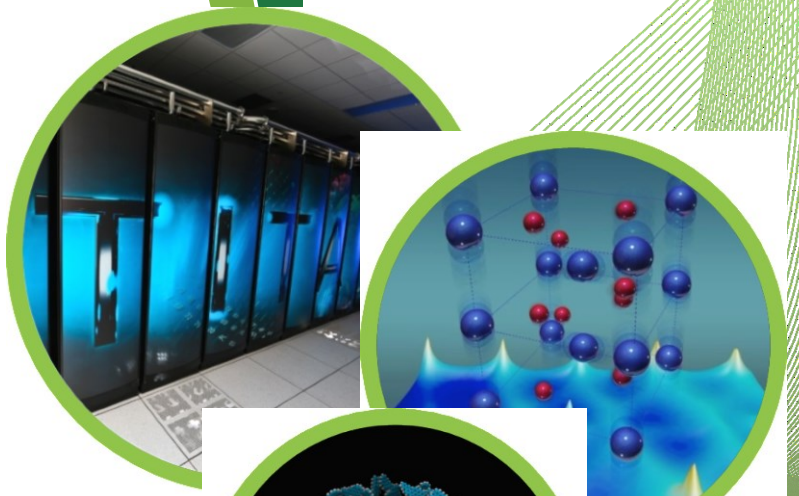
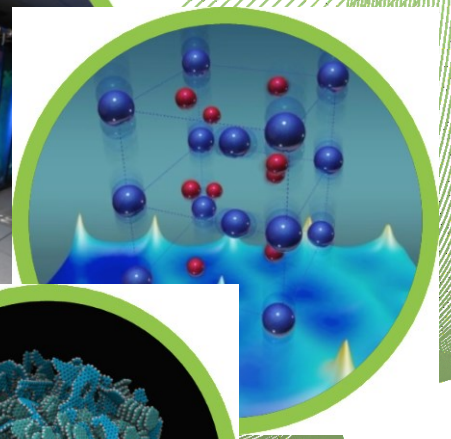
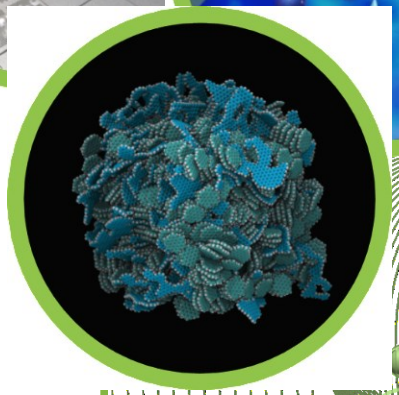
Human Capacity Building in Nuclear Security







Cary Crawford, ORNL

Adam Williams, SNL

ORNL is managed by UT-Battelle
for the US Department of Energy

Elements of HCD

- Training (NSSCs)
- Education (INSEN)
- Professional Development
- Internships
- Holistic approach to State-level Nuclear Security needs

Education/Training/Professional Development

- Training
  - ”How?”
  - Proceduralized
  - How to do the right things
- Education
  - “Why”
  - Foundational Concepts/Basic Principles/Underlying Theory
  - How to do things right
- Professional Development
  - Relationship between the ”how” and the “why”
  - Diverse academic backgrounds
  - Need to integrate academic disciplines with operational know-how

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Academic Disciplines in Nuclear Security

Academic Discipline	Applicable Topics in Nuclear Security
Hard sciences: Physics and chemistry	• Non-destructive assay/nuclear materials accounting and control • Destructive assay for nuclear material accountability measurements
Engineering: Electrical, mechanical, industrial, systems, computer science, etc.	• Physical protection systems design, operation, and maintenance • Physical protections technical component design and development • All aspects of digital hardware, software, and operations related to systems involved in the protection of nuclear materials • Nuclear forensics • Radiation monitoring/detection
Social sciences: Psychology, sociology, anthropology, international affairs, etc.	• Human reliability/trustworthiness programs • Nuclear security culture programs • Threat assessment development • State-level security policy development • International engagement
Business administration, project/program management	• Security management • Program management • State-level security regulation
Mathematics: Statistics and operations research	• Uncertainty analysis and quality control for all aspects of security organization and performance testing • Security system effectiveness, risk management, and vulnerability assessment

