



The Nuclear Security Program at the University of Tennessee

Howard L. Hall, Ph.D.

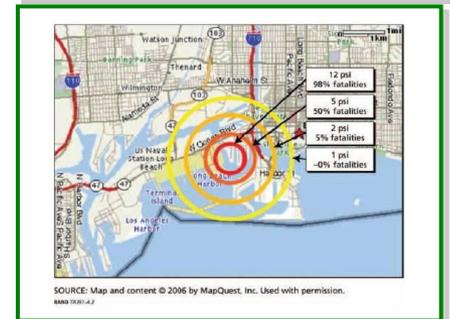
*Department of Nuclear Engineering,
Center for Interdisciplinary Research and Graduate Education, &
The Howard H. Baker Jr. Center for Public Policy
The University of Tennessee, Knoxville, TN 37996-2300*

**2011 U.S. WIN Region II Conference
February 6-9, 2011 -- Oak Ridge, TN**

Nuclear Security...

The totality of activities undertaken to ensure that:

- The beneficial applications of nuclear/radiological materials and devices are not diverted to illicit or malicious purposes.
- Arms control priorities can be achieved through support and development of technologies for declaratory policy verification. Nuclear weapons and related technology are appropriately controlled and monitored, and weapons-usable materials can be accounted for and secured.
- Advances are made toward meeting other nonproliferation goals and objectives (such as for interdiction, render safe, and forensics) that mitigate threats, increase proliferation resistance, and support deterrence.
- Consequences of radiological or nuclear incidents, including attacks, are mitigated or minimized.

