

## Topical Report: Guidelines for Implementing Physical Vulnerability Assessments in the Nuclear Industry

**PI:** Dan McCorquodale, RhinoCorps

**Collaborators:** NuScale Power, EXCEL Services Corporation

**Pathway:** Regulatory Assistance Grant (Pathway-III)

### *Abstract*

For many years the DOE, and more specifically the National Nuclear Security Administration (NNSA), has employed physical security modeling and simulation tools to support their vulnerability assessments at high protection level sites within the complex. Many tools and associated processes have been employed over the last two decades. Initially, some of these tools provided pathways/timelines using a layer-based approach that did not substantially include geolocation data of targets nor traversal areas. However, in recent years, commercial tools have continued to increase in fidelity and capability to model the human behavior which is critical in determining neutralization values, identifying pathways, and realistic timelines for adversary under tactical conditions and using more modern computing techniques and 3D models of sites.

Although the NRC/NSIR published NUREG/CR-7145 in 2013 which discussed processes, and some assessment tools, many NRC licensees were still reluctant to incorporate modeling and simulation into their security assessment process. Only recently has the nuclear industry started to incorporate modeling and simulation data into decisions and strategy changes regarding physical security however a consistent process, using appropriate modeling tools and source data, still needs to be applied. Although this gained traction in with some operating nuclear units, there is a much more potential for Advance Reactors and Small Modular Reactors (SMR) [sawyer\\_87@yahoo.com](mailto:sawyer_87@yahoo.com)

. The primary objective of this project is to provide a roadmap acceptable to and vetted by the NRC that an applicant could follow to assess current and candidate defensive strategies that would meet NRC requirements in 10 CFR Part 73. The roadmap will be presented in a Topical Report to be submitted to the NRC for review and approval. The Topical Report will outline a DOE/NNSA based process (covered in DOE/SD 470.4) but applied to an NRC licensee. Engagement with NRC staff over the course of the project will ensure the processes meet their requirements.

To illustrate this process, RhinoCorps has collaborated with the NuScale Power and EXCEL. This project will employ the DOE/NNSA based process, tailored for NRC sites, using the targets sets, site models and several defensive strategies for a NuScale SMR site. The Topical Report will be partitioned to provide (1) a narrative discussion of the processes, tools, and methods employed that can be provided to industry and (2) a detailed example of the process centered on a NuScale SMR model and conceptual attack scenarios that will likely be SGI and controlled. The narrative will include discussion of standard source data (often provided, agreed upon and vetted by DOE sites) that is critical to ensuring accurate measurements. Using these proven processes, data, and methods, a probability of interruption and neutralization will be computed for a suite of attack scenarios that will provide a series of security system effectiveness scores for the suite of attack scenarios. This process will be applied to (at least) a pair of conceptual defensive strategy and facility models to illustrate the impact of potential changes on security system effectiveness. NRC review and validation of this process will provide licensees a pathway and consistent process, using appropriate tools and source data, to ensure a highly secure and yet cost-effective defensive strategy.