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Representative set of US Universities w/Security Programs

University/Organization	Scope
Texas A&M (nuclear engineering)	• Masters of Science Concentration in Nuclear Nonproliferation • Graduate Certificate in Nuclear Security
University of Tennessee, Knoxville (nuclear engineering)	• Graduate Certificate in Nuclear Science and Analysis
University of Nevada, Reno (mechanical engineering)	• Graduate Certificate in Packaging and Transportation • Graduate Certificate in Nuclear Safeguards and Security (under development)
Purdue University (multi-disciplinary)	• Nuclear Security Graduate Program (under development)
Multiple universities offer individual nuclear security related courses	• Pennsylvania State University (e.g., nuclear security threat analysis and assessments) • University of Georgia • Massachusetts Institute of Technology (e.g., principles of nuclear radiation measurement and protection)

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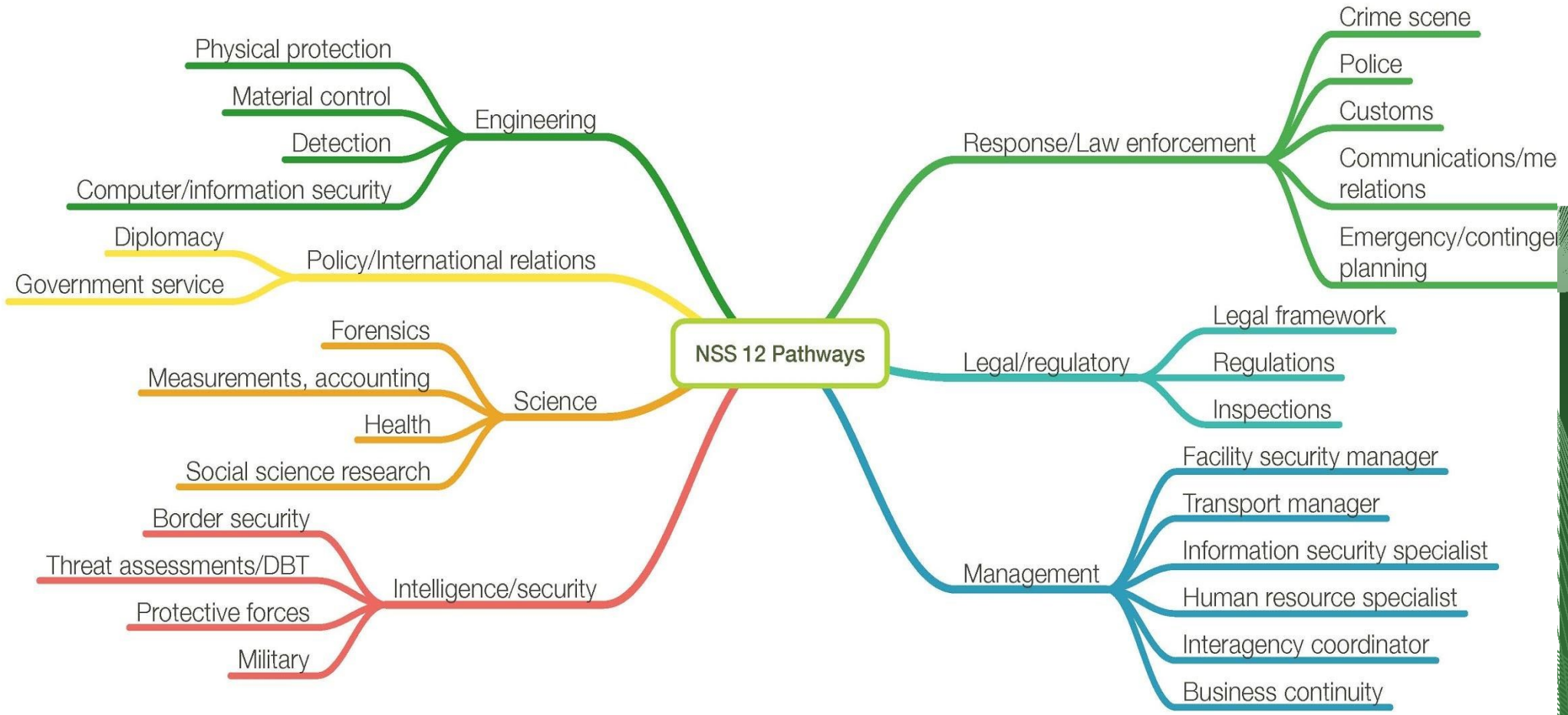
Potential pathways from academia to nuclear security



