574-6085,<br/>Oak Ridge National Lab</li> </ul> | <ul style="list-style-type: none"> <li>• <b>Treasurer/Finance:</b><br/><a href="#">Bonnie J. Rumble</a><br/>Phone: 859-319-3200,<br/>NISYS Corporation</li> <li>• <b>Secretary:</b><br/><a href="#">Randy Shackelford</a><br/>Phone: 423-743-2504<br/>Nuclear Fuel Services, Inc.</li> </ul> |
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### Executive Committee

- | Through June 2010:                                                                                                                                                                                                                                                                                                                                    | Through June 2011:                                                                                                                                                                                                                                                                                                                                | Through June 2012:                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• <a href="#">Donna M. D'Aquila</a><br/>Phone: 740-897-4076<br/>United States Enrichment Corporation</li> <li>• <a href="#">Peter L. Angelo</a><br/>Phone: 865-241-4559<br/>Y-12 National Security Complex</li> <li>• <a href="#">Darby S. Kimball</a><br/>Phone: 415-768-5360<br/>Bechtel National</li> </ul> | <ul style="list-style-type: none"> <li>• <a href="#">Julie G. Ezold</a><br/>Phone: 865-574-9594<br/>Oak Ridge National Lab</li> <li>• <a href="#">David P. Heinrichs</a><br/>Phone: 925-424-5679<br/>Lawrence Livermore National Lab</li> <li>• <a href="#">Larry L. Wetzel</a><br/>Phone: 434-522-6580<br/>Babcock &amp; Wilcox - NOG</li> </ul> | <ul style="list-style-type: none"> <li>• <a href="#">Jerry Hicks</a><br/>Phone: 505-845-6287<br/>DOE, Albuquerque</li> <li>• <a href="#">Deborah A. Hill</a>,<br/>Phone: (+44) 1772 764359<br/>National Nuclear Laboratory</li> <li>• <a href="#">Ronald E. Pevey</a><br/>Phone: 865-974-7573<br/>University of Tennessee</li> </ul> |

The executive committee met at the Atlanta meeting. The highlights of the meeting are listed below. The full minutes of the meeting can be read on the [website](#).

#### Report from the Chair

The ANS president continues to emphasize the topic of “getting the word out.” NCSD is responding to this request with the brochure, which is to be finalized shortly. The brochure will emphasize what we provide to new professionals and students.

What can national headquarters do for us? Although we are in the large division category, we only have 817 members, just exceeding the 800-member threshold for a large division. Our division needs additional income to support our programs. Our primary source of income is topical meetings. The extra \$1/member recently allocated to NCSD was passed on to students.

Government relations – president Burchill and president-elect Sanders sent letters to the Obama transition team to discuss the role of ANS in nuclear matters in the US. Other letters were sent to Secretary of Energy Chu who has responded to letters personally.

Chris Profetti, 2009 Student Conference chair from University of Florida, reported that they hosted the largest student conference with 528 attendees and 139 presentations. They are thankful for support from NCSD. The next student conference will be held at University of Michigan.

Report from the Treasurer:

For the current year, the student funds were distributed. The Division currently has a \$15,000 surplus in the budget, but this could be more based on the lack of expenses and the potential high income from the NCSD topical meeting.

