Nuclear Security Education, Research and Training at Texas A&M University

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Nuclear Security Education Begins at Texas A&M (March 2006)

A new nuclear security initiative is established at Texas A&M

The new Nuclear Security Science and Policy Institute at Texas A&M University will focus on nuclear security education and research.

The new Nuclear Security Science and Policy Institute (NSSP) on the campus at College Station, Tex. Under director William Chariton and associate directors David Boyle and Warren Miller, NSSP will promote graduate-level education and research that will focus on topics related to safeguarding nuclear materials and enhancing national security against nuclear terrorism.

The new program is expected to get off the ground in mid-summer with early activities on new courses, degree programs, and preparation for a national workshop, according to Miller. “NSSP will be the first campus-based entity, with a higher education mission, focusing on the details of nuclear security science and the interface with national and international policy,” he said.

“We are convinced that a new trend in nuclear engineering will be to establish programs to prepare students for careers in the vital area of nuclear security.”

NSSP was approved by the university’s Board of Regents on March 24, 2006. The new program will be a collaborative effort between Texas A&M’s Department of Nuclear Engineering and its Bush School of Government and Public Service. The university is seeking funding of about $1.5 million each year from the Department of Energy. The goal is to obtain from various sources an additional $1 million per year to support NSSP’s administrative, educational, and research activities, and $5 million per year for research activities. The DOE may provide some of the additional funds, according to Miller. “Because it is interested in supporting nuclear security science and policy activities.”

Existing collaborations

Texas A&M faculty and students have been active in the fields of nuclear nonproliferation, nuclear material safeguards, and international security for many years, Miller said. Activities have included scientific and engineering research projects with Los Alamos, Sandia, Oak Ridge, and Pacific Northwest national laboratories. Faculty members have been involved in research related to proliferation-resistant nuclear fuel designs, proliferation resistance assessments for fuel cycles, nuclear material safeguards development and analysis, the development of portal monitors for detecting the illicit trafficking of nuclear materials, modeling of nuclear smuggling routes, post-accident nuclear containment, compilation of reactor data for international safeguards, and safety purposes, developing methodologies for verifying the history of plutonium production reactor histories, and assessing techniques for the identification of covert nuclear weapons programs, and studying nuclear terrorism pathways.

“Texas A&M is the leader in nuclear nonproliferation technical education and teaches some of the only engineering courses in the United States dedicated to addressing the technical aspects of nuclear nonproliferation,” Miller said. He noted that...
MISSION

• Employ science, engineering, and policy expertise to:
  – Conduct R&D to help detect, prevent, and reverse nuclear proliferation and guard against nuclear terrorism
  – Educate the next generation of nuclear security leaders
  – Analyze the relationship between nuclear security policy and technology
  – Serve as a public resource for to reduce nuclear threats

NSSPI
Nuclear Security Science & Policy Institute

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Richard Mac Namee (Bush School)
NPT
1. Nonproliferation
2. Peaceful Uses of Nuclear Energy
3. Disarmament

Nuclear Security
1. Prevention
2. Detection
3. Response

State Actors
Non-State Actors
Nuclear Security Education Features

• Program includes:
  – Graduate and undergraduate courses
  – MS degree in Nuclear Engineering with Nonproliferation track
  – Certificate offerings
    • Nuclear security certificate
    • Nuclear forensics certificate
  – Tabletop exercises
  – Field exercises at Disaster City
  – Nuclear facilities experience

• Other facts:
  – Currently 30 students in the program
  – Publications: 500+
  – Theses/Dissertations: 91+

Total NSSPI Graduates: 76

Degrees in nuclear nonproliferation related topics:
• MS Degrees: 56
• M.E. Degrees: 5
• Ph.D. Degrees: 22

NSSPI has also supported students in many other multidisciplinary research areas

Employment Status After Graduation:
Topics Covered

• Fundamental Nuclear Engineering
  – Interactions of Radiation with Matter
  – Radiation Detection
  – Reactor Physics
  – Radiation Transport
  – Nuclear Fuel Cycles

• Nuclear Safety
  – Radiation Shielding
  – Radiation Protection
  – Reactor Engineering

• Nuclear Nonproliferation
  – History and Policy Impacts
  – Proliferation Detection
  – Export Controls

• Nuclear Safeguards
  – Nuclear Material Quantification and Accountancy
  – Safeguards System Design

• Nuclear Security
  – Threat Assessment
  – Physical Security
  – Border Security
  – Nuclear Forensics
Strong Research Focus

- Safeguards Instrumentation Development
- Novel Detection Systems with Robotics Support
- Nuclear Forensics
  - Pre-detonation and post-detonation
- Reactor Analysis for Proliferation Detection
- Nuclear Security and Deterrence Analysis using Game Theoretic & Bayesian Network Models
- Proliferation Resistance Analysis
- Consequence Management
From October 2011 to April 2017, over 84,000 unique users accessed NSSEP.

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of NSSEP Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>46,416</td>
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<tr>
<td>India</td>
<td>9,293</td>
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<tr>
<td>United Kingdom</td>
<td>5,105</td>
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<td>Philippines</td>
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<tr>
<td>Canada</td>
<td>2,520</td>
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<tr>
<td>Nigeria</td>
<td>2,297</td>
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</tbody>
</table>
## Nuclear Security Certificate

<table>
<thead>
<tr>
<th>Relevant Nuclear Security Area</th>
<th>Course Developed</th>
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</thead>
<tbody>
<tr>
<td>Applications of sensors/sources for radiation detection in nuclear security</td>
<td>NUEN 605 (Radiation Detection and Nuclear Materials Measurement)</td>
</tr>
<tr>
<td>Global nuclear security policies</td>
<td>NUEN 650 (Nuclear Nonproliferation and Arms Control)</td>
</tr>
<tr>
<td>Threat Analysis and Assessment</td>
<td>INTA 669 (Nuclear Security Threat Assessment)</td>
</tr>
<tr>
<td>Design and analysis of security systems for nuclear and radiological facilities</td>
<td>NUEN 451 (Nuclear Security System Design)</td>
</tr>
</tbody>
</table>

Students must complete 3 out of 4 courses to earn certificate
International Engagement

NSSPI is heavily involved in international activities

– Observer status at the IAEA General Conference
– Research collaborations with Russia, France, India, and Japan
– Educational collaborations in UAE, Russia, India, UK, Japan, Malaysia, Indonesia, Jordan, Brazil, South Africa, UAE
– Nuclear Facilities Experience for students in Japan, UK, France
NSSPI’s Global Impact

- Asia: 6
- Africa: 3
- Europe: 8
- Middle East: 2
- North America: 1
- South America: 1
- Total Visited: 21
NSSPI’s Many Customers

NSSPI

National Laboratories

LANL

SNL

INL

ORNL

SRNL

PNNL

Luminant

Areva

ZelTech

Private Industry

DoE/NNSA

DOE/NE

NA-21

NA-22

NA-24

State Department

DoD

DTRA

AFTAC

NM

Others

DHS

NTNFC

S&T

CCNY

IAEA

CEIP

USDA

SAIC

Private Industry

Luminant

Areva

ZelTech

CCNY

DoED

NA

NA-21

NA-22

NA-24

NA

Nuclear Security Science & Policy Institute

Texas A&M Engineering Experiment Station

Nuclear Engineering Texas A&M University