

# Annual Report Calendar Year 2002

## Nuclear Science and Technology Group Harry Reid Center for Environmental Studies

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**Prepared by:**

**Anthony E. Hechanova  
Group Leader**

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### INTRODUCTION

The Nuclear Science and Technology Group (NSTG) is a division of the Harry Reid Center for Environmental Studies (HRC) at the University of Nevada, Las Vegas (UNLV). The NSTG's students and staff conduct research and communicate information regarding aspects of nuclear science and technology that are of interest to the community and sponsoring organizations. The NSTG was formed in 2000 as an offshoot of a U.S. Department of Energy (DOE) cooperative agreement with UNLV that established in 1995 the Nevada Risk Assessment/Management Program (NRAMP), a broad program in environmental risk assessment and management of the nuclear weapons testing legacy in Nevada. Upon its completion on April 30, 2000, NRAMP had distributed 80 reports; produced 44 refereed published papers and articles; gave 42 invited presentations; and, conducted stakeholder working groups, focus groups, and continuing education classes and seminars as part of its risk assessment/management program. Further details are contained in the NRAMP *Final Technical Report* (June 2000).

Researchers who have contributed to NSTG products in calendar year 2002 as principal staff, authors, and/or collaborators (not including the campus-wide Advanced Accelerator Applications/Transmutation Research Program that is administered by NSTG staff):

Donald H. Baepler, Ph.D.	Biology and Ornithology
Denis Beller, Ph.D.	Nuclear Engineering
Gary S. Cerefice, Ph.D.	Nuclear Engineering and Actinide Chemistry
Jeanette Daniels	Analytical Chemistry and Laboratory Coordination
Anthony E. Hechanova, Ph.D.	Nuclear Engineering and Health Physics
Carter D. Hull, Ph.D.	Radiogeochemistry and Nuclear Instrumentation (Associate)
Kathleen Lauckner	Stakeholder Interaction
Longzhou Ma, Ph.D.	Materials Science and Engineering

#### Students:

Amanda Brandt	Graduate Student, Water Resource Management
Christina Crossan	Health Physics Department
Dean Curtis	Physics Department
Steve Curtis	Graduate Student, Health Physics Department
Demian Gitnacht	Health Physics Department
Cheryl Gustafson	Kinesiology Department
Ingrid James	School of Social Work
John Knoten	Civil and Environmental Engineering, Webmaster
Kondala Rao Mantri	Graduate Student, Transportation Research Center
Patrick Morris	Graduate Student, Health Physics Department
Jeff Stutz	Graduate Student, Health Physics Department

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Richard Turner

Health Physics Department

### PROJECTS

#### 1. Information Management: NSTG Websites and Libraries

The Nuclear Science and Technology Group provides avenues for communication and maintains archives through websites and libraries. The NSTG website was established in 2000 and was maintained by a student webmaster John Knoten in 2002. The following websites are currently located on the HRC server except for the YMEP site:

- NSTG Home Page: <http://nstg.nevada.edu>
- Transmutation Research Program website: <http://aaa.nevada.edu>
- Waste Management Research Project website: <http://wmp.rp.nevada.edu>
- Pahrump Nuclear Waste and Environmental Advisory Board website:  
<http://nstg.nevada.edu/PAHRUMP.html>
- Support to Yucca Mountain Education Project website: <http://www.library.unlv.edu/yucca/>

The websites serve as the main vehicle for information dissemination and contains information about the NSTG and its research projects including distributed reports, presentation slides, pictures and movie clips from activities, and links to related sites. As identified above, the NSTG also hosts the UNLV Transmutation Research Program website, the International Youth Nuclear Congress Waste Management Research Project website, and the Pahrump Nuclear Waste Advisory Board website. The NSTG website is a valuable asset and serves communication needs of research collaborators and stakeholders.

The NSTG maintains and updates an extensive library that was established in 1995 with the Nevada Risk Assessment/Management Program. The library currently contains about 2000 documents related to nuclear science and technology. In addition to the main library located in room HRC 401, a smaller Transmutation Research Program Library located in room HRC 415 and exhaustive Ecological Bibliography are maintained by the NSTG. These libraries are open to community and databases are provided on request.