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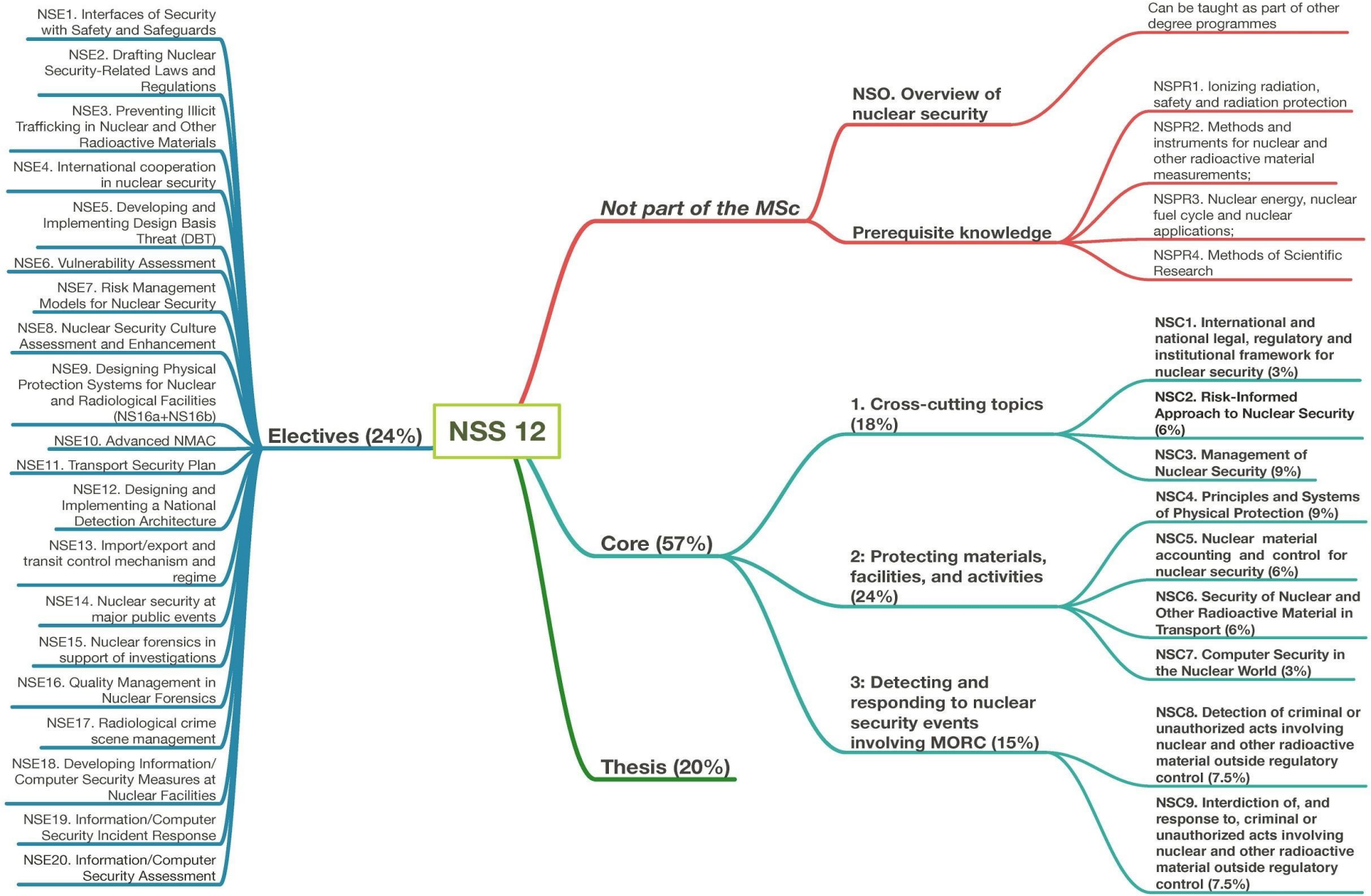
NSS-12 recommended curriculum



