Russian University Education in Nuclear Safeguards and Security

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Contents

▸ Background

▸ General Activities
  ▼ Curriculum Development
  ▼ Training and Internships
  ▼ Laboratory Equipment

▸ Moscow Engineering Physics Institute (MEPhI)
  ▼ MEPhI Master’s Program
  ▼ Engineering Degree Program

▸ Tomsk Polytechnic University (TPU)
  ▼ Engineering Degree Program

▸ Nonproliferation Education

▸ Recent Initiatives

▸ Conclusions
Goal: Educate the next generation Russian safeguards and security (S&S) specialists in nonproliferation and S&S methodology

U.S. DOE Office of International Material Protection and Cooperation has worked with the Russian Federation since mid-1990s to secure its nuclear materials through the Material Protection, Control and Accounting (MPC&A) Program

MPC&A Program supports infrastructure activities at national and regional levels, including university level education
Safeguards and Security Education Program Curriculum Development

- Prepares graduates for entry-level professional positions at nuclear facilities, agencies or research institutes

- Graduates are qualified to:
  - Assess effectiveness of facility’s S&S system
  - Design improvements to S&S systems
  - Prioritize proposed improvement based on cost/benefit analysis and regulatory requirements
  - Address technical issues
  - Undertake oversight activities
  - Contribute to development and implementation of S&S and nonproliferation policy
Safeguards and Security Education Program Curriculum Development

Developed through a 4-stage process:

- Week Charts
- Summary of Lectures
- Training Manuals
- Textbook

This process of curriculum development is used for the master’s program and the engineering degree programs.
Textbooks

- *Physical Protection of Nuclear Facilities* – published 2009
Safeguards and Security Education
Training and Conferences

- Selected students participate in training courses
  - Russian Methodological Training Center (for material control and accounting)
  - Interdepartmental Special Training Center (for physical protection)
- Student tours of nuclear facilities
- S&S professors attend conferences in U.S. and Europe
- Professors and students participate in the International Nuclear Student Conference *Polar Lights*
- In 2009, conference for college and high school students in Snezhinsk
Safeguards and Security Education Internships

- Internships at Russian facility or organization for all students
- Select top students have opportunity for international internships
  - Monterey Institute of International Studies
  - Aquila Technologies
  - EU Joint Research Centre – Ispra, Italy
  - University of Missouri
  - International Atomic Energy Agency (IAEA)
MEPhI MC&A Laboratory Equipment

NDA

Barcoding
MEPhI Physical Protection Laboratory Equipment

- Interior sensors laboratory
- Exterior sensors laboratory
- Access control laboratory
- Video surveillance laboratory
- Data collection station laboratory
TPU MC&A Laboratory Equipment

Tamper-Indicating Devices Laboratory

Nondestructive Assay Laboratory

Spectrophotometer

Proudly Operated by Battelle Since 1965
EDP students get hands-on experience with different camera systems

Information on access control systems

Information on video surveillance systems
MEPhI Master’s Program

► World’s first S&S degree program established in 1997
► 2 years; 4 semesters
  ■ 1st and 2nd semesters: lecture and lab courses
  ■ 3rd semester: internships
  ■ 4th semester: thesis development and defense
► 10 classes have graduated; 79 students
  ■ Graduates working for Rosatom, Rostekhnadzor, Institute of Physics and Power Engineering, Kursk NPP, Kurchatov Institute, Situation and Crisis Center, Bochvar, Eleron, ATOMINFORM, Ministry of Trade, etc.
  ■ Graduates pursuing PhD studies
MEPhI Master’s Program
Curriculum Development

Example courses

- Introduction to systems of safeguards and security
- Methods and devices for nuclear material measurements
- Computerized systems for material control and accounting (MC&A)
- Organization of communications, alarm, access delay and response actions in physical protection (PP)
- Methods of vulnerability analysis and optimization of PP systems
- Nuclear nonproliferation: political, legal and economic aspects
MEPhI Engineering Degree Program

- Oriented toward facility needs
- 5½ years; 11 semesters
  - 6th – 9th semesters: lecture and laboratory courses
  - 10th semester: internship
  - 11th semester: thesis development and defense
- 3rd class graduated in February 2009
  - Total of 38 students graduated since 2007
  - Graduates working at Mayak, Eleron, ATOMINFORM, Rosatom, Rostekhnadzor, Kurchatov Institute, Kursk NPP, Energoatom Concern, etc.
  - Graduates pursuing PhD studies
Example courses

- Methods and devices of physical measurements
- Active methods of nuclear material control
- Computerized technologies in MC&A systems
- Engineering technical tools of physical protection
- Design of physical protection systems
- Fundamentals of design and vulnerability assessment
- Legal and international aspects of nonproliferation

Many of these courses have associated laboratory courses; DOE and MEPhI have purchased laboratory equipment
TPU Engineering Degree Program

▶ Serves students east of the Ural Mountains
▶ 5½ years; 11 semesters
  ■ 6th – 10th semesters: lecture and laboratory courses
  ■ Summer between 10th and 11th semesters: internships
  ■ 11th semester: thesis development and defense
▶ Offers courses and laboratory exercises in chemical technology
▶ 1st class of 17 students graduated February 2009
  ■ All-Russian Scientific Research Institute of Experimental Physics (Sarov), All-Russian Scientific Research Institute of Technical Physics (Snezhinsk), Research Institute of Atomic Reactors (Dmitrovgrad), Mining and Chemical Combine (Zheleznogorsk), Petersburg Nuclear Physics Institute, Novosibirsk Chemical Concentrates Plant, etc.
TPU Engineering Degree Program
Thesis Defense
Example courses
- Accounting and control of fissile materials in the nuclear fuel cycle
- Methods and devices of physical measurements
- Analytical chemistry of uranium, plutonium and thorium
- Automatic systems of physical protection
- Physical protection hardware
- Basics of protection and physical protection vulnerability
- Legal basis for nonproliferation of nuclear weapons

Many of these courses have associated laboratory courses; DOE and TPU have purchased laboratory equipment
Monterey Institute of International Studies has been assisting the project in addressing nonproliferation education and training in Russia

- Assisting Russian universities to develop nonproliferation courses
- Training professors
- Lecturing at universities
- Establishing high school nonproliferation curriculum
- Introducing nonproliferation sessions at student conferences in St. Petersburg and this summer in Snezhinsk

Center for Policy Studies in Russia (PIR Center) conducts Summer School on Global Security, with one week devoted to nonproliferation
Recent Initiatives

- MEPhI is developing new lecture course *Fundamentals of Nuclear Materials Safe and Secure Management*
  - Pilot course to be delivered at MEPhI and other selected Russian “nuclear universities”
- National Nuclear Research University to be led by MEPhI
- Nonproliferation Educators Seminar was held in 2007 to exchange curriculum and teaching techniques among participants from Russia and the Former Soviet Union
Conclusion

► Russian universities have successfully established the first S&S degree programs in the world
  ■ Continue to enhance S&S and nonproliferation policy education in the Former Soviet Union
  ■ Are assisting the IAEA in S&S and nonproliferation policy curriculum for global use
► Strengthening of global nonproliferation regime
► DOE continues to work to ensure these programs are self-sustaining by 2012 when it completes its involvement