INL/CON-10-17738
PREPRINT

An American Academy for Training Safeguards Inspectors – An Idea Revisited

INMM 2010

Philip Casey Durst
Robert Bean

July 2010

The INL is a
U.S. Department of Energy
National Laboratory
operated by
Battelle Energy Alliance

AN AMERICAN ACADEMY FOR TRAINING SAFEGUARDS INSPECTORS – AN IDEA REVISITED

Philip Casey Durst (a) and Dr. Robert Bean (b)

(a) Durst Nuclear Engineering and Consulting Inc.,
P.O. Box 944, Richland, WA, 99352 USA

(b) Idaho National Laboratory
P.O. Box 1625, Idaho Falls, ID, 83415-3740 USA

ABSTRACT

In 2009, we presented the idea of an American academy for training safeguards inspectors for the International Atomic Energy Agency (IAEA), due to the declining percentage of Americans in that international organization. In this paper we assert that there is still a compelling need for this academy. While the American Safeguards Academy would be useful in preparing and pre-training American inspectors for the IAEA, it would also be useful for preparing Americans for domestic safeguards duties in the U.S. Department of Energy (DOE), U.S. DOE National Laboratories, and the U.S. Nuclear Regulatory Commission (NRC). It is envisioned that such an academy would train graduate and post-graduate university students, DOE National Laboratory interns, and nuclear safeguards professionals in the modern equipment, safeguards measures, and approaches currently used by the IAEA. It is also envisioned that the Academy would involve the domestic nuclear industry, which could provide use of commercial nuclear facilities for tours and demonstrations of the safeguards tools and methods in actual nuclear facilities. This would be in support of the U.S. DOE National Nuclear Security Administration's Next Generation Safeguards Initiative (NGSI). This training would also help American nuclear safeguards and non-proliferation professionals better understand the potential limitations of the current tools used by the IAEA and give them a foundation from which to consider even more effective and efficient safeguards measures and approaches.

INTRODUCTION

American representation in the regular professional staff positions at the International Atomic Energy Agency, in the Department of Safeguards, has diminished from a high of 20% in 1981 to approximately 12% in 2008.[1, 2] The United States Department of Energy, National Nuclear Security Administration (NNSA), Office of NA-24 is trying to increase the representation of Americans in the IAEA Department of Safeguards, to more actively support the mission of the IAEA and international nuclear safeguards. NNSA is pursuing this under the Next Generation Safeguards Initiative (NGSI), along with a number of other goals, focused on improving the effectiveness and efficiency of international nuclear safeguards.[3] Towards supporting this goal, the authors propose the creation of an American Safeguards Academy. The purpose of the Academy would be to pre-train and qualify young and mid-career American professionals that are seeking posts at the IAEA. Over the last thirty years, the nuclear infrastructure in the United States declined to 104 operating light water reactor nuclear power plants and a handful of uranium fuel fabrication plants. It is true that a new generation of uranium enrichment plants and one government-owned MOX fuel fabrication plant are being constructed and plan to start up, reversing this decades-long trend. However, the net result is that professional opportunities in the U.S. nuclear industry have declined, along with the opportunity to become proficient in the niche area of nuclear safeguards and security.

Another issue in the United States is that, as a Nuclear-Weapons State, the IAEA randomly selects civil and governmental nuclear facilities from an Eligible Facility List in order to economize on using limited IAEA inspection resources.[4] Because these inspections and safeguards activities are not as frequent and routine as in Non-Nuclear-Weapons States, Americans do not have the same opportunity to observe and become familiar with IAEA inspection procedures and verification activities as in most other countries, such as Japan, Germany, and Canada, etc. For these reasons, the authors propose that NNSA support the creation of an American Safeguards Academy that would expose young and mid-career American professionals to the expanded nuclear fuel cycle, international nuclear safeguards, and IAEA safeguards equipment and approaches.

While the primary purpose of the Academy would be to pre-train and qualify applicants for the IAEA, the Academy could also be used to train nuclear safeguards professionals for the DOE National Laboratories, DOE Headquarters, NNSA, and the U.S. Nuclear Regulatory Commission (NRC) in the equipment and approaches used by the IAEA. This would help these organizations better understand the capabilities, and limitations, of IAEA safeguards.

