U.S. NEXT GENERATION SAFEGUARDS INITIATIVE: THE HUMAN CAPITAL DEVELOPMENT PROGRAM

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Abstract. The Human Capital Development (HCD) subprogram of the U.S. Next Generation Safeguards Initiative (NGSI) is developing sustainable academic and technical programs that support the recruitment, education, training, and retention of the next generation of international safeguards professionals. This wide-ranging HCD effort endeavors to develop additional human resources to address current shortfalls, encourage U.S. experts to seek employment at the IAEA, and identify and train a new cadre of safeguards experts to meet the needs of both the United States and the IAEA for decades to come. In recent years, a convergence of factors has challenged the IAEA’s ability to carry out its safeguards mission effectively. An aging workforce nearing retirement and growing workload, coupled with a safeguards budget that has remained essentially flat in real terms for nearly two decades, have posed particular challenges to the IAEA’s Department of Safeguards. Recognizing the trends, the National Nuclear Security Administration’s (NNSA) Office of Nonproliferation and International Security (NIS) launched NGSI in the fall of 2007. Since that time, the HCD subprogram of NGSI has sponsored over 300 safeguards internships at U.S. National Labs, organized eight annual short safeguards policy and technical courses, worked with ten universities to develop new undergraduate and graduate coursework on international safeguards and nonproliferation, established a highly competitive graduate fellowship program, and completed a human capital requirements study that closely examined the safeguards workforce within the U.S. National Lab complex. Of past NGSI students and interns, nearly four in ten pursue multiple NGSI opportunities, one in five have converted to U.S. National Lab staff, and nearly 20% have gone on to pursue a nonproliferation or safeguards-focused Masters or PhD.

Introduction

The NGSI HCD program endeavors to staff international safeguards positions at the U.S. National Laboratories, federal agencies, and at the IAEA Department of Safeguards with qualified U.S. candidates. The program helps promote the recruitment of qualified individuals into the international safeguards workforce by offering opportunities for safeguards education, training, and professional development, while also taking steps to improve early awareness of IAEA employment openings and to address certain impediments to Lab staff taking positions at the IAEA. The emphasis within the program, at least in its initial years, has been on initiatives directed towards universities, especially at the graduate level among technical disciplines. This is a very deliberate decision that reflects a perceived need to ensure that nuclear engineering students in particular be exposed to the nonproliferation and safeguards field.

Overall, the HCD program aims to 1) revitalize and expand the international safeguards human capital base in the United States by attracting, educating, training, and retaining a new generation of talent, 2) recruit high quality candidates for positions in the IAEA’s Department of Safeguards, and 3) identify ways to integrate efforts to promote human capital development in the United States with NGSI international engagement programs. Key elements of the NGSI HCD program are discussed below.

Staffing Study
Initiated in 2009, the NGSI staffing study aimed to verify anecdotal evidence and quantify gaps in the safeguards professional field. Without a clear baseline of current safeguards capabilities and gaps, it would be difficult to have any confidence in future projections. The staffing study assessed the anticipated human resource needs in the U.S. National Lab complex to support international safeguards objectives over the next couple of decades. It addressed the size of the workforce needed, skill sets, educational background, and work experience. The findings estimated that less than 20% of the international safeguards specialists in the U.S. workforce are 44 years of age or younger and that over 80% of the international safeguards specialists at the National Laboratories will be retired or otherwise resigned within 15 years. These striking numbers underscore the importance of recruiting and retaining a new cadre of international safeguards professionals.

**University Engagement**

An important building block of NGSI’s HCD strategy has been engagement with U.S. universities: identifying university faculty champions, encouraging regional networks of Lab-university partnerships, and building an interdisciplinary educational approach. NGSI has worked with ten U.S. universities to initiate collaborations between Lab-based international safeguards experts and university faculty, with the goal of developing new courses on international safeguards and nonproliferation. In 2011, seven of these universities offered an undergraduate or graduate course for academic credit focused on nuclear safeguards and/or nonproliferation. Over 100 students were enrolled in these courses. In the past, NGSI has sponsored workshops for university faculty on safeguards and nonproliferation educational approaches and course design. Considerable thought has also been given to creating university-level certificate programs.

Additionally, NGSI sponsors guest lectures by safeguards experts from the National Laboratories at U.S. universities for both policy- and technical-oriented classes at the undergraduate and graduate levels. NGSI also sponsors a nationally competitive graduate fellowship program – the Nuclear Nonproliferation International Safeguards (NNIS) Graduate Fellowship – that targets graduate students in nuclear engineering and related technical disciplines specializing in nonproliferation and international safeguards. The fellowship is awarded for one to four years of graduate study, and requires summer internship and thesis or dissertation work performed in areas related to international safeguards. The program pays student tuition, administers monthly stipends, and coordinates National Laboratory-based summer practicums. There are currently fifteen Fellows from eight different U.S. universities.

Lastly, recruitment for both internships and summer courses hosted at the National Laboratories takes place at U.S. universities. Over the past three years, students have been recruited from over one hundred different universities and colleges to take part in the internship and summer course programs.