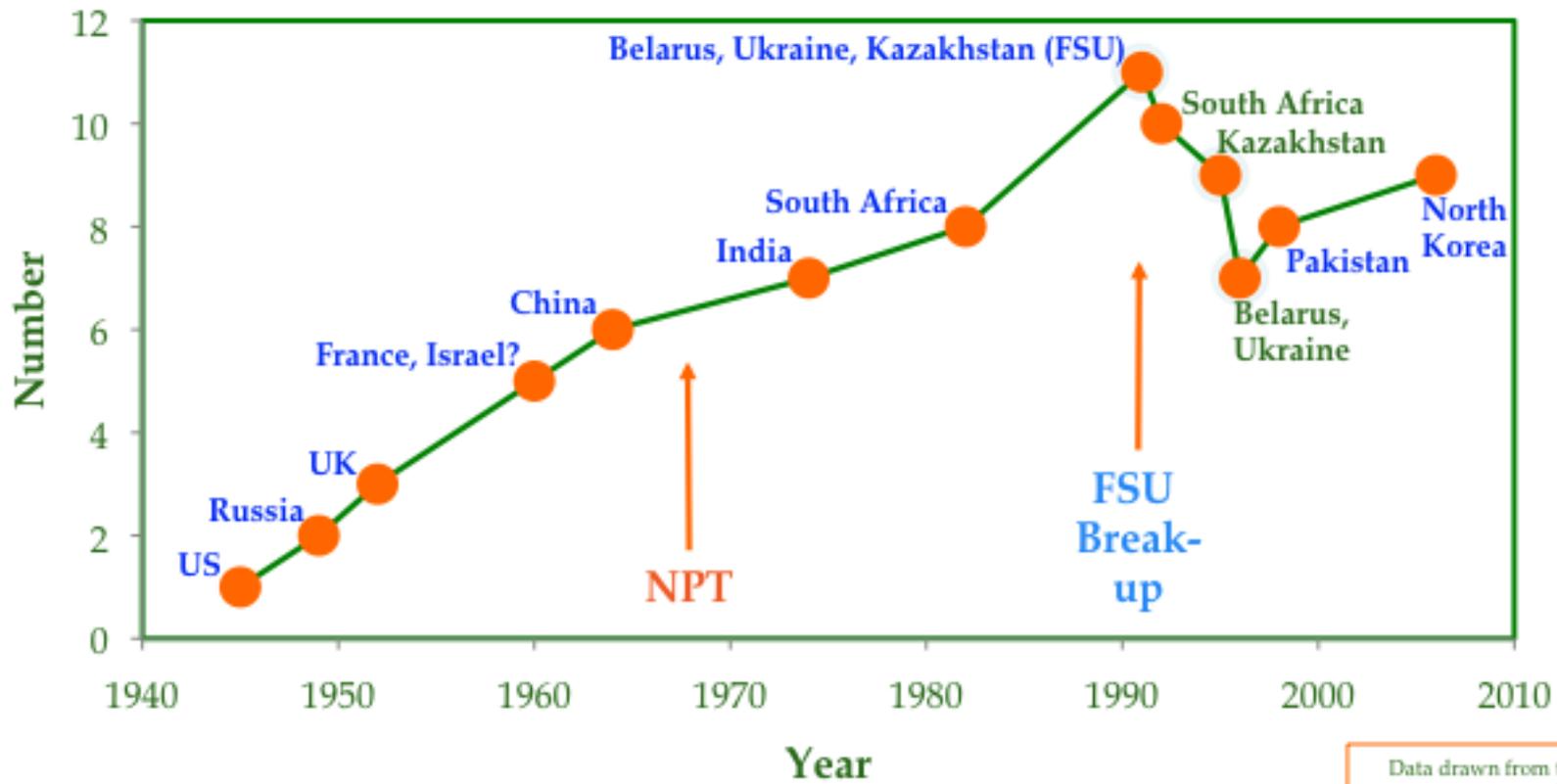


The central questions

- How do we assure that radiological material and/or nuclear technology is where it is supposed to be, being used for its intended purpose, and properly protected?
- How do we detect things outside the bounds of appropriate use?
- How do we effectively deal with bad events?
- How do we objectively assess what we do know and what we think we know?