#### 2. Experimental Facilities

##### 2.1 Radiation Detection Laboratory

The NSTG opened a new Radiation Detection Laboratory (RDL) in 2001. In 2002, the RDL was remodeled and new equipment was added. The RDL is approved for use of radioactive materials at UNLV. Both Dr. Cerefice and Dr. Hull are approved Users of radioactive material at UNLV, and can supervise work in the laboratory. The RDL has several counting instruments such as a state of the art alpha spectrometry system, low background alpha/beta proportional counting instruments,

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calibrated radiation sources, a Liquid Scintillation Counting system, an approximately 35% intrinsic efficiency High Purity Germanium (HPGe) gamma ray spectrometry detector, and a nuclear lead shield for the HPGe detector.

NSTG students and staff perform routine maintenance on the Radiation Detection Laboratory to satisfy Radiation Safety Office and Environmental Health & Safety requirements. The RDL was checked and upgraded for electrical and plumbing issues.

### **2.2 Transmission Electron Microscopy User Facility**

The NSTG is developing a Transmission Electron Microscopy (TEM) user facility to allow researchers to examine materials down to the atomic level (approximately 1 to 2 angstrom resolution, 0.1 to 0.2 nm), obtaining not only images of the materials, but also determine the elemental and molecular chemistry of the sample. This custom designed user laboratory will allow UNLV researchers access to the cutting edge in materials and imaging technology. The Transmutation Research Program purchased a state-of-the-art TECNAI-F30-SUPER-TWIN series TEM for the facility. This highly versatile tool is used to explore in-depth structure within the microscopic world in disciplines spanning life sciences and materials science. This acquisition institutes tremendous scientific advancement for research at UNLV and within the research community.

In 2002, a room at the HRC was procured for the TEM facility. A TEM purchasing procedure was implemented and the TECNAI-F30-SUPER-TWIN from FEI was selected and purchased. It is in storage until remodeling is completed in 2003.

### **2.3 Inductively Coupled Plasma - Atomic Emission Spectroscopy User Facility**

Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES) is one of the fundamental analytical techniques for physical chemistry, allowing researchers to rapidly, easily, and affordably determine elemental concentrations of most elements down to the parts per billion level. This facility will also host a pyrolysis unit, allowing the direct measurement of the composition of any sample that can be vaporized at temperatures up to 2000 C.

In 2002, a room at the HRC was procured and cleaned out for the ICP-AES facility. The ICP-AES facility was checked and upgraded for electrical and plumbing issues. In addition, all chemistry laboratories were reorganized and upgraded, and enforcement of all OSHA policies pertaining to the laboratories were reviewed and ensured. A purchase request for an ICP-AES was submitted to UNLV's purchasing office in December 2002.

### **3. Technology Needs Development**

#### **3.1 Tritium Probe Research and Development**

For the past several years, the highest priority DOE technology need has been for an in-place down-hole measuring device for groundwater radionuclides, in particular tritium. The NSTG students and staff performed ongoing work on several In situ Tritium Probe (ITP) designs in 2002. The work was done in collaboration with Technical Associates, Inc (TA) and Science & Engineering Associates (SEA) who provided the probes for testing.

NSTG students and staff performed tritium dilution lots required to test a prototype detection cell using calibrated tritiated solutions, determine the Minimum Detectable Limit Allowable for tritium, and fill a “mock” groundwater well for initial deployment of a prototype detector.

NSTG students and staff continued to calibrate and test the Liquid Scintillation Counting system that was acquired from SAIC/YMP. This counting system is essential in producing well-characterized tritium solutions for both ITP projects. System software/firmware required re-configuration, as the hardware portion of the system appeared to be operating properly.

NSTG students and staff tested the TA ITP pump assembly. Pump capacity testing was completed in mid-March. Additional testing data was gathered with the pump in the older (Phase I) TA instrument sonde to determine pump capacity with the filtration cell and deionization cell systems in place.

NSTG staff decided upon Prototype Filtration/Deionization cells and they are in fabrication. Modifications will depend on results of pump testing of the older ITP onboard pump and the new peristaltic “stand-alone” pump for the second generation Tritium Detection and Measurement Cell. The prototype filtration system was tested with natural waters with well-defined particulate size fractions. The initial filtration, mass fractionation and deionization results were completed in April. Research on the filtration sub-systems and detection limits of this system are ongoing.

