

The Coming Nuclear Renaissance for the Next Generation Safeguards Experts

Maximizing Benefits While Minimizing Proliferation Risks

December 15-18, 2008

Joint Institute for Computational Sciences
Oak Ridge National Laboratory
Oak Ridge, Tennessee



Oak Ridge National Laboratory
in partnership with
Y-12 National Security Complex and Savannah River National Laboratory

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Global Nuclear Security Technology Division (GNSTD) and the Nuclear Science and Technology
Division (NSTD)

**THE COMING NUCLEAR RENAISSANCE FOR NEXT GENERATION SAFEGUARDS SPECIALISTS –
MAXIMIZING POTENTIAL AND MINIMIZING THE RISKS**

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INTRODUCTION

This document is intended to provide an overview of the workshop entitled “The Coming Nuclear Renaissance for the Next Generation Safeguards Experts—Maximizing Benefits While Minimizing Proliferation Risks,” conducted at Oak Ridge National Laboratory (ORNL) in partnership with the Y-12 National Security Complex (Y-12) and the Savannah River National Laboratory (SRNL). This document presents workshop objectives; lists the numerous participant universities and individuals, the nuclear nonproliferation lecture topics covered, and the facilities tours taken as part of the workshop; and discusses the university partnership sessions and proposed areas for collaboration between the universities and ORNL for 2009. Appendix A contains the agenda for the workshop; Appendix B lists the workshop attendees and presenters with contact information; Appendix C contains graphics of the evaluation form results and survey areas; and Appendix D summarizes the responses to the workshop evaluation form.

The workshop was an opportunity for ORNL, Y-12, and SRNL staff with more than 30 years’ combined experience in nuclear nonproliferation to provide a comprehensive overview of their expertise for the university professors and their students. The overall goal of the workshop was to emphasize nonproliferation aspects of the nuclear fuel cycle and to identify specific areas where the universities and experts from operations and national laboratories could collaborate.



WORKSHOP INFORMATION

“The Coming Nuclear Renaissance for the Next Generation Safeguards Experts—Maximizing Benefits While Minimizing Proliferation Risks,” was held at Oak Ridge National Laboratory from December 15–18, 2008. This workshop was sponsored by Oak Ridge National Laboratory International Safeguards Group of the Global Nuclear Security Technology Division (GNSTD), the Radiation Safety Information Computational Center (RSICC), the Y-12 National Security Complex and Savannah River National Laboratory (SRNL) with support from the Department of Energy’s Office of International Regimes and Agreements (NA-243). The intended audience was university professors and upperclassmen or graduate students enrolled at U.S. universities.

Workshop objectives were to:

- engage participants in the area of nuclear nonproliferation by introducing them to next generation safeguards initiatives;
- discuss nonproliferation aspects of the nuclear fuel cycle;
- discuss domestic and international legal requirements and provide tours of operations areas; and
- work with participants to identify curriculum and training opportunities to prepare for the next generation of safeguards experts.

The first two days of the workshop concentrated on lectures covering nuclear nonproliferation topics, for example:

- The Nuclear Fuel Cycle
- Enrichment Technology
- Reactors (Production, Research and Power)
- Safeguards for Plutonium Reprocessing
- Safeguards for Transportation
- Nonproliferation Computational Codes
- International Treaties and Agreements
- International Safeguards and the International Atomic Energy Agency (IAEA)
- The Nuclear Regulatory Framework and Implementation of Material Control and Accountability (MC&A) Systems
- The Nuclear Regulatory Commission and Nuclear Security Incidence Response Program
- Export Control Program
- Domestic Physical Protection Systems
- Domestic Nuclear Material Control and Accounting
- Plutonium Measurement Systems