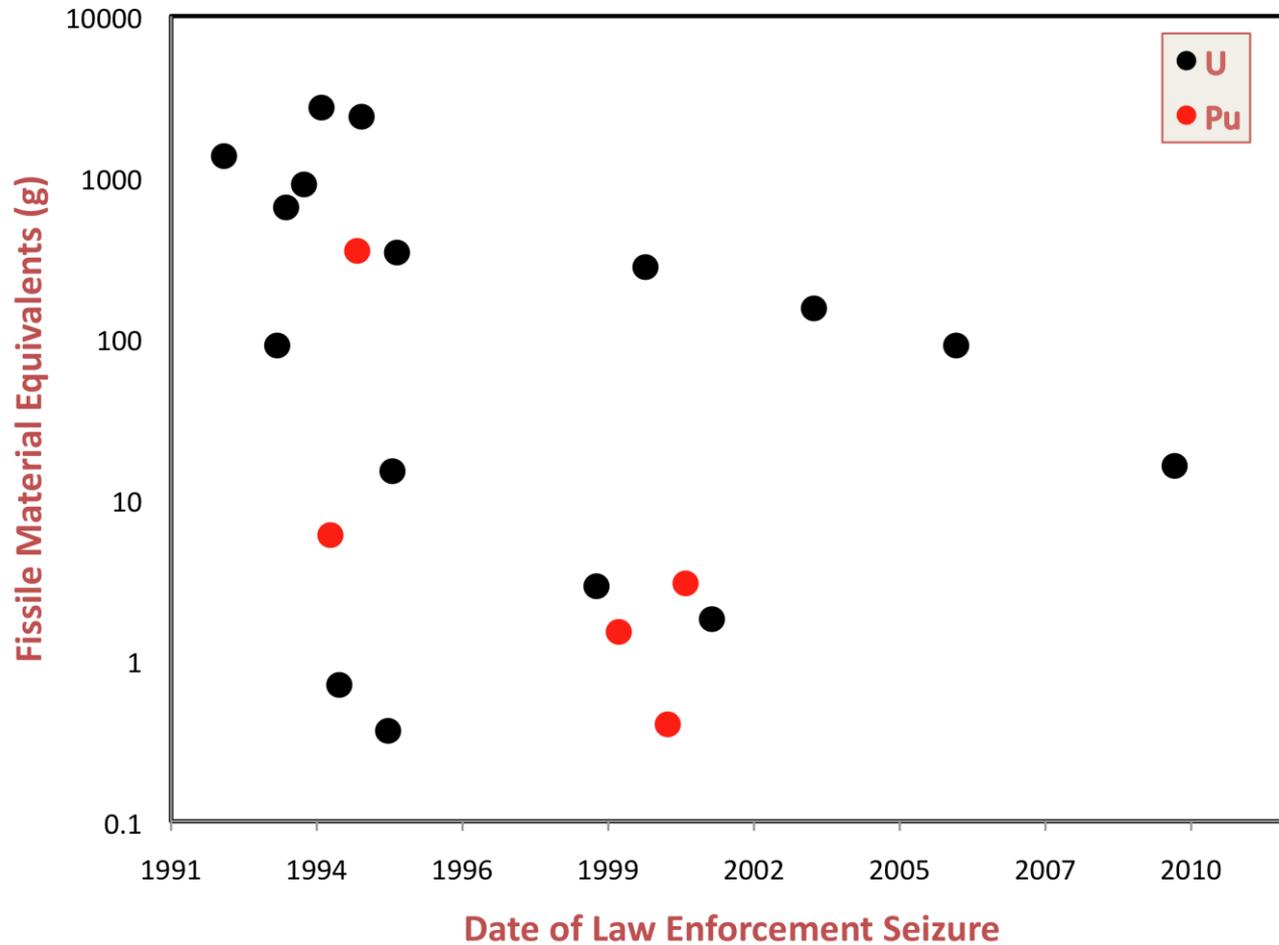


States with nuclear weapons



Data drawn from the Nuclear Threat Initiative (www.nti.org)

Black market SNM has been found



Global efforts in nuclear security: All depend on people

- Education is the critical underpinning to **sustain** our abilities and meet the needs of the future
- An effective security framework requires:
 - Scientific and technical disciplines
 - Medical and health sciences, social sciences, humanities, and law
 - Policy and law, diplomacy
 - Civilian, military, intelligence, and NGO commitment



East Tennessee has a long history in things nuclear



Photo by Ed Westcott

Significant events in nuclear history in Tennessee

- February 18, 1942 – Ground broken for first calutron building in Oak Ridge
- December, 1942 – Ground broken for the ORNL Graphite Reactor
- 5 AM, November 4, 1943 – the Graphite Reactor goes critical
- January, 1944 – First reactor-produced plutonium isolated
- March, 1944 – First enriched uranium shipped to Los Alamos