A paper was presented at the Health Physics Society Annual Meeting in Tampa, FL in June 2002 by J. Stutz and C. Hull, “In Situ Tritium Probe for Effluent and Ground Water Monitoring.” NSTG staff gave a presentation to NNSA/NV staff on the progress of the NERP-funded tritium probe on October 8.

#### **3.2 Avian Dose Reconstruction Project**

The Avian Dose Reconstruction Project is part of a larger HRC study to investigate mutations and their associated rates using non-migratory avian species at the Nevada Test Site. In order to correlate findings to radiation dose, a biokinetic model is being developed that will be applied to the species of interest for the larger study. This model must consider the sources of radioactive material

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(both background radionuclides and those deposited from Nevada Test Site activities), the environmental pathways that could lead to radiation exposure of the animal, the chemical characteristics of the elements and their metabolism by the animal, and the biological effectiveness of the radioactive emission. The tasks are divided into three subtopics: (1) site characteristics and surface contamination, (2) biokinetic modeling of birds, and (3) radionuclide detection and measurement capability. The results of these studies should provide a scientific foundation to the implementation of a dose reconstruction plan that will contribute much needed data to the area of damage and risk from environmental- and elevated-levels of radioactivity.

In 2002, NSTG students and staff continued development of protocols for preparing and analyzing tissue samples for radionuclides. Protocols are being standardized and documented protocols for the RDL.

### **4. Risk Assessment Activities**

The NSTG began two research projects in 2002 dealing with issues related to the DOE National Nuclear Security Administration Nevada Operations Office (NNSA/NV) environmental management program as part of the purview of the Nevada Test Site (NTS) Risk Assessment grant. NSTG staff met with DOE-EM on July 25 to discuss these new research projects. One on depleted uranium disposal at the NTS and another on using RADTRAN or other state-of-the-art codes for performing stakeholder-driven transportation risk assessments. Both concepts were approved and two graduate students were hired and have started their research with their ultimate goal being M.S. degrees.

#### **4.1. Depleted Uranium Disposal at the Nevada Test Site**

A DOE-commissioned study recommended the Nevada Test Site (NTS) as the preferred location for depleted uranium (DU) disposal. Currently, the NTS operates two low-level radioactive waste management sites in Area 3 (Yucca Flat) and Area 5 (Frenchman Flat), and has accepted depleted uranium in several forms in the past. Legislation and infrastructure presently in place at the NTS supports the creation of additional uranium disposal sites. Given its arid climate, large capacity volume, and experience with DU disposal, it is possible that existing NTS low-level waste management sites could be expanded to accept large volumes of depleted uranium.

To assess the performance of a depleted uranium disposal cell, the GOLDSIM modeling suite is being used to create a performance model for a hypothetical disposal unit at the Nevada Test Site, particularly in the Area 5 radioactive waste management site (Area 3 may also be examined in the future). Emphasis is placed on developing a conceptual, dose-based model with interchangeable components for ease of transferability and multi-party use, promoting compatibility with existing research in the field. Such a model should be easily integrated into the current modeling efforts for the Area 5 waste management site (e.g., the Probabilistic Evaluation Group project). Components of this model can also be adapted to examine the thorium waste disposal cell in Area 5, which should

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pose similar (albeit lesser) risks and challenges as the DU disposal facilities.

The first area of focus involves identification of physical parameters affecting uranium disposal and transport. The second area concentrates on model development and building, including incorporation of existing modeling approaches as applicable. The model will provide a valuable tool for site engineers, designers, and decision makers by providing a test-bed for disposal site design components, links to dose-based standards through the employment of receptor modules, and potential for integration with current Area 5 groundwater flow modeling efforts.

The model for the DU is intended to evaluate if the facility would meet the current requirements for low-level radioactive waste management (10CFR60). This model will then be used to examine the variables affecting the safety of DU disposal at the NTS, as well as provide a basis for evaluating design changes and performing cost-benefit analyses in advance of siting these facilities.