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US Examples of Academic HCD

- Harvard University's Belfer Center for Science and International Affairs
- Texas A&M University's Nuclear Security Science and Policy Institute (NSSPI)
- University of Tennessee's Institute for Nuclear Security
- Purdue University's Institute for Global Security and Defense Innovation
- University of Georgia's Center for International Trade and Security

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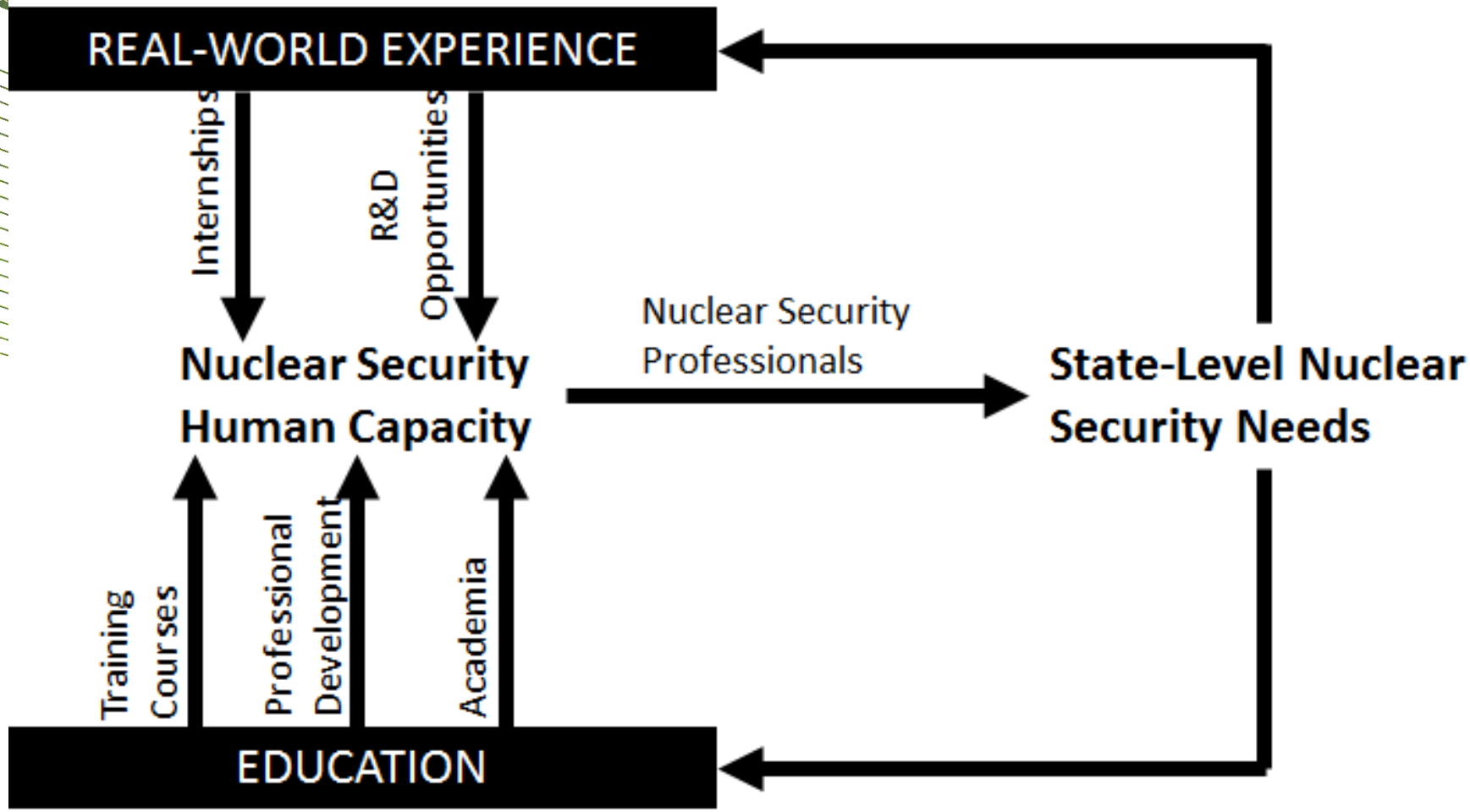
Systems Approach to HCD



