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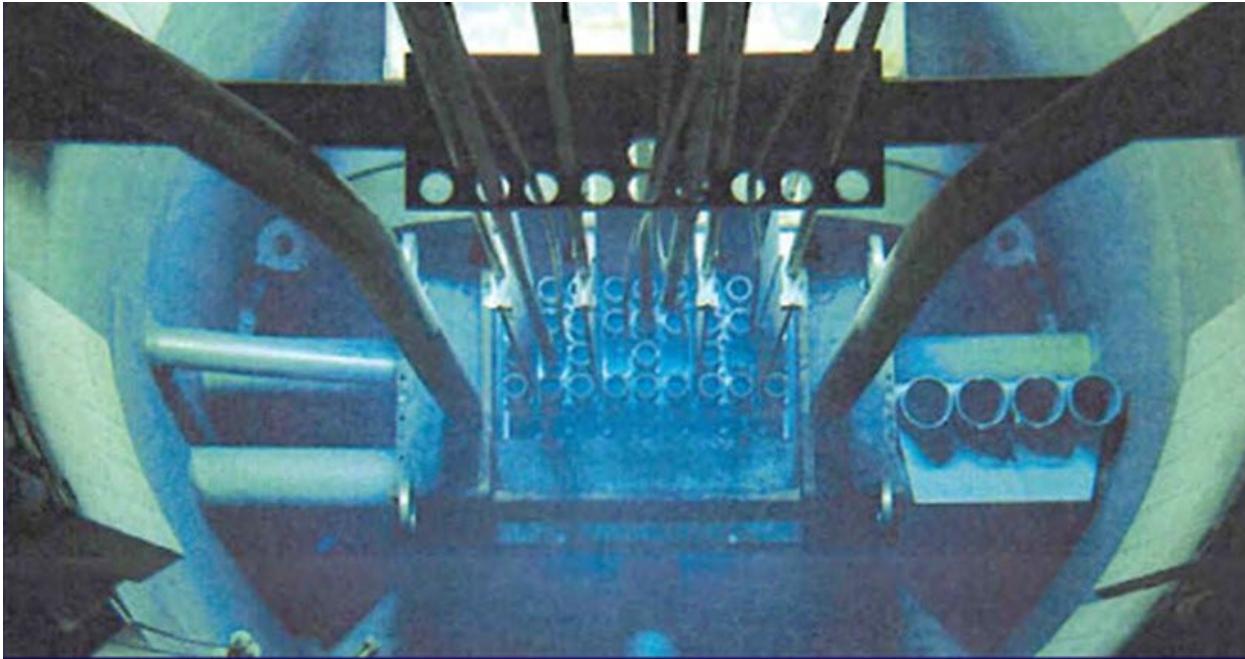
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Safeguards by Design Table Top Exercises Final Report

FY 2023

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9/29/2023



Safeguards by Design Table Top Exercises Final Report- FY23

1. Project Summary

This University Engagement project challenged engineering students at universities, that do not have bachelor's degree programs in nuclear engineering but do have research reactors and some nuclear engineering coursework, to develop capacity in Safeguards by Design concepts through the application of Tabletop Exercises. This University Engagement project was part of the U. S. Department of Energy's (DOE) National Nuclear Security Administration (NNSA), Office of Defense Nuclear Nonproliferation, Office of International Nuclear Safeguards, Next Generation Safeguards Initiative (NGSI), Human Capital Development (HCD): University Engagement Program. This program exposed university students with Mechanical Engineering majors and Nuclear Engineering minors to the concepts of international nuclear safeguards.

In FY22, three teams at the University of Rhode Island and two teams at the University of Texas - Austin participated in researching, designing, building, and testing projects to support international nuclear safeguards measurements or verification. The projects involved engaging in activities at the university's research reactors. All the projects engaged students with prototyping a design and/or tool for application at the Universities' reactor. However, for FY23, the direction of the HCD project had changed to implementing a Tabletop Exercise in Safeguards by Design (SBD). A Tabletop Exercise was not executed during FY23, but relationships with both Universities was maintained and how to integrate the exercise into the curriculum of both programs was determined.