### 4.2 Transportation of Radioactive Waste

In 2002, NSTG staff met with UNLV's Transportation Research Center and developed a detailed proposal outlining the stakeholder-driven transportation risk assessment project. The proposal was reviewed by a major stakeholder group, the Pahrump Nuclear Waste and Environmental Advisory Board (PNWEAB, see Section 7.1) and approved. Students and staff are conducting an in depth literature review on transportation accidents and incidents to support the project and respond to PNWEAB inquiries. In particular, statistics pertaining to hazardous materials transportation accidents for years 1993-2001 were collected, as well as radioactive material transportation accidents.

The potential risks and impacts of transporting low-level radioactive waste (LLW) to the NTS is a concern to the residents of Nevada and to those residing along these shipment routes in Nevada and the main foci of the project. The routes used to transport LLW traverse towns and cities. In doing so, trucks with LLW pass within short distances of homes, schools, hospitals, nursing homes, factories, and business establishments. Risks and consequences could be severe when trucks containing LLW are involved in a crash. The NSTG is developing tools to address questions related to public health and safety. Examples of such questions are the following:

- How much exposure to radiation could affect public health and safety?
- How might risks associated with a route be assessed?
- What impact might a major crash involving a truck with low-level radioactive waste material have on the local area?
- Can a tool be developed to help stakeholders evaluate the level of safety and efficiency in the transport of low-level radioactive waste material?

The purpose of this research project is to address concerns of the stakeholders such as the Pahrump Nuclear Waste and Environmental Advisory Board by identifying the extent of the problem,

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determining transportation alternatives, and developing a tool to support local efforts in providing for the safe transportation of radioactive wastes.

The objectives of the project are to: (1) Identify the extent of the type and amount of LLW shipments, and potential LLW transportation routes; (2) Identify on-link and off-link characterization measures which may be used to quantify the “risks and consequences” involved in transporting LLW to the NTS, and (3) Develop a tool to evaluate consequences of transporting LLW to the NTS along highway routes in Nevada.

### **5. Transmutation Research Program**

NSTG staff are the principal administrators of the UNLV Transmutation Research Program (TRP) established on March 6, 2001 as the then-named Advanced Accelerator Applications University Participation Program. The UNLV program was supported by a \$3 million grant in FY01 and a \$4.5 million grant in FY02 from DOE-NE as a core component of the new national transmutation of radioactive waste program led by Los Alamos and Argonne National Laboratories. Complete and detailed information about the UNLV TRP can be found on their website at <http://aaa.nevada.edu> or by referring to the program’s quarterly reports (located on the website) and Year 1 annual report (published September 2002). This information (such as deliverables, milestones, and schedules) is not repeated in this document.

The UNLV TRP is a major component of the NSTG and the funding source for the TEM and ICP-AES facilities at the HRC (see Sections 2.2 and 2.3, above). The UNLV TRP also sponsors information management, new academic program development, and appropriate stakeholder activities.

### **6. International Youth Nuclear Congress (IYNC)**

The International Youth Nuclear Congress was organized by a new generation of professionals in the nuclear field from different countries to: develop new approaches to communicate benefits of nuclear power as part of a balanced energy mix; promote further use of nuclear science and technology for the welfare of humankind; transfer knowledge from the current generation of leading scientists to the next generation; and, encourage the creation of a global network among young professionals. The primary purpose of the IYNC is to transfer knowledge from the current generation of leading nuclear scientists and engineers to the next generation.

The NSTG Group Leader was appointed as the lead of the International Youth Nuclear Congress (IYNC) Waste Management Research Project (WMRP). A website has been set up at <http://wmp.nevada.edu> on the HRC server to facilitate communications. As of December 31, 17 countries have appointed representatives to the WMRP (two more additions are pending approval). Two major deliverables were developed in 2002. First, a series of radioactive waste management fact sheets are being prepared by each participating country. Twelve countries have submitted fact

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sheets (Armenia, Bulgaria, Iran, Korea, Lithuania, Slovenia, Sweden, Switzerland, Romania, Russia, United Kingdom, and U.S.). The NSTG staff prepared the U.S. Fact Sheet. The second deliverable is a radioactive waste management opinion poll to be conducted on nuclear science and engineering students and young professionals. Both deliverables were presented at the IYNC conference in Daejeon, Korea held April 15 to 19, 2002 (IYNC 2002).