THE PROPOSAL – AN AMERICAN SAFEGUARDS ACADEMY

Currently, DOE/NNSA funds a number of training programs and activities that support international nuclear safeguards across the U.S. DOE National Laboratory Complex and at the IAEA. While this is laudable, the efforts in the United States could be more effectively coordinated and integrated within the DOE Complex, focusing especially on bettering the chances of Americans seeking positions at the IAEA. As envisioned, the Academy would integrate these programs so that relevant courses taken across the Lab Complex would accrue Academy credit towards pre-training and qualifying attendees for the IAEA. This, then, would leverage the existing National Laboratory Facilities, training staff, and programs to the fullest. Contractors and consultants would be brought in to provide targeted and supplemental expertise, as required.

THE SAFEGUARDS ACADEMY – WHO, WHAT, WHERE, WHY, WHEN, AND HOW

The details pertaining to the American Safeguards Academy and reason for being are summarized as follows:

- **Who:** The American Safeguards Academy would train American graduate and post-graduate students, U.S. DOE Laboratory interns, and other young and mid-career professionals with an interest and background suited for a career in nuclear safeguards and supporting nuclear non-proliferation policy.
- **What:** The Academy would train attendees in the safeguards equipment, methods, and approaches used by the IAEA.
- **Where:** The Academy would leverage and utilize existing U.S. DOE National Laboratory sites, facilities, programs, and affiliated college and university programs.
- **Why:** To pre-train and qualify American safeguards and nuclear non-proliferation policy professionals in the use of actual IAEA equipment and methods to better prepare them for careers at the IAEA.
- **When:** Elements of the Academy are already being developed by the NNSA Office of NA-24, under the Next Generation Safeguards Initiative, but could be better coordinated and expanded with greater emphasis on applied safeguards training.
- **How:** A prospective structure and curriculum for the Academy is shown in the following section.

PROPOSED ACADEMY STRUCTURE AND CURRICULUM

The Academy would leverage and utilize the facilities and capabilities of the U.S. DOE National Laboratories, and affiliated college programs, and could conduct training in the proposed topical areas:

- **The Nuclear Fuel Cycle and International Nuclear Safeguards** (All National Laboratories)
- **Advanced IAEA Nuclear Safeguards Equipment and Approaches** (Idaho National Laboratory)
- **Non-Destructive Assay of Nuclear Material** (Idaho and Los Alamos National Laboratories)
- **IAEA State-Level Safeguards Approaches** (Brookhaven and Pacific Northwest National Laboratories)
- **Nuclear Material Containment and Tracking Devices** (Oak Ridge National Laboratory)
- **Uranium Conversion and Enrichment Plant Safeguards** (Oak Ridge National Laboratory)
- **MOX Conversion and Fuel Fabrication Plant Safeguards** (Los Alamos and Savannah River National Laboratories)
- **State-Level Information Analysis** (Lawrence Livermore National Laboratory)
- **Environmental Sample and Destructive Analysis** (Pacific Northwest and Oak Ridge National Laboratories).

These are listed simply to show a prospective training curriculum for the Academy and indicate which National Laboratories have the expertise and/or facilities to provide the training indicated. It should not be viewed as all inclusive, but is shown merely for the purpose of illustration. As noted, the Academy would not be in a fixed location per se, but would utilize existing facilities and specialists within the U.S. DOE National Laboratory System, supplemented by subcontracted consultants with relevant expertise. The core of the Academy would be the instructors, the training modules, the equipment, and the attendees. The training locations could shift as appropriate to utilize available facilities, or to accommodate regional training demands. This represents a significant shift in the traditional view of a learning institution, where the focus has been on the brick and mortar building or location. In our view, the first emphasis should be on the content and the instructors, with the location to float as required. It is recognized that training in the use of equipment for non-destructive assay (NDA) and destructive assay (DA) requires the use of radioactive sources and samples of nuclear material in a secure and controlled environment. However, there are a number of advanced systems used by the IAEA that do not have such limitations, including equipment used for surveillance, containment, monitoring, tracking, 3D computerized mapping, and information analysis, etc. These advanced systems do not require the use of controlled radioactive sources and nuclear material. Consequently, they can be demonstrated in ordinary classroom, laboratories, or other environments that do not entail access to actual nuclear facilities.