HCD Systematic Approach

- Risk focused
  - Types of facilities, material quantities/attractiveness, enterprise-level understanding of nuclear infrastructure needs
- Academic/Operational balance
  - Integration of academic discipline with operational realities
- Flexible
  - Multiple universities, academic disciplines, rotational assignments, multi-site agreements, recruitment programs, etc
- Traceable
  - Metrics, matriculation
- Scalable
  - Expand or contract with industry

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Conclusion

- Benefits of systematic approach to develop State-Level Security HCD program
- Alignment between HCD options provided & national nuclear security ***NEEDS***
- Robust & sustainable pipeline of new talent for dynamic, increasingly complex nuclear security environment

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Additional Information on INMM and other Professional Organizations in Nuclear Security

ABOUT INMM

The Institute of Nuclear Materials Management was established in 1958 and represents more than 1,200 members in more than 30 countries around the globe.

It is dedicated to the professional quality, ethics, and advancement of its membership. It hosts an Annual Meeting in July, which draws a wide, international attendance for key plenary talks, many sessions of contributed technical presentations, commercial exhibitors, and numerous opportunities for related side meetings. The Institute also sponsors a variety of topical meetings throughout the year. The INMM publishes the *Journal of Nuclear Materials Management* quarterly, featuring peer-reviewed, scholarly articles from its membership.

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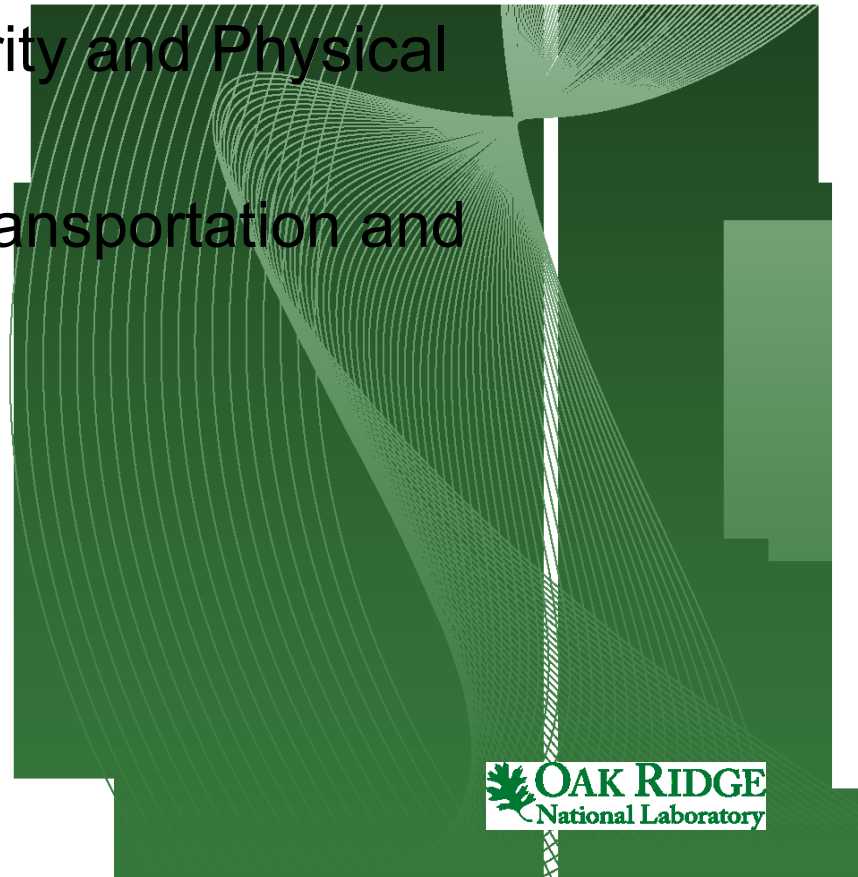
INMM Executes Its Mission Through Six Technical Divisions