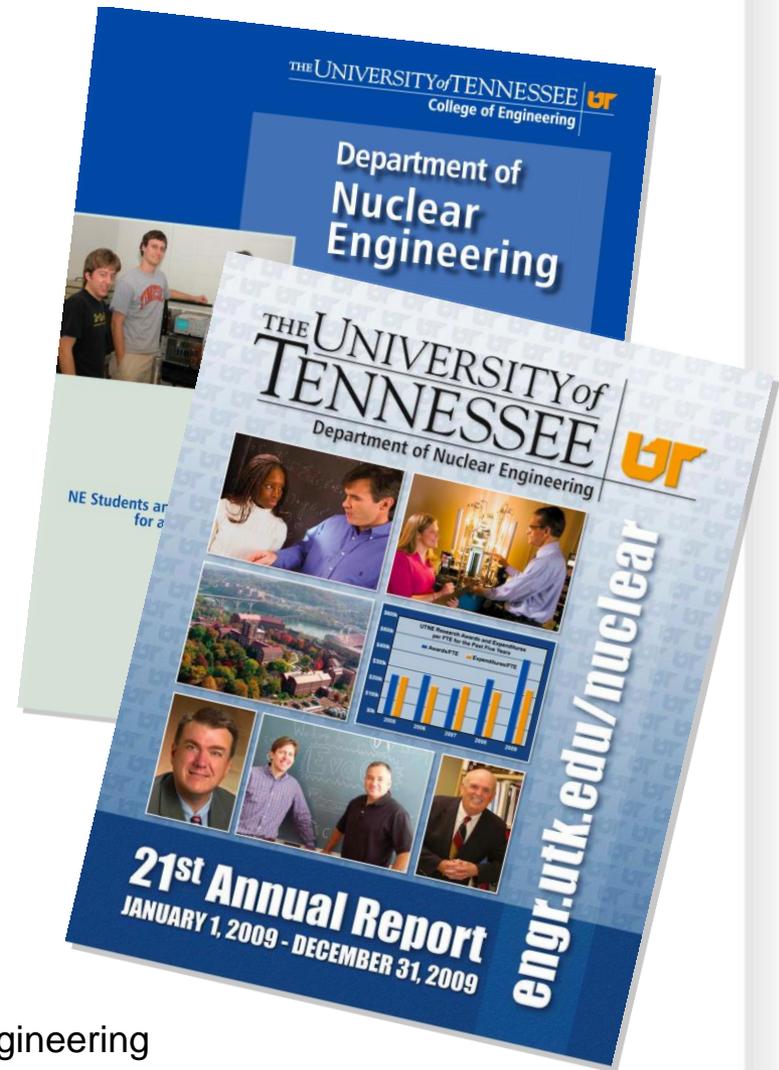


Selected events in the birth of U.S. nuclear engineering

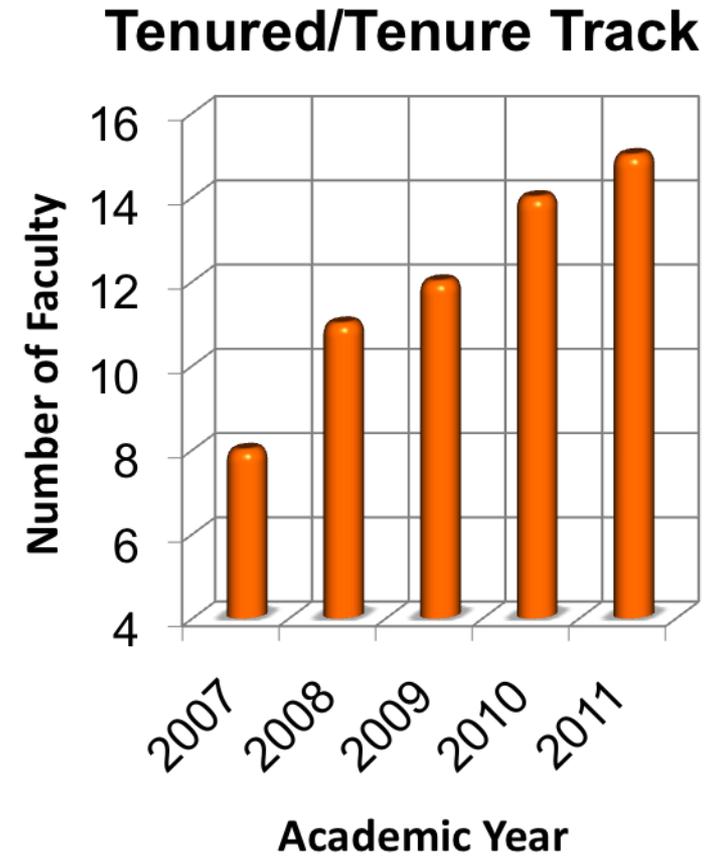
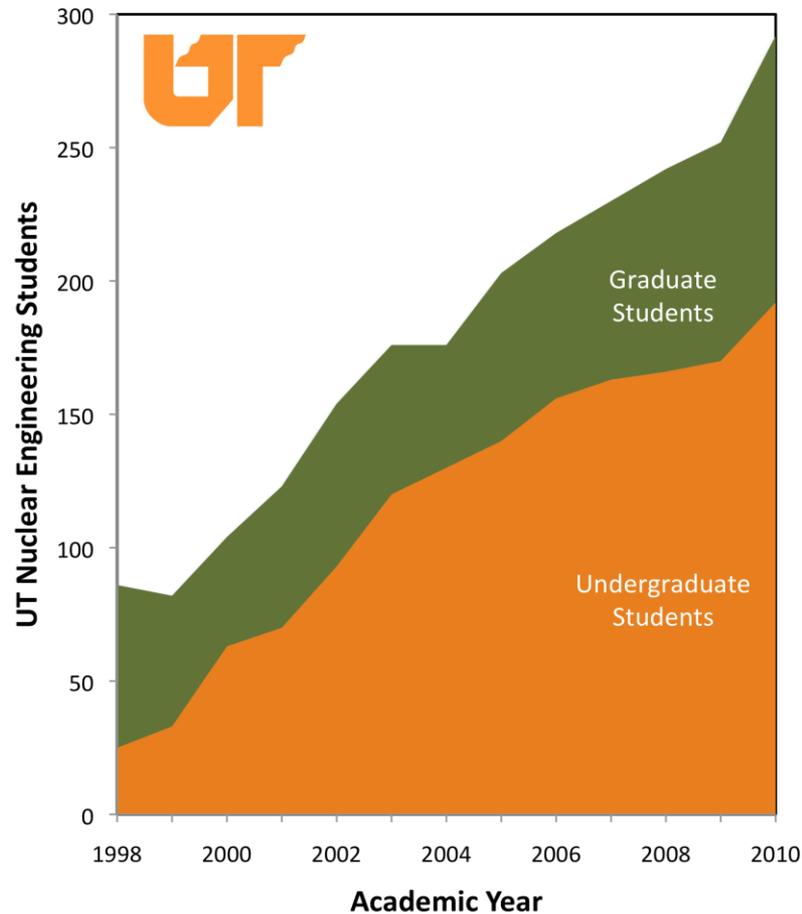
- 1946 – the Clinton Training School
 - A collaboration of ORNL, UT, and MIT
 - “Clinch College of Nuclear Knowledge”
 - Transitioned to ORSORT
- Oak Ridge Institute of Nuclear Studies
 - Biological applications, tracers
- Oak Ridge School of Reactor Technology (ORSORT)
 - Classified applications of nuclear science for military uses
 - AEC focused
 - “Doctor of Pile Engineering,” or D.O.P.E.’s
- “Atoms for Peace” created opportunities for academic programs