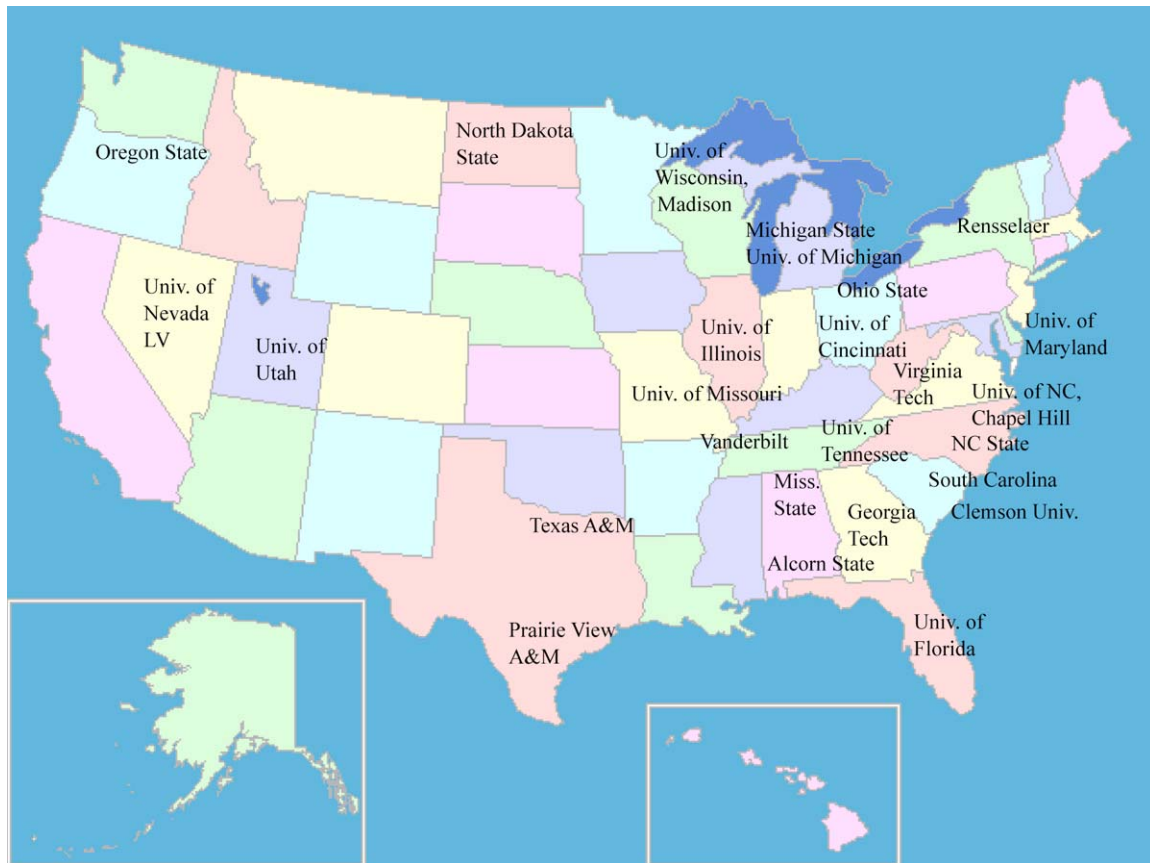
Although not currently covered in academic courses at the university level, activities associated with these topics are regularly performed by laboratory personnel as part of their job activities. Furthermore, several such activities are mandated by DOE or NRC requirements. The workshop provides a useful, real-world introduction to valuable hands-on training for professors and students alike.

WORKSHOP ATTENDEES

The total number of attendees was 38, including 14 university professors and 19 students from nuclear engineering departments or programs, as well as other institutions. The universities that were represented were:

- Alcorn State University
- Clemson University
- Georgia Institute of Technology
- Michigan State University
- Mississippi State University
- North Carolina State University
- North Dakota State University
- Ohio State University
- Oregon State University
- Prairie View A&M University
- Rensselaer Polytechnic Institute
- University of Cincinnati
- University of Florida
- University of Illinois at Urbana
Champaign
- University of Maryland at College Park
- University of Missouri
- University of Nevada at Las Vegas
- University of North Carolina at Chapel Hill
- University of South Carolina
- University of Tennessee
- University of Utah
- University of Wisconsin
- Vanderbilt University
- Virginia Tech

Map showing locations of universities represented at the workshop.



Other institutions represented at the workshop included

- North Atlantic Treaty Organization School/Weapons of Mass Destruction (WMD) Department
- New York State Police
- Oak Ridge National Laboratory
- Rensselaer Polytechnic Institute
- U.S. Department of Energy
- Y-12 National Security Complex
- Savannah River National Laboratory
- Savannah River Site
- Savannah River Nuclear Solutions
- U. S. Nuclear Regulatory Commission

FACILITY TOURS

Attendees had the opportunity to tour several ORNL, Y-12, and Oak Ridge, Tennessee, locations during the workshop. These are highlighted below.

Central Training Facility

The Central Training Facility at Oak Ridge is a unique operation that trains personnel responsible for maintaining security. The facility consists of 712 acres, indoor and outdoor firing ranges, training rooms, towers, a simulated house of tires, and paved trails through the woods that provide scenarios for training. A wide range of firearms and tactics training has been developed and is conducted on site and also through Mobile Training Teams. Training is performance based and may be site specific. The training staff consists of highly qualified and dedicated personnel, many of whom are nationally ranked marksmen, certified by the National Rifle Association, and/or with prior military background. The training, philosophy, techniques and programs are available to qualified activities.

The Graphite Reactor

In the early days of U.S. involvement in World War II, the United States launched the top-secret, top-priority Manhattan Project. The Graphite Reactor, designed for the pilot-scale production of plutonium for atomic weaponry, was built in only 11 months. Its job was to show that plutonium could be extracted from irradiated uranium slugs, and its first major challenge was to produce a self-sustaining chain reaction. During the 20 years the Graphite Reactor operated—from 1943 to 1963—it continued its pioneering role. It produced the first electricity from nuclear energy. It was the first reactor used to study the nature of matter and the health hazards of radioactivity. And for years after the war, it was the world's foremost source of radioisotopes for medicine, agriculture, industry, and other purposes.

American Museum of Science and Energy, Oak Ridge

Originally named the American Museum of Atomic Energy, the museum opened in 1949 in an old wartime cafeteria. Its guided tours took visitors through the peaceful uses of atomic energy. The present facility, opened in 1975, continues to provide the general public with energy information. The name of the museum was changed to the American Museum of Science and Energy in 1978.