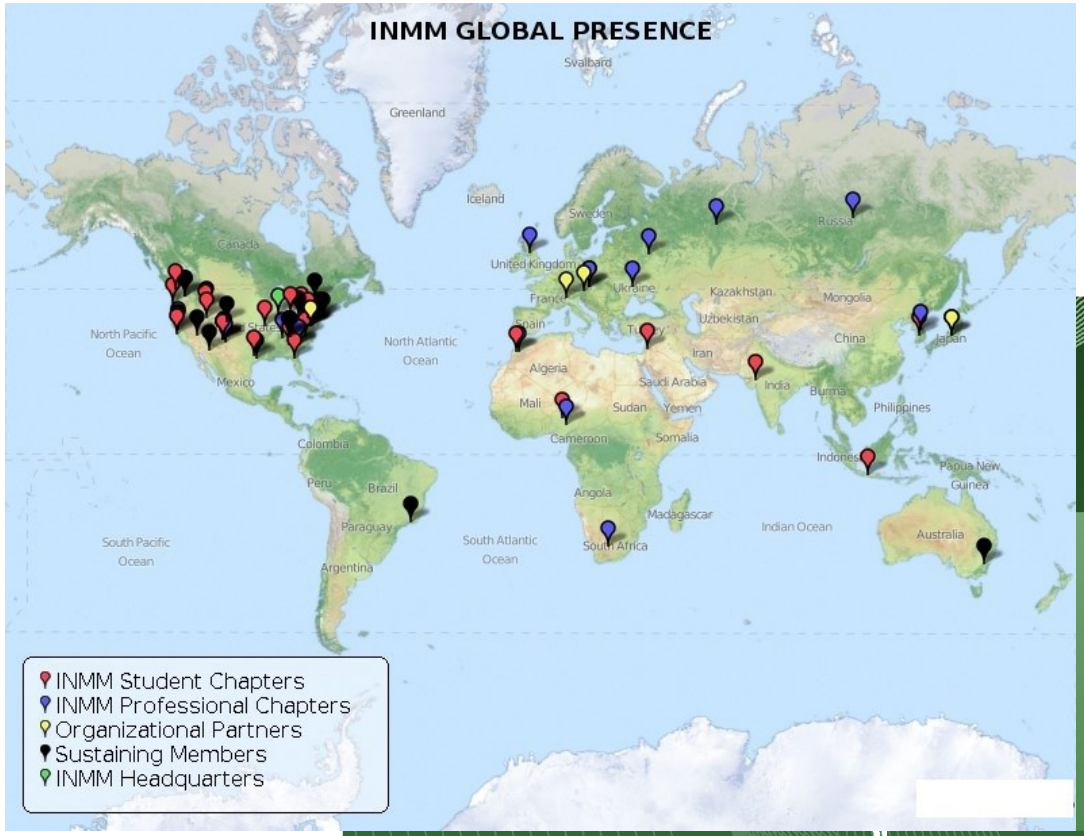
- Facility Operations
- International Safeguards
- Materials Control and Accountability
- Nonproliferation and Arms Control
- Nuclear Security and Physical Protection
- Packaging, Transportation and Disposition



Global Presence

INMM is a global organization with members, professional chapters, student chapters, and organizational partners in more than 30 countries around the world.

Australia
Austria
Belgium
Brazil
Canada
China
Czech Republic
Denmark
Egypt
Finland
France
Germany
India
Israel
Italy
Japan
Jordan
Luxembourg
Morocco
Netherlands
Nigeria
Norway
Poland
Russia
Saudi Arabia
Slovenia
South Africa
South Korea
Spain
Sweden
Switzerland
Ukraine
United Arab Emirates
United Kingdom
United States



OAK RIDGE National Laboratory

Professional Chapters

Chapter Activities

- Promote INMM purpose in assigned geographical area of chapter
- Sponsor, organize, and host chapter meetings and topical workshops
- Encourage students and teachers at local schools and universities.