Nuclear Engineering at UT

- Department (undergraduate and graduate degrees) established 1957
- Over 1000 graduates to date
- Top-ranked department in the College of Engineering at UT
 - Most R&D productivity
 - Student scholarships and awards average \$5,165 (2008)
- Top 10 program (and rising) in the annual *US News and World Report* rankings for nuclear engineering

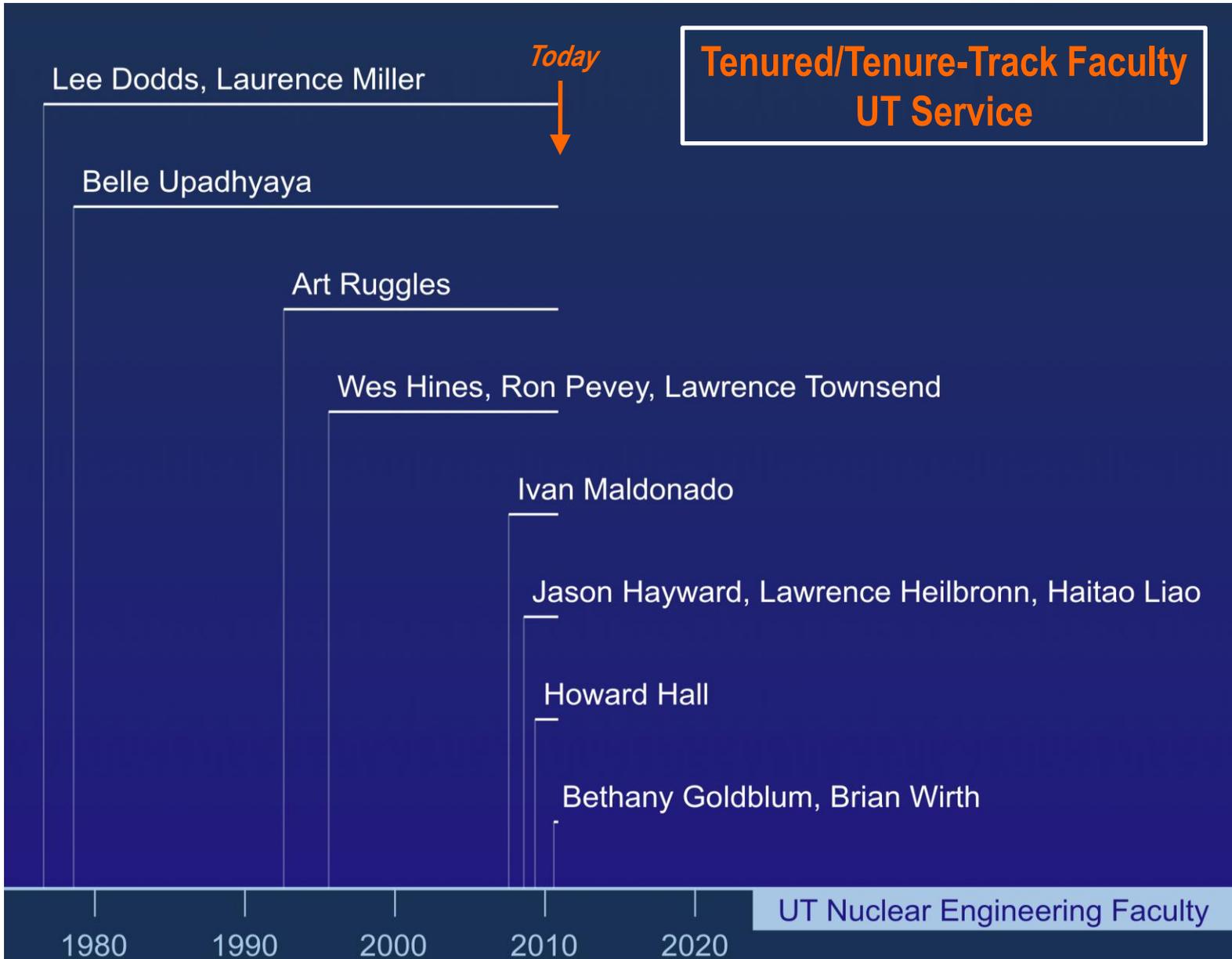


Growth in UT nuclear engineering





**Tenured/Tenure-Track Faculty
UT Service**



Today
↓

UT Nuclear Engineering Faculty

1980 1990 2000 2010 2020

Department of Nuclear Engineering

Faculty with efforts in nuclear security

Ivan Maldonado, Ph.D.

Associate Professor, Joint appt. with ORNL



- Ph.D. in Nuclear Engineering from North Carolina State University (1993)
- His research interests include reactor physics, nuclear fuel/actinide management, LWR assembly/core design, core operational management, and the promotion of nuclear engineering education.

Jason Hayward, Ph.D.

Assistant Professor, Joint appt. with ORNL



- Ph.D. in Nuclear Engineering from the University of Michigan (2007)
- His research interests include radiation detection and measurement, nuclear security and safeguards, and nuclear instrumentation. .

Faculty with efforts in nuclear security

Lawrence Heilbronn, Ph.D.

Assistant Professor



- Ph.D. in Nuclear Physics from Michigan State University (1991)
- His current research interests are high-energy neutron production from heavy-ion interactions, space radiation protection, radiological engineering, medical physics, experimental nuclear physics, and radiation shielding and transport.

Laurence Miller, Ph.D.

Professor



- Ph.D. in Nuclear Engineering from Texas A&M (1976)
- His current research interests are radiological assessments and pathway analysis, applications of pulse-shape discrimination in radiation detection, and uncertainty analysis.

Faculty with efforts in nuclear security

Howard Hall, Ph.D.

*Governor's Chair Professor, Joint appt. with ORNL
Director of Global Security Programs at the Baker Center*



- Ph.D. in Nuclear and Radiochemistry from University of California, Berkeley (1989)
- His research interests are nuclear security applications including proliferation detection, counter-proliferation, detection of and response to radiological or nuclear threats, radiochemistry, nuclear forensics, and related security issues