Building 9213, Nuclear Radiological Field Training Center

A site used for nuclear research in Oak Ridge, Tennessee, during the Manhattan Project is now the Y-12 National Security Complex's Nuclear and Radiological Field Training Center (NRFTC) — the only facility of its kind in the world. Members of the 44th WMD Civil Support Team (Florida National Guard) consolidate information from the initial entry team assessment. The Center provides world-class nuclear and radiological training in a safe, secure, realistic environment using expert instruction and personnel to serve as observers/evaluators for customer training. For military and emergency response units that may operate in a nuclear or radiological environment, the center provides scenario-driven training customized to meet an individual's or team's unique requirements and needs.

New Hope – Highly Enriched Uranium Materials Facility (HEUMF)

The New Hope Center, completed in 2007, is located at the Y-12 National Security Complex. This facility provides safe and secure storage for the nation's supply of highly enriched uranium (HEU). This single state-of-the-art storage facility replaced multiple aging facilities. The HEUMF will play a major role in helping the National Nuclear Security Administration accomplish its mission of protecting the nation's inventory of HEU, which is a vital national security asset.

Containment and Surveillance Systems Laboratory (CSSL)

The CSSL develops, integrates, and deploys technologies to implement the following:

- asset tracking systems
- security system development and deployment
- tamper-indicating devices and vulnerability assessments
- unattended remote monitoring systems
- wired and wireless sensor-based monitoring

High Flux Isotope Reactor (HFIR)

ORNL's 85-megawatt HFIR provides one of the highest steady-state neutron fluxes of any of the world's research reactors. Thermal and cold neutrons produced by HFIR are used to study physics, chemistry, materials science, engineering, and biology. The intense neutron flux, constant power density, and constant-length fuel cycles are used by more than 200 researchers each year for neutron scattering for probing the fundamental properties of condensed matter.

Coupled End-to-End Virtual Simulation

ORNL is conducting a complete, coupled end-to-end (CETE) demonstration of advanced nuclear fuel reprocessing to support the DOE Advanced Fuel Cycle Initiative (AFCI). These multikilogram scale reprocessing operations provide a unique opportunity to test integrated off-gas treatment systems designed to recover the primary volatile fission and activation products (^3H , ^{14}C , ^{85}Kr , and ^{129}I) released from the spent nuclear fuel (SNF) during the head-end operations. The CETE project is demonstrating an advanced dry head-end process referred to as "voloxidation," designed to condition the SNF, separate it from the cladding, and release the tritium contained in the fuel matrix. The off-gas from this process as well as from the more traditional fuel dissolution process is treated separately and the volatile components are recovered. The CETE has recently completed the voloxidation of three batches of SNF.

UNIVERSITY PARTNERSHIPS SESSION

The University Partnerships session was held on Day IV of the workshop. After students were provided with overviews of topics that make up the safeguards system both domestically and internationally, the university session focused on identifying areas where the national laboratory can work with university participants to identify curriculum and training opportunities to prepare for the next generation of safeguards experts. Presenters are listed with questions and answers from each presenter's session summarized below each session listing.

Presenter: Ed Wonder – DOE/NNSA (8:10am), "University Outreach and the NCSI"

- Safeguards human resources and technology base shrinking in the U.S.
- Defining the "Next Generation Safeguards Specialist"

Session Questions	Answers
Brief sketch of ideal resume?	No ideal resume, probably a Masters degree, engineering with a relevant thesis, international safeguards/nonproliferation coursework, intern experience, experience with information management/analysis.
Use private consulting as an enticement?	Safeguards consulting salaries not much better than government, real competitor is nuclear industry, can't compete with industry on salaries.
Why the emphasis on early exposure?	To increase the number and quality of candidates.
Security concerns and internships (e.g., Y-12)?	Yes, security will always be a concern; clearance issues will impact human resources goals.
Internships at labs other than ORNL?	Yes.

Presenter: Glenn Sjoden – University of Florida (9:25am), "Computation and Nonproliferation at Florida"

- Communicate to nuclear engineering students that there are three main problems in the nuclear field today: nuclear power/energy, nonproliferation, and medicine/cancer

<No Questions>

Presenter: Jason Hayward – University of Tennessee (9:50am), "Nuclear Engineering and Nonproliferation at UT"

- New graduate certificate program
- New INMM student chapter at UT

Session Questions	Answers
New certificate available through distance learning?	Yes.
How many students in INMM chapter?	8 students officially signed up (meets minimum), 10–30 at meetings so far, planning lots of potential events through INMM chapter for the future.
How to engage policy students in technical aspects and vice versa?	Partnerships with Baker Center, definite interest in such partnerships, but nothing concrete yet.

Presenter: Man-Sung Yim – North Carolina State (10:10am), "Nuclear Nonproliferation at NC State"

Session Questions	Answers
How far is research in this area, still academic [theoretical] or beyond [practical]?	Still academic right now, initially there was some private funding but it petered out.
Has this research been presented at INMM?	Not yet, planning to this next summer.

