LA-UR-18-20441
Approved for public release; distribution is unlimited.

Title: University of Texas Safeguards by Design Problem Statement

Author(s): Rauch, Eric Benton
Scherer, Carolynn P.
Ruggiero, Christy E.

Intended for: Report

Issued: 2018-01-22

University of Texas Safeguards by Design Problem Statement

This document describes the problem statement that students at the University of Texas will use for their senior level capstone design class. The purpose of this project is to introduce students to Safeguards by Design concepts as part of their capstone design course at the culmination of their degree program. This work is supported by Los Alamos National Laboratory with FY17 and FY18 programmatic funding from the U. S. Department of Energy's (DOE) National Nuclear Security Administration (NNSA), through the Office of Defense Nuclear Nonproliferation (DNN), Office of International Nuclear Safeguards (INS), Next Generation Safeguards Initiative (NGSI), Human Resource Development Program, Safeguards by Design Project.

LANL Personnel Contact Information:

Carolynn Scherer
scherer@lanl.gov
(505)665-3202

Eric Rauch
ebrauch@lanl.gov
(505)606-0116

Christy Ruggiero
ruggiero@lanl.gov
(505)665-2725

Method of Fuel transfer from inside containment to storage

Transferring used/spent fuel out of containment at a Light Water Reactor (LWR) to storage is a complicated process that has many constraints. Because the fuel is still generating 1-5% of its full power from decay products and irradiation of the structural materials in the assembly, it must be transferred to storage under water. The penetrations through the containment building are normally hard to access and have limited visibility, so maintaining continuity of knowledge (CoK) on the assembly can be difficult. Also, the mechanism for transporting the assembly will be subjected to high radiation and high temperature environments and will likely have to be put in place with minimal maintenance for the life of the reactor.

Confirmatory Measurements of neutron/gamma radiation are valuable to determine that the assembly is intact and transiting from containment to storage properly. Safeguards by design principles mandate that room must be made available for sensors at both ends of the transfer tunnel and that anything requiring maintenance must be placed outside of the tunnel. The design must address the following criteria:

Challenge: Design an automated method to transfer a 2-ton fuel assembly from containment vessel to storage (20 feet) while under water, and with monitoring capability (IAEA safeguards).

Requirements:

1. Limited or no maintenance over 50 years of occasional use.
2. The conveyance must be mechanical only, no electronic motors.
3. All electronics or items that might fail must be placed outside of the transfer tunnel, for easier maintenance.
4. Space must be available for sensors at both ends of the tunnel, immediately preceding and immediately after exiting tunnel.
5. May test with a scaled down mock-up.