SAFEGUARDS ACADEMY PARTNERS - COLLEGES, INDUSTRY, AND OTHERS

The Academy can only be effective in pre-training and facilitating the recruitment of American nuclear safeguards and non-proliferation specialists for the IAEA if it has an established rapport with American colleges and universities and the commercial nuclear industry. The former is necessary to provide the talent pool for training nuclear safeguards specialists for the DOE National Laboratories, NNSA, NRC, and the IAEA. Rapport with the American Safeguards Academy would benefit the affiliated colleges and universities by providing focus for college research and development, as well as professional opportunity for students. Rapport with the commercial nuclear industry would benefit the Academy by providing access to commercial nuclear facilities for the purpose of tours, demonstrations, and discussions with plant operations staff. This would also provide the focus on applying the safeguards measures in actual facilities and discussing how nuclear facilities operate. While much of the Academy training need not be conducted in nuclear facilities, access to the nuclear facilities would still be useful for the sake of discussion and illustration. Rapport between the

Academy and the commercial industry would also benefit industry by expanding their public outreach, especially to the pool of young and mid-career professionals seeking positions within the nuclear industry. Historically, there has been a close relationship between nuclear safety, security, and safeguards. As the trainees become more familiar with one, familiarity with the other topics follows. The ultimate goal is to improve the training to help the nuclear industry worldwide be safer, more secure, and better safeguarded. This also improves the acceptance of the nuclear industry in the eyes of the public.

Colleges, universities, and institutions which could be potential partners with an American Safeguards Academy could include:

- The Monterey Institute, Texas A&M, the University of Michigan, Purdue University, Idaho State University, Washington State University, the University of Tennessee, University of Missouri, University of California at Berkeley, MIT, etc.

Proposed commercial industry partners could include:

- AREVA, Bechtel, General Atomics, GE/Hitachi, Westinghouse/Toshiba, The Shaw Group, Energy Solutions, Energy Northwest, Entergy, etc.

Collaboration with international partners, having a similar need and interest, could also support the Academy with instructors and access to advanced techniques, methods, and nuclear facilities.

Prospective international Academy partners could include:

- The European Commission's Joint Research Centre (JRC), the Canadian Nuclear Safety Commission (CNSC), Japan Atomic Energy Agency (JAEA), Rosatom, the IAEA, etc.

The preceding is merely for the sake of example and discussion. This list is not all inclusive and could be much larger, depending on the interest of the institutions, organizations, and companies in cooperating with an American Safeguards Academy and U.S. DOE/NNSA. However, based on the history of involvement with these entities in the area of nuclear safeguards, collaboration and partnership would appear viable – and mutually beneficial.

CLOSEUP OF A TRAINING MODULE

Having described the proposed structure of the Academy and a prospective curriculum, it is illustrative to look more closely at a proposed training module, to see the shift in focus to applied safeguards equipment, methods, and approaches. An example is provided by the Training Course on Advanced IAEA Equipment and Safeguards Approaches, currently being prepared by the U.S. DOE Idaho National Laboratory, with support from Durst Nuclear Engineering and Consulting Inc. The preparation of this course is being funded by the NNSA Office of NA-24, in support of NGSI. The purpose is to better prepare American applicants for the IAEA, by exposing them to the latest IAEA safeguards equipment and methods.[5, 6, 7, 8] While it is recognized that Los Alamos National Laboratory and others already provide training to the IAEA in the non-destructive assay of nuclear materials, enrichment plant safeguards, complementary access, etc., the subject course is unique in that it would train Americans to better prepare them for posts in the IAEA Department of Safeguards.

The course is intended to be a two-week intensive course, directed at young and mid-career professionals. They will be trained in the following units:

- Introduction to the IAEA and Safeguards Verification Activities
- Use of the HM-5 Advanced Handheld Radiation Detector
- Use of the 3D Laser Range Finder (3DLR) for Verifying Facility Design Information
- Use of the Digital Cerenkov Viewing Device (DCVD) for Verifying Spent Nuclear Fuel in Wet Storage
- Use of the Digital Multi-Camera Optical Surveillance System (DMOS) and the General Advanced Review Station and Software (GARS)
- Use of Advanced Electro/Optical Seals (VACOSS and EOSS)
- Use of Next Generation NDA Systems- (NGAM and Mini-GRAND)
- The Evolution of IAEA Safeguards to State-Level and Integrated Safeguards
- Living and Working in Vienna.