Presenter: David Ford – Texas A&M (10:40am), "Nuclear Nonproliferation at A&M"

- MS in nonproliferation program
- Foreign Field Experience (FFE) [good model for the cultural & technical collaboration internship trip?]
- NGSi Pilot Program at LANL and LLNL

Session Questions	Answers
	Importance of INMM/professional society involvement, multidisciplinary involvement with Bush School policy programs
How many master's degree students vs. doctoral degrees?	Right now, 3 PhDs, ~15 masters students.

Presenter: Shaheen Dewji – Georgia Tech (11:05am), "Nonproliferation Education and Research at Georgia Tech"

- Center for International Strategy, Technology, and Policy (CISTP)
- International affairs and nuclear engineering department connections
- Representing professors Nolan Hertel and Adam Stulberg

Session Questions	Answers
Getting any NRC funding?	We're applying for NRC funding for workshops.

Presenter: Paul Wilson – University of Wisconsin-Madison (11:25am), "Interdisciplinary Efforts at UWM"

- Graduate energy analysis and policy certificate, open to everyone, some courses that count towards degree programs, may be a good model for a safeguards certificate program

<No Questions>

Presenter: Sudarshan Loyalka – University of Missouri (11:45am), "Nonproliferation at University of Missouri"

- Graduate certificate in nuclear safeguards science and technology since 2006

<No Questions>

Presenter: Shaun Clarke – University of Michigan (12pm), "Nonproliferation Activities at University of Michigan"

- Part of new group under Sara Pozzi: Detection for Nuclear Nonproliferation
- Department expertise in radiation detection
- Working on certified degree program in nuclear nonproliferation (graduate certificate)
- Working to bridge the gap with policy school at University of Michigan
- New INMM student chapter since November 2008

<No Questions>

Presenter: Cheryl Terry - ORISE (1:15pm), "ORNL's Programs for Students and Faculty"

Session Questions	Answers
Which programs available to foreign nationals?	NESLS and HERE, if already student at U.S. university

Presenter: Dawn Eipeldauer – ORNL (1:30pm), "Next Generation Safeguards Specialist Development at ORNL"

- Expanding nuclear nonproliferation summer seminar series
- Lots of future proposals

<No Questions>

Presenter: Craig Williamson – South Carolina University Research Education Foundation (SCUREF) (1:45pm), "Proposed Workforce Development Programs"

- Southeast Universities Nuclear Reactor Institute for Science and Education (SUNRISE)
- Nuclear Forensics Fellowship may be a good model for other fellowships
- Proposed programs: graduate fellowships, undergrad research, faculty development

Session Questions	Answers
How do you get word out to students?	Good question, currently flyers to university departments, internet.

Presenter: Jeff Jay – SRNL (2:00pm), "Human Capital Working Group—A Complex-wide Perspective"

- Energy Facilities Contractors Group (EFCOG)-Human Capital Working Group (HCWG)
- Capacity and capability for a sustainable DOE mission

<No Questions>

PROPOSED ACTIONS FOR 2009 BASED ON UNIVERSITY SESSION FEEDBACK AND EVALUATION RESULTS

There were several suggestions from workshop attendees specific to the university session. To continually improve the overall workshop, this feedback will be incorporated where feasible and appropriate into the next proposed workshop format. See Appendix D for complete list of feedback comments from the evaluation forms completed by attendees.

One key insight from the feedback session was how to communicate information on opportunities, events, and network-building to students and professors. To address this issue, ORNL identified several specific actions to improve and enhance communication among subject matter experts (SMEs) and university staff and students.

SharePoint area

ORNL staff members have created a SharePoint area on the Global Nuclear Security Technology Division (GNSTD) homepage where all presentation materials, a listing of all participants and contact information, a workshop agenda, and a final workshop report will be posted. Students and professors will have access to this area and can download information and also communicate with SMEs at the laboratory.

In addition, a newsletter will be posted in same area and will include upcoming workshops, events, seminars and monthly highlights for GNSTD. The monthly highlight is particularly important because it will show students all areas of nuclear nonproliferation and programs such as the Global Nuclear Energy Partnership and the Global Threat Reduction Initiative (for example); furthermore, it will provide a point of contact for additional information. The SharePoint site will serve as the mechanism to enhance the network we are building and will provide us with additional feedback about university needs and areas for collaboration.

Two new workshops

Two new workshops are proposed for FY 2009:

“Domestic Safeguards and Security”: A one-week workshop focused on nuclear material control and accounting and physical security for plutonium and enriched uranium. Smaller sessions with exercises where students/professors will be asked to apply safeguards measures to a facility design. This workshop is proposed for spring 2009; the number of students will be limited to 25.

“International Safeguards”: A one-week workshop focused on the State System of Accounting and Control (SSAC). Topics such as Introduction to IAEA Safeguards, International Safeguards, Inspection Activities, Typical IAEA Inspection Activities at the Model Facilities, The Model Protocol Additional to Safeguards Agreements, Development of Strengthened Safeguards System, Complementary Access, Concepts of IAEA Nuclear Material Accounting, Provision of Nuclear Material Accounting Reports to the IAEA (Application of Code 10), Introduction to IAEA, Use of Containment & Surveillance, NDA Techniques for Nuclear Material Verification, NDA Instruments Used by the IAEA, Functions of National Safeguards Authority and the Role in Strengthening Safeguards, Introduction to Design Information Questionnaire, and DA Sampling and Evaluation would be offered. ORNL has access to SMEs such as Shirley Johnson, Diane Fischer, and John Oakberg who have all worked or are currently working at the IAEA and have taught the SSAC regionally, nationally, and internationally. This workshop is proposed for fall 2009; the number of students will be limited to 25.