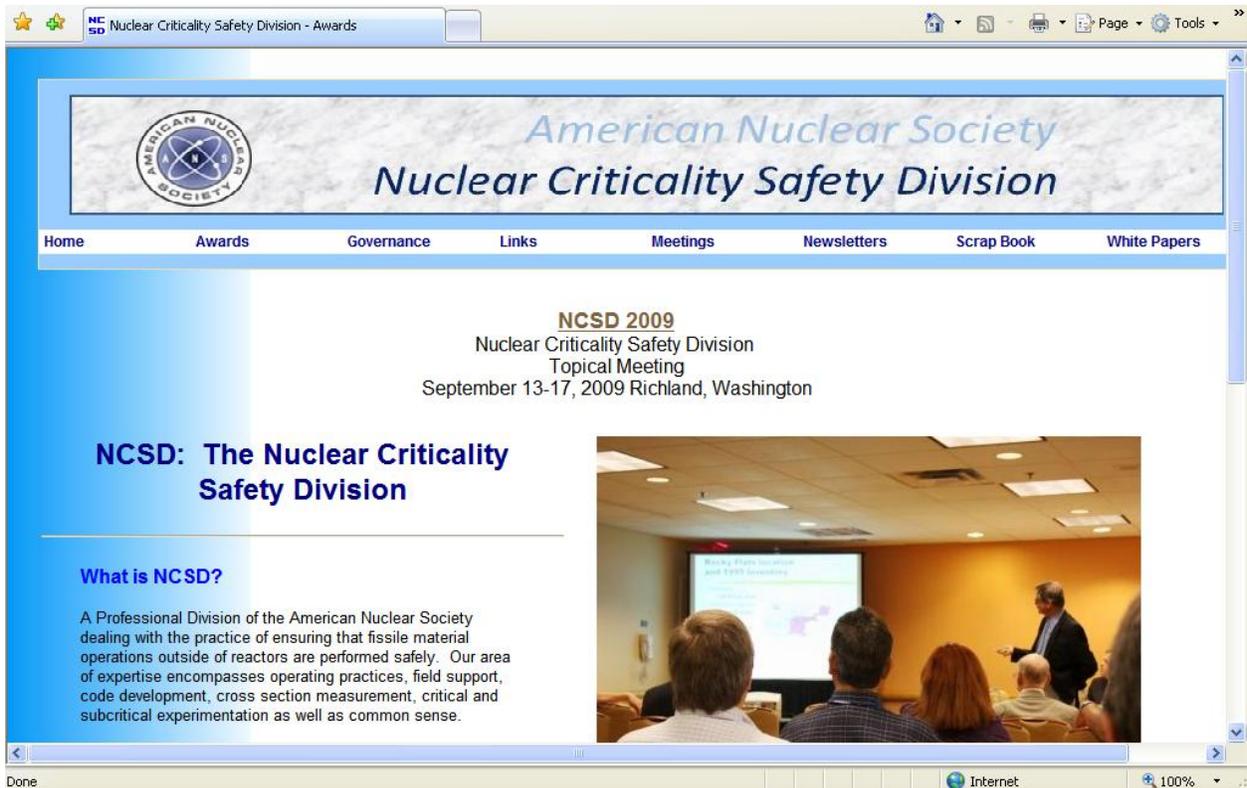
From the Membership Chair

The membership committee has focused on the brochure. The final brochure does not meet expected quality standards. The help of a professional graphic designer was employed. Turnaround on the brochure is expected in approximately one month. No comments were received on the initial draft brochure. Cost estimates for the brochure are \$0.30 - \$0.60/copy for folded 8.5" x 14" color glossy prints. It is expected to purchase about 4000 copies for \$2000.

**NCSD Website**

**Webmaster: Larry Wetzel**

The NCSD website continues to undergo changes to better present our division to the world. Information from the soon to be issued brochure was used to describe the Who, What and Why of NCSD. Most of the presentations for the Reno and Atlanta meetings are on the website. Check it out at [ncsd.ans.org](http://ncsd.ans.org).



## ***News from Members***

**Submitted by Randy Shackelford**

### **NFS Receives Nuclear Historic Landmark Award from ANS**

At the 2008 ANS Winter Meeting in Reno, Nuclear Fuel Services, Inc. (NFS) was recognized as a Nuclear Historic Landmark for contributions that NFS has made to the nuclear industry for more than 50 years. NFS Representatives Richard Booth (Corporate Services Director) and Randy Shackelford (Nuclear Criticality Safety Manager) accepted the award on behalf of NFS at the Honors and Awards Luncheon. The citation was for contributions to the development and production of nuclear materials, the advancement of nuclear chemical processing technology, and excellence in nuclear materials management. On June 3, 2009, ANS Executive Director Jack M. Tuohy presented the inscribed bronzed plaque to NFS at a ceremony held at the NFS site. While congratulating NFS on the award, Mr. Tuohy said “What I find particularly striking is that unlike most of the previously designated National Historic Landmarks, NFS continues today as a vital part of the nuclear industry.”