An important aspect of this intensive course is that it would not be a computer or web-based push button training course. Course units would be taught by recognized safeguards and equipment experts. In this manner, the course attendee will derive maximum use of their time and benefit by being taught by experts.

Following successful completion of the course, and having demonstrated proficiency in the use of the subject equipment and methods, the attendees would receive a certificate that recognizes their accomplishment and successful completion of this training module within the American Safeguards Academy. As proposed, this training effort could be integrated and coordinated across the U.S. DOE National Laboratory Complex to provide the participants with a number of training focus areas that would complement their academic and professional training and better prepare them for a position in international nuclear safeguards at the IAEA, U.S. DOE, NNSA, NRC, and the U.S. DOE National Laboratories. This training would also better prepare professionals seeking a position in the commercial nuclear industry by providing them with intensive instruction in this important, and often neglected, area of nuclear safeguards.

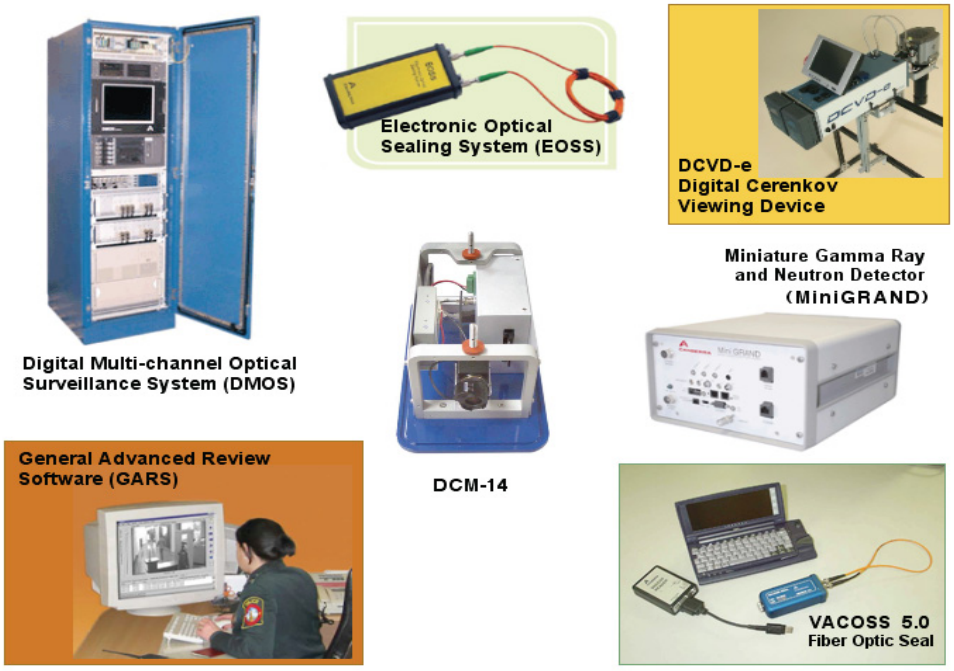

Figure 1: Equipment to be used in the INL Course on Advanced IAEA Equipment and Safeguards Approach Training (Pre-Inspector Training).
(Sources – AREVA/Canberra and Channel Systems of Canada, ca. 2009)