Bethany Goldblum, Ph.D.

Assistant Professor



- Ph.D. in Nuclear Engineering from University of California, Berkeley (2008)
- Her research interests are nuclear cross-sections, especially those of interest in nuclear forensics and proliferation detection. Also applications of nuclear science to issues of homeland security. , counter-proliferation, detection of

Faculty with efforts in nuclear security

Brian Wirth, Ph.D.

Governor's Chair Professor, Joint appt. with ORNL



- Ph.D. in Mechanical Engineering from University of California, Santa Barbara (1998)
- His research interests are materials performance under extreme conditions and environments, such as nuclear fuels and nuclear reactor structural materials.

Adjunct faculty

- **Dr. Brian Anderson, Adjunct Associate Professor**
- Dr. Andrei I. Apostoaei, Adjunct Assistant Professor
- Dr. Tom Byrne, Special Instructor
- Dr. Zhong Cao, Adjunct Professor
- Dr. David H. Cook, Adjunct Associate Professor
- Dr. Mark D. DeHart, Adjunct Associate Professor
- Dr. Felix Difilippo, Adjunct Professor
- Dr. Keith Eckerman, Adjunct Associate Professor
- Dr. Paul W. Frame, Adjunct Associate Professor
- Dr. Jess C. Gehin, Adjunct Associate Professor
- Dr. Herschel Godbee, Adjunct Professor
- Dr. F. Owen Hoffman, Adjunct Professor
- Dr. David E. Holcomb, Adjunct Assistant Professor
- Mr. Calvin M. Hopper, Lecturer
- **Dr. Alan Icenhour, Adjunct Assistant Professor**
- Dr. Erik B. Iverson, Adjunct Associate Professor
- Dr. James Lyon, Adjunct Professor
- Dr. Jose March-Leuba, Adjunct Associate Professor
- Dr. Gloria Mei, Adjunct Associate Professor
- Dr. Trent L. Nichols, Adjunct Professor
- Dr. Adrian Oliver, Adjunct Associate Professor
- Dr. Sara A. Pozzi, Adjunct Assistant Professor
- Dr. Chet R. Ramsey, Adjunct Assistant Professor
- Dr. Brandon P. Rasmussen, Adjunct Asst Professor
- Mr. Davis A. Reed, Lecturer
- Dr. David Simpson, Adjunct Assistant Professor
- Mr. Richard G. Taylor, Lecturer
- Dr. Joseph Thie, Adjunct Professor
- Dr. James E. Turner, Special Instructor
- Dr. Timothy Valentine, Adjunct Assistant Professor
- **Dr. Graham V. Walford, Adjunct Professor**
- Dr. Colin West, Adjunct Professor
- Dr. Robert M. Westfall, Teaching Associate
- Dr. Graydon L. Yoder, Jr., Adjunct Professor

