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National Nuclear Security Administration

Progress Update on Exploring Novel Physical Security Enhancements for Industrial Irradiators Through Government-Industry Partnerships

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Overview

Partnership between U.S. Department of Energy/National Nuclear Security Administration's Office of Radiological Security (ORS) and Nordion (Canada) Inc. established in 2018.

Goal of partnership is to develop and pilot enhanced security solutions for industrial gamma irradiators to further protect radioactive materials–cobalt-60.

Co-60 is a high value target for theft or sabotage.

Partnership also includes end-user organizations:

- Sterigenics
- STERIS Applied Sterilization Technologies

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Project Status

Project tasks completed to date include:

- Baseline security analysis of irradiator
- Requirements development
- Concept development
- Prototype fabrication and assembly
- Verification testing of prototype (October 2021)

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Security Concepts

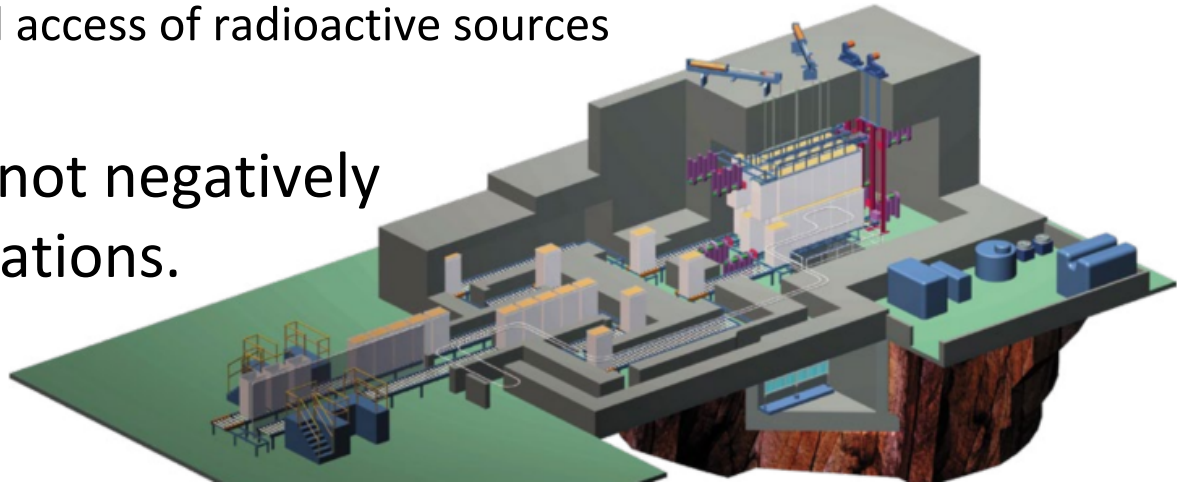
Nordion industrial gamma irradiator used as representative model and test bed upon which to develop universal security solutions.

Security prototypes developed for irradiator pool and source rack.

Objective is to:

- Increase time required for adversary to access radioactive sources in pool
- Detect unauthorized access of radioactive sources

Viable solutions must not negatively impact irradiator operations.



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Verification Testing

Also known as attack testing.

Assesses the improved state of the system with addition of security enhancements.

Simulates a system attack to reevaluate vulnerabilities and determine new illicit source access times.

Uses pre-determined adversary tool set, knowledge level, and skill set based on assumed threat.

Results compared against baseline testing to determine whether performance expectations have been met.

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Project Vulnerability Testing

Verification testing of security prototypes conducted at Sandia National Laboratories, NM, USA in October 2021.

Objective to test hardware components for irradiator pool and source rack security prototypes to determine delay and detection performance.

Results then compared to November 2015 baseline attack testing.

Testing details:

- Sandia's Gamma Irradiation Facility pool used to simulate wet-source-storage pool of irradiator.
- Two attack teams used for testing to simulate varying levels of capability
  - Included insider and outsider threat actors

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Test Results

Details of each attack path and method of attack were documented.

Example Summary Attack Test Time Table (simulated data used)

Path	Attack Method	Detection	Barrier Defeat Time	Best Attack
Path 1:	Method 1	N	0:05:16	X
	Method 2	N	0:08:49	
	Method 3	N	0:01:20	
		Total Time	0:15:25	
Path 2:	Method 1	Y	0:03:46	
	Method 2	Y	0:01:49	
	Method 3	Y	NA	
	Method 4	Y	NA	
		Total Time	Incomplete	

Testing times for each component of the design were also collected to allow individual adjustments to be made to satisfy delay needs.

Testing results do show that security prototype components can be tuned to meet overall security objectives.

Partner and stakeholder feedback require further investigation into potential impacts to irradiator operations.

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Implementation

When prototypes are finalized, a pilot installation will be sought.

Pilot may be security-by-design or retrofit, depending on site availability.

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Questions?

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