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## Next Generation Safeguards Initiative Efforts at Los Alamos National Laboratory: Developing Our Human Capital FY2015

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### **Executive Summary**

This report documents the accomplishments of the Safeguards HCD Fiscal Year 2015 (FY15) Project Work Plan, highlighting LANL's work as well as the accomplishments of our NGSI-sponsored students, graduate and postdoctoral fellows, and mid-career professionals during this past year. While fiscal year 2015 has been a year of transition in the Human Capital Development area for LANL, we are working to revitalize our efforts to promote and develop Human Capital in Safeguards and Non-proliferation and are looking forward to implementing new initiatives in the coming fiscal year and continuing to transition the knowledge of staff who have been on assignment at IAEA and Headquarters to improve our support to HCD.

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### **24.1.1.3.1.1 University Engagement**

#### **Development of University Courses**

Rian Bahran is working to engage his alma mater, Rensselaer Polytechnic Institute (RPI), in developing a safeguards and non-proliferation component in its nuclear engineering program. The plan is to incorporate the Integral Nonproliferation Introductory Teaching and Learning (INITIAL) Module - intended to serve as a primer at the undergraduate nuclear engineering level to programs that either have no courses or no course requirement in this topical area – at RPI this fall. Only seven years ago, RPI had the largest undergraduate nuclear engineering program in the country where it awarded over 10% of all nuclear engineering bachelor degrees in the US. While that number has decreased to less than 5% of all nuclear engineering bachelor degrees in the US with the growth of other nuclear engineering programs and general enrollment trends in the area, it is still an important program at which to target at least an introductory-level safeguards and non-proliferation course.

#### **Promoting and Engaging Students in Safeguards and Nonproliferation**

##### **INMM Annual Meeting –**

NGSI/HCD funded Rian Bahran and Chantell Murphy to attend the annual INMM meeting in Indian Wells, CA in July. Chantell was the co-author of a paper together with colleagues at UNM which won the best student paper in the International Safeguards group. For this work, simulations of an electrorefiner were performed using the computer code Enhanced REFIN with Anodic Dissolution (ERAD).

##### **Support to South Carolina Universities Research and Education Foundation**

In the Summer of 2015 LANL hosted NNIS fellow Matthew Marcath who was working with Robert Haight of the LANSCE Weapons Physics group.

## **24.1.1.3.1.4 / 24.1.1.3.1.6 Student Support Tasks**

### **Julia Eigenbrodt- NGSI Ph.D. Candidate**

NGSI HCD supported Julia Eigenbrodt at TAMU and during her stays at LANL to work on her experimental thesis work. Eigenbrodt completed the data set she needs to benchmark MCNP calculations for her thesis and expects to defend her Ph.D. thesis in December 2015.

### **Chantell Murphy – NGSI Ph.D. Candidate**

Chantell Murphy is in her fifth year in her PhD program. She is preparing her dissertation research proposal defense for December 2015 and anticipates finishing her degree in December 2016. She is researching the viability of using the neutron balance technique coupled with process monitoring as a safeguards approach for electrorefiners. This work will be carried out with both simulations and small-scale experimental validation at the University of Utah.

Chantell co-authored a paper for the annual INMM meeting (see above) and another on 'Acquisition Path Analysis Quantified – Shaping the Success of the IAEA's State-level Concept,' was published in the Journal of Nuclear Materials Management Volume 43, No. 4. This paper details the methodology developed at the Forschungszentrum Jülich to carry out the state level concept and presents results on one of the case studies performed while I was there. The paper also discusses four new ideas on how to estimate non-detection probabilities in cases of undeclared facilities or imports.

In July, Chantell presented her acquisition path analysis work to the safeguards concepts and planning group and operations divisions at the IAEA. She and Kory Budlong Sylvester demonstrated a software tool, APAT, which was not originally designed to perform the State level concept but is being tailored to more specifically perform relevant tasks. Those in attendance seemed very interested in the tool and provided a lot of feedback, work is planned to continue on these efforts.

## **24.1.1.3.1.5 Laboratory Safeguards Courses**

### **NGSI Summer Lecture Series**

LANL supported the NGSI Summer Lecture series organized by LLNL with presentations from LANL's Karen Miller on "Technology Development for Safeguards Applications" and from Kory Budlong-Sylvester on "Acquisition Path Analysis and the State-Level Approach".

