

Human Capital Development, Safeguards by Design,  
and University Engagement—Lessons Learned

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**INTRODUCTION**

The Department of Energy (DOE), Next Generation Safeguards Initiative (NGSI), Human Capital Development (HCD) program recognized a need to expose college students in nuclear engineering programs to concepts related to safeguards. In many universities’ students are trained in the mechanical engineering departments, and receive an emphasis or minor in nuclear engineering. These students typically have limited interception with safeguards concepts. Most of these students are required to do a mechanical engineering senior design project for a graduation requirement. Los Alamos National Laboratory (LANL) through funding from DOE began reaching out to universities to support senior design projects related to a safeguards problem. To date LANL is in the second year of working with University of Rhode Island, and is using the current model to reach out to additional universities with nuclear engineering minors or emphasis in Mechanical Engineering Departments, such as University of Texas.

A recommended practice is to get subject matter experts (SMEs) at national laboratories to outreach material to engage with universities.<sup>1</sup>

**DESCRIPTION**

**University of Rhode Island – 2016/2017 school year**

LANL began in the fall 2016 with an introductory lecture to senior level mechanical engineering students to introduce the concepts of safeguards by design, and to introduce problem statements to the students.<sup>2</sup> During the 2016/2017 school year LANL worked with 3 design teams on 3 different design, build, and test projects, with 11 students. The projects included designing (1) system for assaying waste containers that contain plutonium, to decrease worker exposure and reduce, see Figure 1; (2) safeguards for an underwater reactor, see Figure 2; and (3) safeguards for a floating reactor, see Figure 3. The students worked with LANL on understanding safeguards requirements, concept designs, and redesign efforts. The students followed a protocol of establishing a couple of designs for their customer (LANL), costs, required budget, and schedule. The results of the first year were written up in a LANL report.<sup>3,4</sup>

**University of Rhode Island – 2017/2018 school year**

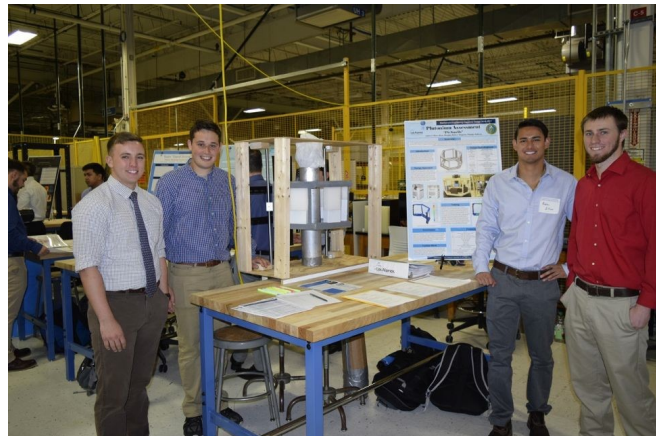


Fig. 1. Pu Waste Measurement inside Hot Cells



Fig. 2. Marine-based Modular Reactor Safeguards

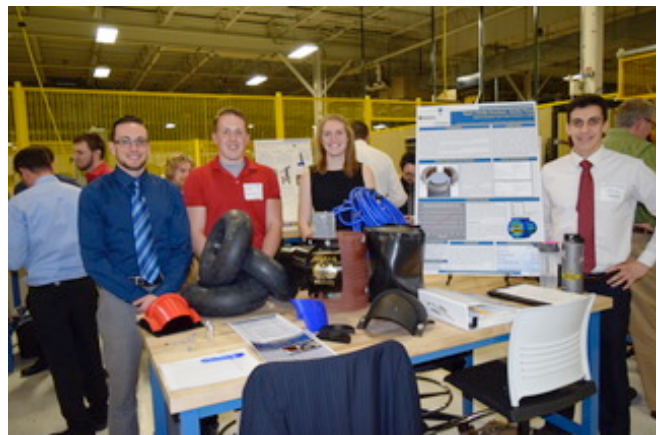


Fig. 3. Floating Modular Reactor Safeguards

The LANL project team began working on design challenges for the University of Rhode Island students during the summer 2017. In early September two LANL staff visited the University of Rhode Island. This gave the LANL staff the opportunity to see the facilities the students use for the design/build efforts. Additionally, the LANL staff were able to see presentations with design projects by other industry partners. This gave a much better understanding of the scope of other projects. Furthermore, during one of the course lectures, LANL gave a lecture on Safeguards by Design.<sup>5</sup>

This school year LANL is working with 2 design teams, a total of seven students. The first design project, HEPA (High Efficiency Particulate Air) Filters for Safeguards, is an automated filter replacement system, for buildings or gloveboxes, that IAEA inspectors may use for collecting environmental samples. The second project focuses on Nuclear Fuel Transfer, being able to maintain continuity of knowledge during fuel transfer from the reactor to the irradiated fuel storage area.<sup>6</sup>

### Lessons Learned

There were many lessons learned through the first year of LANL engagement with the University of Rhode Island. LANL found that we needed to have funding to the students within the first half of school year. The students were beginning to purchase supplies for the build and testing portions of the senior design project. The challenge the first year was the funding being on the government fiscal year, did not reach LANL until into October, and then we needed to find the best mechanism to work with the university. For school year 2017/2018 LANL addressed the funding plan during the summer, so we had a process in place when the school year started.

A second lesson was this began as a safeguards-by-design project, emphasis design. This did not meet with the student needs that also included building and testing. With the help of the university professor, Dr. Bahram Nassersharif, LANL refined the scope so the students could solve a problem with a design, build, and test. By the end of the school year we had successfully completed 3 projects, and the students were excited to have the opportunity to engage with LANL scientist in the area of safeguards.<sup>3</sup>

A third lesson is engagement with the student design teams. Working long distance relationships and projects is always a challenge, but we also had the additional challenge of working with students. Most of the projects in the University of Rhode Island Local industry supports most of the projects in the Senior Capstone Design Class. The students working on local projects get an opportunity to visit their customer facilities and have a more visual idea of location for their projects. Also, these students have more personal interactions with their customers.

A fourth lesson was we found that different project teams needed different types of support. Additionally, those

teams that were always completing assignments for the course at the last minute had less engagement with LANL in reviewing their report or presentation before submission. This in fact is not unique to just working with students, but happens on projects in the work place.

We found that even with these set backs the students had a positive experience working with LANL, and appreciated the opportunity of engaging technical staff in the areas of safeguards.

### Expanding to Other Universities

LANL is looking to expand efforts to the University of Texas, Austin. Also they may give a lecture on safeguards-by-design to Nuclear Engineering Students at The Pennsylvania State University.

### RESULTS

LANL and the University of Rhode Island Mechanical Engineering Department developed a good working relationship. We have current model that LANL uses to support the student project teams for success. LANL is working to expand the model to other schools with a Nuclear Engineering emphasis inside a Mechanical Engineering Department. This is a successful model for not only teaching the concepts of safeguards, but also for the students to incorporate the concepts into a design project that they must build and test.

### REFERENCES

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