Nuclear nonproliferation “chat room”

ORNL also proposes to develop in 2009 a nuclear nonproliferation chat room for communication among ORNL SMEs and university staff and students. The chat room will post questions that are carefully designed by both SMEs at ORNL and university professors (a pilot chat room is being discussed with Dr. Man-sung Yim from North Carolina State University). The questions are designed for the students either individually or as a team to research topics and develop reports. Both the SME and the professor will grade these reports, which will be unclassified in nature. SMEs will also be working with professors to design ongoing discussions that are held in a chat room. This is an important means to enhance network-building and provide an online forum for discussions involving nuclear nonproliferation topics. In addition, the chat room will be a mechanism to retain and transfer knowledge and enable SMEs at ORNL to assist in developing the next generation of safeguards specialists. This is especially important since embedding safeguards and security topics in academic curriculum is another need posed by the universities.

APPENDIX A. AGENDA
THE COMING NUCLEAR RENAISSANCE FOR THE NEXT
GENERATION SAFEGUARDS EXPERT—
MAXIMIZING BENEFITS WHILE MINIMIZING PROLIFERATION RISKS

December 15–18, 2008
Joint Institute of Computational Sciences (JICS), Building 5100

Oak Ridge National Laboratory (ORNL) UT-Battelle in partnership with
Y-12 National Security Complex
Savannah River National Laboratory (SRNL) and Savannah River Nuclear Solutions (SRNS)
(Version 16)

Day I - Monday, December 15, 2008

8:30 – 9:30 – Registration at Joint Institute for Computational Sciences (JICS) Building 5100
9:30 – Welcome—Dana Christiansen, Associate Laboratory Director, Energy and
Engineering Sciences Directorate
10:00 – Alan Icenhour, Director Global Nuclear Security Technology Division

I. Introduction to the Nuclear Renaissance

10:30 – Workshop Objectives – Michael Whitaker
10:45 – Overview of Workshop and Logistics – Dawn Eipeldauer

Overview of Site Missions

11:00 – Chuck Goergen, Deputy Manager, Separations, Savannah River Nuclear Solutions;
11:20 – Morris Hassler, Y-12 National Security Complex

Lunch on own

II. The Nuclear Fuel Cycle

1:00 – 1:15 – Ken Baker, Adam Scheinman

A. 1:15 – The Nuclear Fuel Cycle – Mike Ehinger (ORNL)

B. Safeguards for Nuclear Material Production

2:00 – Safeguards for Enrichment – Michael Whitaker (ORNL)

C. 2:45 – Reactors (Production, Research and Power) – Dan Ingersoll (ORNL)

3:30 – Break

D. 3:45 – Safeguards for Plutonium Reprocessing – Chuck Goergen (SRNS)

- E. 4:30 – Type B Radioactive Material (RAM) Packagings for Plutonium Content – Steve Bellamy (SRNL)
 - F. 5:15 – The Radiation Safety Information Computational Center – In Support of the Nuclear Renaissance and Human Resource Development – Bernadette Kirk, RSICC Director (ORNL)
- 5:45 – Closing Comments Day I and Review Day II agenda

Day II – Tuesday, December 16, 2008

III. Legal Framework- Regulating Authority

- A. 8:00 – Nonproliferation Regime and International Safeguards – Ana Raffo-Ciaido (ORNL)
 - B. 9:00 – The Safeguards System of the International Atomic Energy Agency – John Oakberg (Haselwood Enterprises)
- 10:00 – 10:15 – Break
- C. 10:15– The Nuclear Regulatory Framework and Implementation of MC&A Systems, Martha Williams, NRC
 - D. 11:15 - The Nuclear Regulatory Commission (NRC) Robert Caldwell, Nuclear Security Incidence Response
- 12:15 – Lunch at ORNL on own
- E. 1:15 – Overview of Export Control Program, David Snider (ORNL)

IV. Domestic Safeguards and Security Systems

- A. 2:15 - Domestic Physical Protection Safeguards and Security Systems – Richard E. Glass, Y-12 National Security Complex
 - B. 3:00 –Potential Benefits of Advanced Warehouse Technology Applications for DOE Material Storage Areas, Richard Koenig, K-Area Complex, SRNS
 - C. 4:00 - Domestic Nuclear Material Control and Accounting System, Amy Wilson (Y-12)
 - D. 4:45 – PA Coulometric Measurement System for Plutonium Assay, Michael Holland (SRS)
- 5:30 – Closing Comment Day II and Review Day III agenda
- 7:00 – Flatwater Grill