The NSTG Group Leader presented an oral paper at IYNC 2002. The name of the presentation was “Waste Management Research Project” and it was awarded best presentation of the session. The full paper was published in the IYNC 2002 Congress Proceedings. In addition, the NSTG staff edited the Youth Department of the Russian Nuclear Society English-edition of their Nuclear Cities Tour brochure that was distributed at IYNC 2002.

After the Waste Management Research Project presentation at IYNC 2002, representatives from Japan and France (two of the major countries not yet participating) gave their assurance that they will participate in the ongoing project. NSTG staff continues to coordinate the project and maintain and update the website at <http://wmrp.nevada.edu>.

NSTG staff attended the IYNC 2004 first organizational meeting in Washington, DC, November 16, 2002. The technical area on waste management was designed by the NSTG staff. IYNC 2004 is scheduled for Toronto, Canada in April 2004.

### **7. Highly-Involved Stakeholder Groups**

The NSTG plays an active role in providing support to highly involved stakeholder groups dealing with issues related to the DOE National Nuclear Security Administration Nevada Operations Office (NNSA/NV) environmental management program as part of the purview of the Nevada Test Site (NTS) Risk Assessment grant. In 2002, the NSTG staff were principal participants in the Pahrump Nuclear Waste and Environmental Advisory Board and the UNLV Yucca Mountain Education Project.

#### **7.1 Pahrump Nuclear Waste and Environmental Advisory Board (PNWEAB)**

The NSTG provides technical and material support to the Nuclear Waste Advisory Board of the Town of Pahrump in Nye County, Nevada. Anthony Hechanova is the PNWEAB’s Consultant Emeritus from the University of Nevada, Las Vegas, a position appointed by the Town Board of Pahrump. In addition to hosting the PNWEAB website and attending monthly meetings in Pahrump, the NSTG sponsored and staffed the Board’s outreach booth at the annual Pahrump Harvest Festival held October 4 to 6, 2002 and conducted and reported on several projects commissioned by the PNWEAB.

Harvest Festival Booth: Four staff and five students staffed the Town of Pahrump Advisory Board Booth at the Pahrump Harvest Festival, October 4-6. Six posters were displayed providing

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information on alternative energy sources (Biodiesel, Biomass, Geothermal, Hydroelectric, Solar and Wind). Eight posters and a radiation detection demonstration and three-dimensional Periodic Table with radioisotopes were displayed on the “nuclear” side of the booth. These posters included: (1) Radioactivity and Groundwater Flow at the Nevada Test Site, (2) Basic Facts about Groundwater Flow, (3) Basic Facts about Radiation, (4) How a Geiger Counter Works, (5) Transmutation of Radioactive Waste, (6) Transportation Risks from Nuclear Waste, (7) Mission Statement and Biographies of the PNWEAB Members, and (8) Town of Pahrump Advisory Boards. In addition, handouts were printed that covered much of the information on the “nuclear” posters and the recommendations of the PNWEAB. The booth was centrally located this year and literally tens of thousands of visitors passed by the booth with many stopping in. This year’s booth had involvement of several other Advisory Boards.

NSTG students and staff received Certificates of Appreciation from the Pahrump Town Board at their December 17 meeting for their contribution to the success of the Pahrump Harvest Festival. Dr. Anthony Hechanova received a second Certificate of Appreciation for his “dedication and hard work on the Nuclear Waste & Environmental Advisory Board.”

NSTG students and staff performed a literature search for the PNWEAB on radioactive waste transportation accidents. Presentation and reports were provided to the Advisory Board at their March 7 meeting.

NSTG staff met with UNLV’s Transportation Research Center at the beginning of Fall term 2002 and developed a detailed proposal outlining the stakeholder-driven transportation risk assessment project. The proposal was reviewed by the PNWEAB and approved at their December meeting (see Section 4.2, above).

### **7.2 Yucca Mountain Education Project (YMEP)**

The Yucca Mountain Education Project is a multidisciplinary effort by interested UNLV faculty and staff to create a balanced information resource for the general public on the subject of the proposed Yucca Mountain high-level radioactive waste disposal site. The ultimate goal of the project is to present the positive and negative aspects of the proposed waste site so that the general public can make informed political decisions. NSTG researchers Anthony Hechanova and Kathy Lauckner are founding members of the YMEP and helped to coordinate the lecture series that will begin spring term 2001.