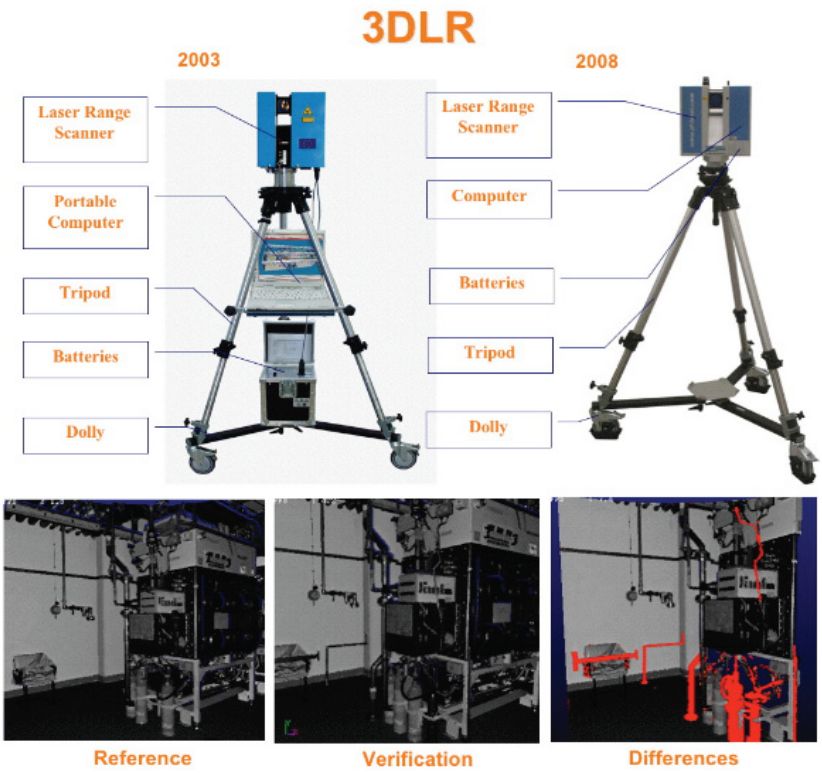

Figure 2: Equipment to be used in the INL Course on Advanced IAEA Equipment and Safeguards Approach Training (Pre-Inspector Training).
(Source – JRC-Ispra, 2008)

SUMMARY AND CONCLUSIONS

Driven by the decline in relative representation of Americans in the IAEA Safeguards Department, and diminished exposure to nuclear fuel cycle facilities and nuclear safeguards in the United States, there is a need for an American Safeguards Academy to better prepare American applicants for the IAEA. The Academy would utilize and leverage existing U.S. DOE National Laboratory programs, facilities, and affiliated college and university programs. An American Safeguards Academy would benefit the attendees by providing advanced and relevant training in international nuclear safeguards equipment, methods, approaches, and related government policy issues. The Academy would benefit U.S. DOE, NNSA, and the NRC by providing more effective applied nuclear safeguards training for young and mid-career professionals seeking careers in those organizations. Support of the Academy would support the goal of the NNSA Next Generation Safeguards Initiative, by qualifying and better preparing American applicants for posts in the IAEA Department of Safeguards. NNSA support for an American Safeguards Academy is also consistent with the U.S. DOE/NNSA and U.S. State Department policy of promoting more effective and efficient international nuclear safeguards, in support of the nuclear non-proliferation regime. An American Safeguards Academy would also benefit the commercial nuclear industry in the United States, by providing an opportunity for industry to expand public outreach, and by providing access to young professionals seeking a career in the nuclear industry.

REFERENCES

1. U.S. Government Accountability Office: U.S. GAO Report *Nuclear Nonproliferation Uncertainties with Implementing IAEA's Strengthened Safeguards System*, Washington, D. C., July, 1998.

2 . U.S. DOE Brookhaven National Laboratory: *Next Generation Safeguards Initiative Workshop on Enhanced Recruiting for International Safeguards*, U. S. DOE Brookhaven National Laboratory, Report BNL-82124-2009-CP, Upton, New York, January, 2009.

3. U.S. DOE National Nuclear Security Administration: *Next Generation Safeguards Initiative*, NNSA Office of Nonproliferation and International Security (NA-24), Washington, D. C., September, 2008.

4. Houck, F. S. (U.S. Arms Control and Disarmament Agency): *The Voluntary Safeguards Offer of the United States – A Review of its History and Implementation*, IAEA Bulletin, Vienna, Austria, Summer, 1985.

5. International Atomic Energy Agency, Department of Safeguards: *New Safeguards Equipment: Teaming IAEA Inspectors with Technology*, Vienna, Austria, 2002.

6. AREVA/ Canberra: Equipment Information and Specification Sheets – Mini-GRAND, DMOS, GARS, VACOSS, EOSS, etc., Canberra U.S.A., ca. 2006.

7. Channel Systems: *The Digital Cerenkov Viewing Device (DCVD-e) Spent Nuclear Fuel Imaging System*, Equipment Specification Sheet and Brochure, Pinawa, Manitoba, Canada, ca. 2009.

8. Sequeira, V. (JRC-Ispra): *3D Laser Range Finder for Design Information Verification in the Rokkasho Reprocessing Plant,* European Commission Joint Research Centre (JRC), Fact-sheet, Ispra, Italy, 2006.