### **Nuclear Lunch**

The Nuclear lunch returned for a second summer in 2015. Hosted by Alison Tamasi and Susan Ramsey, it offered an opportunity for students to hear from practitioners about what they do on a day-to-day basis. This forum also gives mid-career staff a chance to see opportunities available in the nuclear field at the lab.

### 24.1.1.3.1.9 Professional Development

#### NGSI Professional Network Meeting

Alexis Kaplan and Rian Bahran attended the Next Generation Safeguards Professional Network meeting at Idaho National Laboratory in December 2014. The meeting included presentations, tours and an inspection exercise all geared toward providing insight into international safeguards for young professionals.

In their own words, they described the highlights of this meeting:

“An unexpected benefit of the meeting was the inspection exercise. I have been through numerous safeguards courses but have never been placed in the role of the inspector as was done in NGSPN. It is a different experience to walk through a reactor facility and identify material balance areas than to simply read about them. The exercise was supplemented with an example Design Information Questionnaire Template which provided more insight into the detail with which facilities are inspected. My understanding of safeguards inspections and the role of the IAEA was improved significantly by this exercise.” [Alexis Kaplan]

“The NGSPN meeting in Idaho Falls in December 2014 was an effective opportunity to learn, engage and network with peers and experts in the safeguards arena. On the learning side, lectures from Laura Rockwood and Shirley Johnson provided experience-based insight into both high-level and detailed technical and policy issues related to international safeguards. The technical tours and technical exercises were also extremely valuable and facilitated engagement among peers and with the lecturers.” [Rian Bahran]

A specific tangible outcome of the NGSPN networking portion was a small collaboration between Bahran/ Kaplan) and INL (Sean Morrell) on an NA-24 Human Capital Development subtask. Rian and Alexis developed the Integral Nonproliferation Introductory Teaching and Learning (INITIAL) Module that is intended to serve as a primer at the undergraduate nuclear engineering level to programs that either have no courses or no course requirement in this topical area. The one-lecture INITIAL module allows simple integration into courses providing recurring and sustainable academic course content in the area. The plan is to incorporate the university lecture into a mandatory nuclear engineering degree introductory course at Rensselaer Polytechnic (RPI) this fall. The recently completed module is currently available for download as part of the nuclear nonproliferation portal developed by Sean Morrell.

#### Returning IAEA LANL Staff

Continuing a tradition of NGSI support to staff returning from the IAEA, four LANL employees received \$50K of funding to help smooth their transition in the months after they returned to LANL. The returning staff can attest to the fact that transition funds can help to integrate IAEA experience into NA-24 programs.

#### David Beddingfield

The availability of transition funds proved crucial to the reintegration process at LANL for Dave. The funds were spent on two primary activities: Completion of new and

expired training courses required to work safely and securely at LANL and planning & preparation of project funding proposals for FY16.

#### **William Geist**

Bill returned back to active work status at LANL from the IAEA in late August. He is using the HCD funds to explore opportunities for integration into ongoing and new projects in FY16.

#### **Jim Sprinkle**

Jim returned from the IAEA in October of 2014. He used the transition funding to work on SBD guidance and look for FY15 funding. As part of the funding search, Jim worked to promote & share the SBD guidance and to transition his knowledge and experience to mid-career and younger staff.

#### **Rebecca Stevens**

After returning from the IAEA, Stevens used the HCD funding to get integrated back into NA-241/INSEP projects, particularly those related to INSEP's Systematic Approach to Training efforts, which she supported from the IAEA side prior to returning to the U.S. Stevens prepared a summary report on training support to the IAEA, which she provided to INSEP as well as to her replacement, Sarah Poe, who joined the SG training section at the end of July.

#### **UK Nuclear Fuel Course**

KC Drypolcher attended the Joint UK/TAMU Nuclear Fuel Cycle course from September 11-19. The trip included tours at three nuclear facilities (Sellafield, Heysham NPP and URENCO) and a discussion/presentation with students from Kings College. Sellafield provided an interesting comparison with US National Laboratories, and Heysham NPP, which produces 47% of the UK's power, was also an impressive tour. According to KC, "The Kings College discussions were policy focused which gave a great balance to a heavily technical trip. With current situations across the world we had a lot to talk about... The people on the trip offered a lot of knowledge as well. So if we were not learning from the facility tours we were learning from one another on the work that we each did." [KC Drypolcher]