The following two forums were presented in 2002. On March 8 (Spring term), NSTG students and staff hosted a presentation by the DOE on the current design of the Yucca Mountain Repository followed by a presentation by the NRC on the licensing process for Yucca Mountain. On November 14 (Fall term), a joint presentation was given by the U.S. Nuclear Regulatory Commission and U.S. Department of Transportation on their role in the transportation regulatory issues of the Yucca Mountain Project. The seminars were followed by a panel discussion featuring a diverse stakeholder

group.

In addition, an NSTG student translated the YMEP website information into Spanish for the Spanish version of the website.

## **8. Stakeholder Outreach and Educational Activities**

The NSTG plays an active role in providing an avenue for public involvement dealing with issues related to the DOE National Nuclear Security Administration Nevada Operations Office (NNSA/NV) environmental management program as part of the purview of the Nevada Test Site (NTS) Risk Assessment grant. In 2002, the NSTG staff were actively involved in stakeholder outreach and educational activities. This section reviews the activities of 2002.

### **8.1 Workshops and Conferences**

NSTG staff helped to plan and host the State Legislative Leaders Foundation workshop on sustainable energy at UNLV from March 14 to 16.

NSTG staff judged high school exhibits at the UNLV Science Fair held March 15 in the UNLV Physics Building.

The NSTG students and staff organized and implemented a Girl Scout Science Day at the UNLV on March 17. Two scientific areas were covered: weather and space. Certificates of completion that document lectures and hands-on activities worthy of a badge were given to 60 participants.

NSTG staff participated in the national American Nuclear Society as the chair of the Technical Planning Committee and the Public Information Committee at the ANS Winter Meeting in Washington, DC, November 17 and 18, 2002.

The NSTG Group Leader was invited in May 2002 to be a Session Organizer at the 9<sup>th</sup> International Conference on Environmental Remediation and Radioactive Waste Management to be held in Oxford, UK, September 21-25, 2003 (ICEM03). The session he will be organizing is the Major Institutional Issues in Environmental Management Track Session on “Technical and Public Acceptance Criteria for Disposal or for Clearance.” The NSTG staff assisted in publicizing ICEM03 by contacting members of DOE complex sites, the U.S. commercial waste management public information community, and the international waste management community.

NSTG staff met on October 31 and November 1 with UC Berkeley organizers of the American Nuclear Society Student Conference to be held at UCB in April 2003. NSTG staff will be coordinating UNLV participation in the Conference including proposal of a new UNLV ANS Student Section.

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### 8.2 UNLV Research and Academic Support

NSTG staff consulted on the development of academic programs in the fields of radiochemistry and nuclear engineering with the Colleges of Sciences and Engineering. A program roadmap document and a new program proposal were generated for “A Proposed Master of Science Degree Program in Materials and Nuclear Engineering.” The proposal was approved by the Mechanical Engineering Department in September. NSTG staff were also invited by the Dean of the College of Sciences to help develop a proposed degree program in Radiochemistry.

NTSG staff gave four class lectures (July 9, Sept. 23, Sept. 25, and Nov. 26) in support of nuclear energy and NTS environmental management issues.

NSTG staff participated as members of the UNLV Radiation Safety Advisory Committee.

An NSTG student completed the task of identifying the UGTA tests located in the “Western Pahute Mesa” and “Central Pahute Mesa” in light of the new regional source term document released by DOE.

NSTG staff encouraged the formation of a UNLV Student Section of the American Nuclear Society. NSTG staff hosted the organizational meeting for the group on April 5 that attracted 12 students and 4 faculty. The group’s first official meeting was held May 17 where they had a speaker and officer elections. They held two more meeting/seminars in 2002 during the Fall term. In addition, they went on a tour of the Yucca Mountain Project as their first off-campus activity on June 27.

NSTG staff met with DOE personnel in Washington, DC on July 9 to discuss DOE-EMSP Subsurface Contamination research solicitation and communicated this information to potential researchers.

NTSG students and staff met from November 18 to 22 with contractors for the Massachusetts Institute of Technology who are participating in a study on the future of nuclear power in the context of mitigating global warming. NSTG students and staff provided documents and other information regarding issues dealing with waste management strategies and its impact on the nuclear industry.