Day III – Wednesday, December 17, 2008V. Tours at Y-12 or ORNL

A. 8:00 – 12:00 – Tours at Y-12

7:00-7:15 – New Hope Center – meet hosts Sharon Disney and KJ Maddux for tour

8:00 – depart on bus with Ray Smith providing history of Y-12

8:30 – JL Davis – Central Training Facility

9:30 – Building 9213 – Nuclear Radiological Field Training Center

10:30 – New Hope – HEU/MF Storage Facility with Mona Williams & Operational Testing Demonstrations with David Speaks & Joe Rainwater

Participants divided into groups that will tour three locations for 1 hour

1. Safeguards Systems Technology Integration Center
2. High Flux Isotope Reactor
3. Coupled End-to-End Demonstration

3:00- 3:15 - Break

B. 4:30 – Global Security and Nonproliferation Training – Sharon Wagner (ORNL)

5:00 – Closing Comment Day III and Review Day IV agenda

Day IV – Thursday, December 18, 2008

8:00 - Introduction – Bernadette Kirk (ORNL)

VI. Next Generation Safeguards Specialists

8:15 – Ed Wonder, Office of International Regimes and Agreements/QinetiQ-North America, Principal Scientist Q&A

VII. University Partnerships

9:00 - Dr. Glenn Sjoden – University of Florida (UF)

9:20 – Dr. Jason Hayward – University of Tennessee (UT)

9:40 - Dr. Man-sung Yim – North Carolina State (NCS)

10:00 – Break

- 10:20 – Dr. David Ford, Texas A&M University (TAMU)
- 10:40 - Dr. Shaheen Dewji - Georgia Institute of Technology (GA)
- 11:00 - Dr. Paul Wilson – University of Wisconsin (UW)
- 11:20 – Dr. Sudarshan Loyalkas - University of Missouri (UM)
- 11:40 - Dr. Shaun Clarke, University of Michigan (UM)
- 12:00 – At ORNL on own
- 1:00 - Cheryl Terry – Oak Ridge Institute for Science and Engineering (ORISE)
- 1:20 – Dawn Eipeldauer – ORNL Outreach to Universities and Internships
- 1:40 - Craig Williamson, South Carolina Universities Research Education Foundation (SCUREF)
- 2:00 - Open Discussion on University Engagement concerning university needs– Bernadette Kirk (ORNL), and Jeff Jay (SRNL)
- 4:00 – Wrap Up

APPENDIX B: ATTENDEES

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APPENDIX B: ATTENDEES

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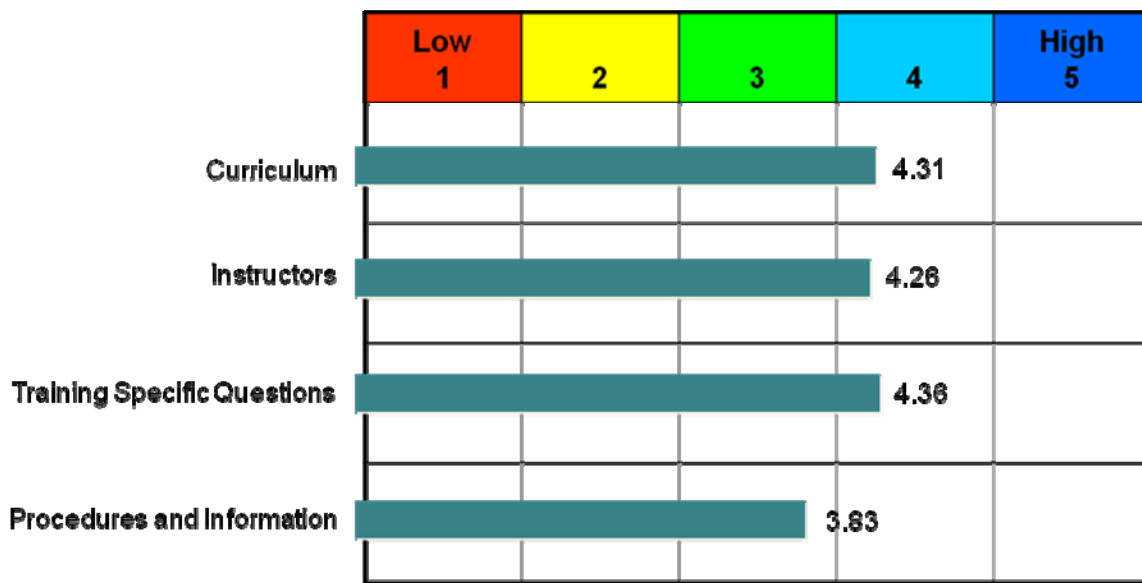
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APPENDIX C: EVALUATION FORM RESULTS AND SURVEY AREAS

Evaluation is an important component of a workshop. Feedback and carefully crafted evaluations such as the one used for this workshop help improve the effectiveness and the quality of the workshop and instruction and allow us to plan, revise, or enhance future workshops. Students tend to give more accurate feedback when the experience is still fresh, and all participants were encouraged to provide feedback. As the graphics in this appendix show, the scores for curriculum, instructors, and training-specific questions were above average. In addition, we received some very constructive comments from the students that we will incorporate into proposed future sessions, for example, not enough time for breaks, not enough time for questions, days were too long, and not enough interaction (see Appendix D for specific comments).