- California Chapter (USA)
- Central Chapter (USA)
- Japan Chapter (Japan)
- Korean Chapter (Korea)
- Moroccan Chapter (Morocco)
- Nigerian Chapter (Nigeria)
- Northeast Chapter (USA)
- Obninsk Chapter (Russia)
- Pacific Northwest Chapter (USA)
- Russian Federation Chapter (Russia)
- South African Chapter (South Africa)
- Southeast Chapter (USA)
- Southwest Chapter (USA)
- Ukraine Chapter (Ukraine)
- United Kingdom Chapter (UK)
- Urals Chapter (Russia)
- Vienna Chapter (Austria)

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Student Chapters

Chapter Activities

- Promote INMM purpose in assigned geographical area of chapter
- Sponsor, organize, and host chapter meetings and topical workshops
- Encourage students and teachers at local schools and universities.

- Ahmadu Bello University (Nigeria)
- Amity University (India)
- Federal University of Rio de Janeiro (Brazil)
- Georgia Institute of Technology (USA)
- Idaho State University (USA)
- Indian Institute of Technology Kanpur (India)
- Jordan University of Science and Technology (Jordan)
- Korea Advanced Institute of Science & Technology (Korea)
- Mercyhurst College (USA)
- Middlebury Institute of International Studies at Monterey (USA)
- North Carolina State & Triangle-areas Universities (USA)
- Oregon State University (USA)
- Pandit Deendayal Petroleum University India (India)
- Pennsylvania State University (USA)
- Texas A&M University (USA)
- Universitas Gadjah Mada (Indonesia)
- University of Florida (USA)
- University of IBN Tofail (Morocco)
- University of Michigan (USA)
- University of Missouri (USA)
- University of New Mexico (USA)
- University of Tennessee (USA)
- University of Utah (USA)
- University of Washington (USA)

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Workshops, Seminars, Meetings & Conferences

Workshops and Seminars

- Spent Fuel Management Seminar
- Vulnerability Assessment Tools Workshop
- Safeguards Culture Workshop
- Reducing the Risk Workshop
- Risk Informed Security Workshop
- Information Analysis Technologies, Techniques and Methods for Safeguards, Nonproliferation and Arms Control Verification

Joint Conferences

- International Symposium on Packaging and Transportation of Radioactive Materials (PATRAM)
- INMM/ESARDA Joint Workshop
- INMM/ANS Workshop on Safety-Security Risk-Informed Decision-Making
- A Technical Meeting on Nuclear Energy and Cyber Security

Upcoming Annual Meetings

INMM 59th Annual Meeting
July 22-26, 2018
Baltimore Marriott Waterfront
Baltimore, Maryland USA

INMM 60th Annual Meeting
July 14-18, 2019
J.W. Marriott Desert Springs
Palm Desert, California USA

INMM 61st Annual Meeting
July 12-16, 2020
Baltimore Marriott Waterfront
Baltimore, Maryland USA

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Related Organizations

National/Transnational Laboratories

- All-Russian Institute of Experimental Physics - VNIIEF
- Argonne National Laboratory
- Brookhaven National Laboratory
- CERN Particle Physics Laboratory
- Fermi National Accelerator Laboratory
- Idaho National Laboratory
- Joint Research Center - Ispra
- Juelich Research Center
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- New Brunswick National Laboratory
- Oak Ridge National Laboratory
- Pacific Northwest National Laboratory
- Sandia National Laboratories
- Savannah River National Laboratory
- Y-12 National Security Complex

International Organizations

- ABACC
- European Safeguards Research and Development Association (ESARDA)

National/Transnational Agencies

- American National Standards Institute
- European Commission
- Partnership for Nuclear Security (within the U.S. Department of State)
- U.S. Department of Energy
- U.S. Nuclear Regulatory Commission

Non-Governmental Organizations

- Atoms for Peace -- Johns Hopkins University Press
- American Nuclear Society (ANS)
- Nuclear Energy Institute
- Nuclear Threat Initiative
- World Institute for Nuclear Security (WINS)
- World Nuclear Association
- World Nuclear Transport Institute (WNTI)

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