In addition, NSTG staff visited or were visited by the following academic and research institutions to investigate collaborations with UNLV academic and research programs:

- Idaho Accelerator Center, Idaho State University, Pocatello, ID, February 4 and September 11, 2002.
- Department of Nuclear Engineering, University of Tennessee-Knoxville, March 13, 2002
- Oak Ridge Associated Universities, Oak Ridge, TN, March 14, 2002.
- Oak Ridge National Laboratory, Oak Ridge, TN, March 14, 2002.
- Ohio State University, April 9, 2002.
- Department of Engineering Physics, College of Engineering, Air Force Institute of

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Technology, Wright-Patterson AFB, OH, April 10, 2002.

- Department of Chemical Engineering, Northwestern University, Evanston, IL, April 18, 2002.
- Physics Department, University of Pittsburgh, Pittsburgh, PA, April 22, 2002.
- Bettis Laboratory, Pittsburgh, PA, April 23, 2002.
- Westinghouse, Pittsburgh, PA, April 23, 2002.
- Institute for Nuclear Power Engineering, Obninsk, Russia, May 6, 2002.
- Health Physics Division of the Austrian Research Center, Seibersdorf, Austria, May 23-24, 2002.
- Nuclear Engineering Department, University of California, Berkeley, CA, May 28, 2002
- Crocker Nuclear Laboratory, University of California, Davis, CA, June 4 and September 8-9, 2002.
- Los Alamos National Laboratory, Los Alamos, NM, July 16, 2002.
- Nova Gorica Polytechnic, Slovenia, August 7 and October 8, 2002.
- Argonne National Laboratory-West, Idaho Falls, ID, September 12, 2002.
- Idaho National Engineering and Environmental Laboratory, Idaho Falls, ID, September 12, 2002.
- Department of Mechanical Engineering and Department of Aerospace Engineering and Mechanics, U of Minnesota, Minneapolis, MN, September 23, 2002.
- Department of Chemistry, McAlester College, St. Paul, MN, September 23, 2002.
- Department of Chemistry and Department of Physics, Washington State University, Pullman, WA, October 10, 2002.
- Pacific Northwest National Laboratory, Richland, WA, October 15, 2002.
- Russian Federal Nuclear Center in Sarov, Nizhny Novgorod, Russia, November 27, 2002.
- Nuclear Engineering Department, U of New Mexico, December 5, 2002.

### 8.3 Invited Seminars

NSTG staff developed a seminar series course on Radioactive Waste for Charles Horne, Mayor, City of Mesquite. The seminar series will seek participation from local government officials in the rural communities and is to start in January 2003.

NSTG staff presented the following invited seminars in 2002:

- “Environmental Benefits of Nuclear Power,” Oak Ridge-Knoxville Section of the ANS, Oak Ridge, TN, March 12, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Graduate Colloquium, Department of Nuclear Engineering, University of Tennessee-Knoxville, March 13, 2002.
- “Nevada Test Site projects and nuclear waste transportation issues,” Humanities Discussion Group, Las Vegas Seniors Center, March 14, 2002.