NFS is a uranium processing facility located in Erwin, Tennessee that provides a variety of services and materials to the nuclear industry, the most notable being uranium fuel materials for the U.S. Navy. NFS also blends highly enriched uranium (HEU), from surplus weapons-grade material, with natural uranium to produce low enriched uranium (LEU). This LEU is subsequently used to fuel commercial nuclear power plants and support the Reliable Fuel Supply Program.

NFS began operations on July 8, 1957 in Erwin, Tennessee as the Davison Chemical Plant (a division of W. R. Grace & Company). Three individuals, including T. C. Runion, the company’s first General Manager and, later, its first President, left the Fernald Plant (outside of Cincinnati, Ohio) to establish the Erwin facility funded entirely with private capital. The Erwin, Tennessee location was chosen because of its proximity to Oak Ridge, Fernald, Savannah River, and B&W-Lynchburg. The early processes included conversion of  $UF_6$  to  $UF_4$  by hydrogen reduction, conversion of  $UF_6$  to derby metal by reduction with magnesium or calcium, solvent extraction for separation and purification of uranium from scrap materials, solvent extraction for purification of thorium, and reduction of thorium oxide to thorium metal. These processes were essentially identical to those used at Fernald; and, one of the primary founders of NFS was the co-holder of the government patent for the solvent extraction process.

Some of the more notable NFS operations included the following: production of HEU/Thorium fuel rods for the Indian Point Reactor (1958); development of Naval Reactor fuel (1965); first private reprocessing plant in the world opens in West Valley, New York (1966); first advanced Naval Fuel for aircraft carrier U.S.S. Nimitz (1969); and  $PuO_2/UO_2$  rods designed and manufactured for Big Rock Point Reactor (1970) – the only MOX to be burned in a U.S. commercial plant.

In 1992 NFS joined a team led by Fluor Daniel, Inc. which successfully bid on the environmental restoration contract for the DOE site at Fernald, Ohio. NFS was a major contributor to that effort over the next 14 years until the successful release of the Fernald site in 2006. At that same time, the NFS-Erwin plant was beginning a number of efforts to reduce the amount of legacy materials from the Cold War era. First, NFS converted 2700 liters of HEU nitrate solution from Rocky Flats to a stable oxide form. That was followed by several contracts for recovery of HEU and downblending to LEU. For the

downblending process, NFS developed and patented in 1997 a unique process which is still being used today to further the country's non-proliferation goals.

As a continuation of its "swords into plowshares" work, NFS signed contracts in 2001 for the downblending of surplus HEU from DOE into LEU which would be used to fuel Tennessee Valley Authority (TVA) reactors. This highly successful effort is continuing to this day. Downblending and conversion to UO<sub>2</sub> occur at the NFS site with fuel fabrication being performed by AREVA in Richland, WA. TVA received the first blended low enriched uranium (BLEU) fuel assembly for loading into Browns Ferry-2 in 2005. This program effectively "recycles" uranium, while eliminating the security risk posed by the storage of excess, unneeded weapons-grade material. In 2007 and 2009, NFS received Reliable Fuel Supply contracts to downblend additional surplus HEU (from DOE) into LEU.

NFS continues to supply the Naval Reactors (NR) program with fuel materials made to the program's stringent physical and chemical specifications. Today, this important national defense work continues to be NFS' primary product. The vast experience gained from its extended participation in the NR program and from 50 years of experimentation, development, and innovation have given NFS an enviable heritage.

The NFS facilities have fostered and supported many contributions to this nation's – and the world's – nuclear programs and science. On July 8, 2007, NFS celebrated its 50<sup>th</sup> anniversary. Congratulations to NFS on being designated as a Nuclear Historic Landmark by the ANS.



Picture Caption: Randy Shackelford (Nuclear Criticality Safety Manager, NFS), Jack Tuohy (ANS Executive Director), David Kudsin (President, NFS) and Richard Booth (Corporate Services Director, NFS) with Nuclear Historic Landmark Award