***Bold** indicates active adjuncts with nuclear security or related expertise*



The UTNE Nuclear Security Certificate

- Currently part of our Master's degree track
- Earned by taking 4 out of the following 6 courses:
 - NE 530 (Nuclear Security Science and Analysis)
 - NE 404 (Nuclear Fuel Cycle)
 - NE 433 (Health physics) *or* NE 470 (Nuclear Reactor Theory I)
 - NE 550 (Radiation Measurements Laboratory)
 - NE 532 (Advanced Topics in Nuclear Security Science and Analysis)
 - Political Science 688 (Seminar on Arms, Arms Control, and Nuclear Non-proliferation)

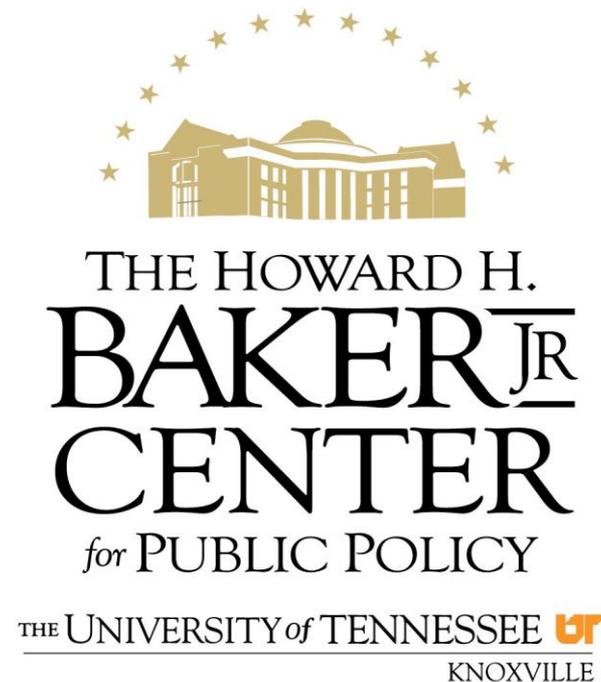


Hands-on learning at ORNL and Y-12

- Undergraduate and graduate radiation measurements classes typically spend several weeks in the ORNL Safeguards Lab
- NE-530 Red/Blue exercise is table-topped at Y-12 National Security Complex
- Collaborative education and graduate research training with ORNL and Y-12 continues to grow

The UT Political Science Department Nuclear Security Graduate Certificate

- Nuclear Engineering, Political Science, and the Baker Center are collaborating on this new certificate program
- Expected to be available soon





...to develop programs and promote research to further the public's knowledge of our system of governance...

...to highlight the critical importance of public service...

The Howard H. Baker Jr. Center for Public Policy was established in 2003 at the University of Tennessee, Knoxville.



Growing the engagement with ORNL

- Joint Faculty Appointments and the Governor's Chair program
- The UT-ORNL Center for Interdisciplinary Research and Education in Energy Science and Engineering (CIRE)
- UTK/ORNL Distinguished Graduate Fellowship program

Looking forward

- More UTNE faculty in near future
 - Department Head search under way
- Extend nuclear security emphasis into the College of Arts and Sciences
 - Chemistry, Physics, etc.
- The Center for Interdisciplinary Research and Graduate Education
- Expand relationship with Y-12, build with SRNL
- Considering development of an undergraduate minor in nuclear security engineering



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