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- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Oak Ridge National Laboratory, Oak Ridge, TN, March 14, 2002.
- “Environmental Benefits of Nuclear Power,” Northern Ohio Section of the ANS, Mansfield, OH, April 9, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Graduate Colloquium, Ohio State University, April 9, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Department of Engineering Physics, College of Engineering, Air Force Institute of Technology, Wright-Patterson AFB, OH, April 10, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Graduate Colloquium, Department of Chemical Engineering, Northwestern University, Evanston, IL, April 18, 2002.
- “Environmental Benefits of Nuclear Power,” undergraduate student seminar, Department of Chemical Engineering, Northwestern University, Evanston, IL, April 18, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Graduate Colloquium, Physics Department, University of Pittsburgh, Pittsburgh, PA, April 22, 2002.
- “Environmental Benefits of Nuclear Power,” Pittsburgh Section of the ANS, Pittsburgh, PA, April 22, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Bettis Laboratory, Pittsburgh, PA, April 23, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Westinghouse, Pittsburgh, PA, April 23, 2002.
- “Nevada, Nuclear Waste, and Transmutation,” Nuclear Engineering Department Seminar Series, Massachusetts Institute of Technology, May 13, 2002.
- “Environmental Benefits of Nuclear Power,” Virginia Council of Trout Unlimited, Verona, VA, May 18, 2002.
- “University Programs of the U.S. Advanced Accelerator Applications Project,” International Conference on Advanced Nuclear Power Plants, 2002 ANS Annual Meeting, Hollywood, FL, June 11, 2002.
- “Transmutation to Enhance Management of Used Nuclear Fuel,” Panel on Management of Used Fuel, 2002 ANS Annual Meeting, Hollywood, FL, June 12, 2002.
- “The U.S. Transmutation of Waste Program,” Clark County High Level Waste Advisory Committee meeting, June 27, 2002.
- “Transportation of Radioactive Waste Study,” Clark County High Level Waste Advisory Committee meeting, July 25, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” INEEL Seminar, INEEL, Idaho Falls, ID, September 12, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” ANL-W Seminar, INEEL, Idaho Falls, ID, September 12, 2002.
- “Environmental Benefits of Nuclear Power,” Idaho Section of the ANS, Idaho Falls, ID,

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September 12, 2002.

- “University Programs of the Advanced Fuel Cycle Initiative,” Graduate Seminar, Department of Aerospace Engineering and Mechanics, University of Minnesota, Minneapolis, MN, September 23, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Department of Chemistry Graduate Colloquium, McAlester College, St. Paul, MN, September 23, 2002.
- “Environmental Benefits of Nuclear Power,” Upper Midwest Section of the ANS, McAlester College, St. Paul, MN, September 23, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Graduate Colloquium, Department of Chemistry, Washington State University, Pullman, WA, October 10, 2002.
- “Environmental Advantages of Nuclear Power,” East Washington Section of the ANS, Richland, WA, October 15, 2002.
- “Accelerator-driven Transmutation of Nuclear Waste and the Advanced Fuel Cycle Initiative,” Pacific Northwest National Laboratory, Richland, WA, October 15, 2002.
- “Environmental Advantages of Nuclear Power,” Boyd School of Law Student Environmental Law Club Seminar, afternoon and evening sessions, UNLV, Las Vegas, Nevada, October 30, 2002.
- “Environmental Advantages of Nuclear Power,” Nevada Section of the ANS, Las Vegas, Nevada, November 6, 2002.
- “University Programs of the Advanced Fuel Cycle Initiative,” Department of Chemical and Nuclear Engineering, University of New Mexico, Albuquerque, NM, December 5, 2002.
- “Environmental Advantages of Nuclear Power,” Nuclear Engineering Class, University of New Mexico, Albuquerque, NM, December 5, 2002.

### 8.4 Outreach in the Community

NSTG staff interviewed on LV-1 regarding radioactive waste management and transportation in March.

NSTG staff was interviewed by a reporter from UNR on April 15 regarding radioactive waste management.

NSTG staff met with actor and philanthropist Paul Newman on March 11 to discuss radioactive waste management strategies and advances in nuclear science and technology. NSTG staff organized and spoke at a Dinner-Debate on Nuclear Energy for the Press at the home of Paul Newman and Joanne Woodward, New York, NY, May 20, 2002.

NTSG Staff attended meetings of the NRC, DOE, UNLV, ASME, and other miscellaneous meetings including a class lecture (April 26) in support of NTS environmental management.

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NSTG staff was interviewed by Television Channel 3 reporter Glen Meek on June 28 regarding low-level nuclear waste and UGTA contamination at the Nevada Test Site. Story is suppose to air July 11 at 5 p.m. and 11 p.m.

NSTG staff was interviewed by a UNLV student on July 1 regarding radioactive waste management.

NSTG staff organized a tour of the Yucca Mountain Project for UNLV faculty/staff and students on July 31.

NSTG staff advertised and is organizing a tour of the Nevada Test Site for UNLV faculty/staff and students and local scientific organizations. The tour is to be conducted on February 22, 2003.

NTSG staff attended meetings of the American Nuclear Society, Community Advisory Board for NTS Projects, DOE, NRC, NTS Historical Foundation, UNLV, and other miscellaneous meetings in support of nuclear energy and NTS environmental management issues.