**Internship Opportunities**

NGSI offers students the opportunity to pursue safeguards internships at U.S. National Laboratories. In its inaugural year (2008), the program drew 50 students from around the country. In 2009, this number more than doubled, with 110 interns—representing more than forty U.S. and foreign universities—participating in internships within the National Laboratory complex. In both 2010 and 2011, this number swelled to over 140 interns from over sixty universities. Roughly a third of all interns are from nuclear engineering backgrounds, while 10% are international relations majors. Other educational backgrounds have included (and been as diverse as): radiochemistry, computer science, theological studies, health
physics, social science, digital entertainment and game design, mechanical engineering, and nuclear physics.

More than half of all interns also participate at the annual meeting of the Institute of Nuclear Materials Management (INMM). NGSI interns and post-docs have won the INMM Student Paper Award for the last three consecutive years.

Interns work on a variety of hands-on projects at the National Labs, samples of which are below:
- Verifying the absence of diversion of spent fuel
- Building virtual reality models for nuclear safeguards training and process analysis
- Developing safeguards approaches for gas centrifuge enrichment plants
- Studying methods for safeguarding the thorium fuel cycle
- Analyzing safeguards holdup and diversion in enrichment plants
- Developing a valve seal and valve tamper indicating device for use on UF6 cylinders
- Creating a course development plan to encourage young engineers and scientists to pursue nuclear nonproliferation early on in their studies.

More than three out of every four interns are also able to couple their internship with a NGSI summer course.

**Summer Courses**

Short summer courses have been a staple of the HCD program’s outreach to students and young professionals. These courses, one to three weeks in length, are hosted at the National Laboratories or nearby universities. Some courses are focused on technical aspects and technical university students such as engineers and scientists, while others are geared towards nonproliferation policy majors and political/social scientists. In any given year, 100-150 students take part in these courses, which include the Public Policy and Nuclear Threats course at the University of California San Diego, nondestructive assay measurement courses at Oak Ridge National Lab, *Nuclear Nonproliferation, Safeguards, and Security (NNSS) in the 21st Century* at Brookhaven National Lab, and technical safeguards courses at Los Alamos National Lab.

**Professional Development**

The professional development component of NGSI’s HCD program aims to attract and introduce early- and mid-career professionals to the safeguards field. Speakers and seminars on international safeguards, access to training materials, and involvement with NNSA-sponsored safeguards projects at the National Labs are part of this initiative. Additional efforts to recruit and prepare U.S. candidates for safeguards employment at the IAEA include a new course that allows U.S. citizens interested in a career as an IAEA inspector to spend two weeks training on IAEA inspector equipment in an accredited course at Idaho National Lab.

NGSI is also sponsoring post-doctoral fellows at six U.S. National Laboratories and a Next Generation Safeguards Professional Network (NGSPN) to build connections between members of the next generation of safeguards experts. Since its launch in October 2009, NGSPN has held three annual meetings, hosted a dedicated session at the INMM annual meeting, and launched a website of resources
for those interested in the field. The NGSPN initiative is particularly important in terms of retaining safeguards expertise and connecting young professionals who are new in the field.

**Metrics of success**

Beginning in 2010, NGSI began to more comprehensively track former NGSI HCD program participants, to better establish specific, measurable metrics. This included collecting a sample of former students and interns involved in the NGSI HCD program. Of tracked NGSI Human Capital Development program students/interns in the first two years of the program:

- 36% returned for another safeguards internship
- 23% were converted to U.S. National Laboratory staff
- 18% went on to pursue a nonproliferation- or safeguards-focused Masters or PhD
- 5% accepted Junior Professional Officer (JPO) positions at the IAEA

The high numbers of students continuing in the safeguards/nonproliferation field is encouraging. Many of the university students who have participated in NGSI programs have further orientated (or in some cases re-oriented) their studies towards safeguards and nonproliferation. Students in nuclear engineering and other technical or science fields have stated that before safeguards exposure under NGSI they were not aware of the professional opportunities that exist in the safeguards field.

**Moving forward**

While NGSI has a U.S. domestic focus, its underlying purpose is international; it is recognized that this initiative cannot succeed as a purely domestic effort. Rather, NGSI efforts are intended to serve as a catalyst for a much broader commitment to international safeguards in partnership with the IAEA and other countries. Only by combining U.S. technical and scientific assets with the resources of international partners will we be able to keep pace with the emerging safeguards challenges.

If international safeguards are to remain credible and effective, the political will must be found, and the necessary funding and support made available, to quickly generate a pipeline of qualified young safeguards professionals capable of carrying out this important work in the future. The NGSI HCD experience has shown that through thoughtfully designed and implemented safeguards internships and Laboratory-university partnerships, students in a wide variety of educational degree programs can become familiar with and involved in safeguards and nonproliferation at a time when they are on the cusp of making career path decisions. Current safeguards experts should be encouraged to advise, mentor, and teach students and young professionals. Such mentoring is especially important to capture the experience and knowledge of safeguards experts nearing retirement. Only through a concerted and coordinated effort can the U.S. Government, academia, and the National Laboratory complex address and reverse the looming human capital crisis facing the global nonproliferation and safeguards community.

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