Survey areas

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Curriculum	Low 1	2	3	4	High 5	N/A	Average
The training met my expectations.	0	1	4	11	11	1	4.19
I will be able to apply the knowledge learned.	0	0	6	9	12	1	4.22
The curriculum content was organized and easy to follow.	0	0	0	10	18	0	4.64
The materials distributed were pertinent and useful.	0	1	0	8	19	0	4.60

Instructors	Low 1	2	3	4	High 5	N/A	Average
The presenters were knowledgeable.	0	0	0	6	22	0	4.79
The quality of instruction was good.	0	0	1	14	13	0	4.43
Adequate time was provided for attendee questions.	0	2	2	17	7	0	4.04
Staff were interested and addressed attendees concerns.	0	0	0	3	23	2	4.88

Training Specific Questions	Low 1	2	3	4	High 5	N/A	Average
How do you rate this training overall?	0	0	6	8	14	0	4.29
This training is worthwhile and should be conducted on a regular basis.	0	0	4	8	16	0	4.43

Procedures and Information	Low 1	2	3	4	High 5	N/A	Average
Did you receive timely, advance training information?	0	2	3	8	12	3	4.20
Was adequate time allowed for breaks and meals?	0	1	3	13	10	1	4.19

**APPENDIX D: SUMMARY OF RESPONSES TO EVALUATION FORM FOR
“THE COMING NUCLEAR RENAISSANCE”**

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1. Which of the training presentations or topics were the most useful to you?

- (1) All presentations geared towards future job possibilities. How to approach. What is vital to know or information/learning that will add to job possibilities.
- (2) I really enjoyed the nuclear fuel cycle lecture on day 1.
- (3) Nothing
- (4) Specific discussions of safeguards issues
- (5) Nothing
- (6) Ed Wonders indication that information about critical skill sets and agency needs is being collected
- (7) Physical protection and security systems
- (8) Fuel cycle, and other applied safeguards lectures and also policy discussions
- (9) University partnerships were a great series of topics to give an idea of topics
- (10) Safeguards, fuel cycle, next generation safeguards
- (11) Nothing
- (12) Nothing
- (13) Safeguards and plutonium reprocessing and international safeguards
- (14) Overview preceding rad training facility as part of the tour
- (15) Implementation of safeguards during the fuel cycle enrichment and reprocessing, international safeguards treaties, NPT, NRC safeguards, IC area safeguards initiatives using RFID, all the tours
- (16) International treaty information and finding out all the different organizations in safeguards.
- (17) Nothing
- (18) Material control and accounting, international safeguards, international treaties and agreements
- (19) ORNL tour
- (20) Nothing
- (21) Generally the resources given for future education opportunities and internships and fellowships helpful.
- (22) Lab visits and excellent presentations
- (23) Tours of the facilities and introduction to the people at facilities very useful.
- (24) Nuclear fuel cycle and CETE virtual tour and safeguards laboratory
- (25) More open discussions should be built into schedule and fewer presentations because there was overlap and tours were a fantastic part of workshop, IAEA, DOE, NNSA
- (26) Nuclear Fuel cycle and organizational overviews and advance workforce technology
- (27) Nothing
- (28) Overview environment, reactors, DOE sites

2. Which of the training presentations or topics did you find the least useful?

- (1) None! All information is beneficial.
- (2) The tour at Y-12 security training facility.
- (3) Security procedures
- (4) Nuclear Regulatory Framework Discussions

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- (5) Nothing
- (6) Nothing
- (7) N/A
- (8) University research
- (9) The section of topics was appropriate
- (10) Y-12 tour
- (11) Nothing
- (12) Nothing
- (13) NRC presentations (Williams, Bukharin), domestic nuclear material control and accounting (Wilson)
- (14) Time at guard training
- (15) Domestic physical protection (the lecturer was good and the content should probably be retained. It just was not an area of interest for me.
- (16) Not really any. It was all useful.
- (17) Nothing
- (18) Nuclear fuel cycle
- (19) Legal framework and just not my cup of tea
- (20) Nothing
- (21) Repetitive nature policy and history and no one presentation just the amount of overlap.
- (22) Nothing
- (23) Nothing
- (24) Some of the university presentations were a little dry and not directly relevant.
- (25) Nothing
- (26) Incidence response
- (27) Nothing
- (28) Portions of topics too basic

3. What presentations or topics were you expecting to hear, but were not presented?

- (1) None
- (2) Some detailed presentations on safeguards at the policies influencing then the presentations given seemed more of an overview/skimming of material
- (3) NDA technology
- (4) More detailed explanations of existing and proposed safeguards or more technical exploration of those issues
- (5) Nothing
- (6) More about specific education objectives
- (7) N/A
- (8) Career paths starting with undergraduate to graduate research through entire career not just technical majors but nontechnical majors also. Jobs at IAEA, NNSA, DOE, LABS, private companies, power plants.
- (9) Presentations of students who did internships at national laboratories.
- (10) More profile on who and where people will be working in nonproliferation and safeguards.
- (11) Nothing
- (12) Nothing
- (13) Nuclear safeguards technologies overview and details by the university community
- (14) Nothing
- (15) None
- (16) Transportation domestically
- (17) Nothing