2. Merit to Human Capital Development (HCD)

These university challenges directly contribute to the HCD mission by introducing students from the broad engineering field to safeguards concepts and approaches as part of their engineering senior level design course. Unlike nuclear engineering or other safeguards-focusing majors, the students have no knowledge of safeguards, non-proliferation, or the International Atomic Energy Agency (IAEA) before initiating their projects. Using a Tabletop Exercise (TTX) is a great venue for the students to get experience incorporating safeguards needs into facilities they may develop in the future and seeing how those needs interact with the engineering requirements that are more standard. The students not only learn about safeguards, but also learn that they can contribute to the safeguards mission. Nuclear safeguards can only reach its full potential in terms of cost and resource savings if all the different voices during the planning and construction phases of a facility are aware of the requirements and incorporate them in the design phases.

3. University HCD Engagements

3.1 University of Rhode Island:

LANL and the University of Rhode Island (URI) are developing the Tabletop exercise to integrate into URI's design projects course specifically with projects related to nuclear engineering. URI has design projects that integrate their Rhode Island Nuclear Science Center (RINSC), which houses a General Electric 2 mega-watt (MW), light water cooled, pool type reactor. See Figure 1. The URI Senior Design Course covers two semesters (a full school year). The goal in development of the TTX was to contextualize the design projects and RINSC into the TTX curriculum.



Figure 1. Photographic showing Rhode Island Nuclear Science Center (RINSC) and the General Electric Research Reactor.¹

Professors and Staff:

- Prof. Dr. Bahram Nassersharif: *Distinguished University Professor*, University of Rhode Island, Mechanical, Industrial and Systems Engineering Department

3.2 University of Texas-Austin:

LANL and the University of Texas-Austin (UT-A) worked together to integrate the TTX into the mechanical engineering design course for undergrads as well as their nuclear engineering focus program. The TTX looks to integrate the research reactor at the Nuclear Engineering Teaching Laboratory (NETL) located on the J.J. Pickle Research Campus into its curriculum. The reactor is a 1 MW TRIGA (Training, Research, Isotopes, General Atomics) Mark II Research Reactor. See Figure 2. As university's shut down other TRIGA reactors across the country, UT-A accepted fuel from the closing reactors. There is limited history on this fuel, so NETL has a safeguard's need to be able to identify the nuclear material content of the fuel. Thus, this provides a potential application to contextualize the TTX safeguards' education around the design of the safeguards for a TRIGA or other research reactor facility.

¹ Rhode Island Nuclear Science Center, accessed August 18, 2020 here: <http://www.rinsc.ri.gov/> and here: <http://www.rinsc.ri.gov/education/>



Figure 2. Photographic showing location of UT-A's Nuclear Engineering and Testing Laboratory (NETL) and the inside of the TRIGA Research Reactor.²

Professors and Staff:

- Prof. Richard Crawford: *Earl N. & Margaret Brasfield Endowed Faculty Fellowship in Engineering*, University of Texas at Austin, Walker Department of Mechanical Engineering
- Prof. William Charlton: *Director, Nuclear Engineering Teaching Laboratory (NETL)* and *John J. McKetta Energy Professor* in the Nuclear and Radiation Engineering Program, University of Texas at Austin, Department of Mechanical Engineering

4. Communication with Universities during FY23

4.1 Communication with URI

Beginning steps were taken in organizing this via Webex call with Professor Nassersharif at URI in April 2023. Specifically, there was a design team that would be working on spent fuel characterization using gamma detectors. We were iterating on developing the TTX in the context of their project during FY24.

4.2 Communication with UTA

Discussion via a skype call with Professor Richard Crawford occurred in April 2023 to begin organizing with the goal of performing the TTX in FY24. He would communicate with the nuclear engineering focus program within the department to integrate their students specifically into the FY24 TTX.

² Picture on left taken from: https://en.wikipedia.org/wiki/J._J._Pickle_Research_Campus

5. FY24 Planned Tabletop Exercise Activities

5.1 URI Tabletop Exercise

There are no plans for a TTX at URI for FY24.

5.2 UTA Tabletop Exercise

There are no plans for a TTX at UTA for FY24.