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- (18) More international security and agreements nonproliferation what is the UN/IAEA doing to limit proliferation concerns in the international community.
- (19) Would have been better to see more nuclear facilities at Y-12
- (20) Nothing
- (21) I was expecting to see more technical presentations and less policy. Some of the policy aspects seem repetitive and could be replaced by more presentations like Mike Holland, Steve Bellamy and Mike Ehinger and the tour.
- (22) Policy changes toward foreign nationals interested in pursuing a career in US.
- (23) Presentations on specific tools in use at ORNL/SRNL would be very helpful to help students focus on training.
- (24) A few hands on activities at the safeguards lab.
- (25) An overview of safeguards activities at DOE funded national laboratory and university
- (26) Nothing
- (27) U.S. nonproliferation priorities and policies.

4. What items or activities or topics would you like to see added to this training?

- (1) It was great.
- (2) More time at Y-12. I was extremely disappointed in the hours we were given. I wanted to see technical presentations and demonstrations. I had very little interest in security guard training at facilities.
- (3) Specific items regarding SG needs and current challenges – i.e., detector systems.
- (4) Application/development of specific safeguards, like looking at specific case studies applying safeguards.
- (5) See number 3
- (6) Add one additional day to allow presenters additional time to expand on their topics.
- (7) Nothing
- (8) Real world issues with safeguards inspections anecdotal information
- (9) See number 3
- (10) How to involve minority schools in a systematic way.
- (11) Nothing
- (12) Nothing
- (13) Use of computer codes and models to support nuclear safeguards and a half day lab session on safeguards technology
- (14) History overview and include political issues encountered
- (15) Can't think of anything
- (16) Department of transportation
- (17) Nothing
- (18) Nothing
- (19) There was a list of questions posted by Ed Wonder would have been better to have time to discuss these questions as well as others.
- (20) Nothing
- (21) More on how the technical tools are used in safeguards
- (22) Nothing
- (23) Nothing
- (24) An internal view of the Y12 during the tours. We just saw the outside of buildings and security facilities
- (25) Nothing
- (26) None – exceptionally work organized and executed

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- (27) Nothing
- (28) Counter proliferation technologies

5. Other Comments:

- (1) Thanks for all of your hard work and hope to see/hear more.
- (2) Nothing
- (3) Nothing
- (4) A very good workshop overall, although the session length could be a little brutal. I feel like talks could have been trimmed slightly 10 minutes each for a substantial time savings. The hospitality was fantastic.
- (5) The days were a bit too long for this type of agenda.
- (6) Will provide more complete feedback in email. Very good organization
Not sure that some of the objectives were clearly articulated before hand.
- (7) It is obvious that Dawn and her staff have done a tremendous job organizing this event. From the pre conference information flow to the level of hospitality and organization displayed made my experience not only educational but also enjoyable. Great job!
- (8) Nice job overall!!!
- (9) Thank you for a well organized and very informative workshop. Please continue hosting the workshop.
- (10) Nothing
- (11) The entire workshop was great! The only thing I would comment on changed is the Y-12 tour. The tour was well organized and the tour staff were very professional. However the areas that were available to tour were not very interesting or relevant to the rest of the workshop. If other areas aren't available to tour at Y-12 maybe consider expanding the ORNL tours to additional labs/facilities.
- (12) How strong is a chain? "As strong as the weakest link". Instead of fortifying the usual suspect more diversification is needed. So please do not forget the weak links because the majority of real works are done by graduates of those institutions. I recently visited a nuclear power plant I don't recall seeing any graduates from the usual suspect universities.
- (13) Good effort, enthusiasm, too many talks on certain topics, more emphasis on what is needed/interest of university
- (14) Nothing
- (15) It was confusing getting different emails from Donna and Sharon regarding separate clearances for ORNL and Y-12. A reminder email for Y-12 signup would have been helpful. Having one email with 2 forms to fill out would be better. A CDROM of the electronic presentations or PDF would be helpful for classroom use.
- (16) Nothing
- (17) I had a fantastic learning experience and FUN! I have really had a spectacular education eye opener experience. As a student this was most definitely something that should not be missed and kept being offered.
- (18) Nothing
- (19) Nothing
- (20) Make a 2 - 2.5 day workshop, fewer presentations more time for discussion. What is the optimum curriculum for NGS and what is the necessary sufficient curriculum. Did we go around the room and introduce ourselves there are still a lot of people I did not meet and talk to. I did not have the opportunity to speak with people because the time during the day is highly structured. Need to strive toward redundancy in the presentation.
- (21) No free lunch

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- (22) This workshop was really valuable as an exposure to the safeguards area. The tours were an excellent opportunity and I would include the graphite reactor an option. It was well organized. I would communicate the logistics earlier. I had already booked my hotel when the room block was announced. Overall very well done. Thank all of you that planned it this is an important topic and a timely workshop.
- (23) Thanks for putting this together really appreciate it
- (24) Nothing
- (25) A few hands-on activities would have been nice at the safeguards laboratory and real tours of the CETE.
- (26) Nothing
- (27) Nothing
- (28) Nothing

