Contribution ID: **492** Type: **Interactive Content Presentation**

Vulnerability Assessment using Modeling and Simulation: Applications and Lessons Learned

Vulnerability Assessment using Modeling and Simulation is a quantitative and performance-based methodology to measure the overall effectiveness of physical protection system. IAEA TECDOC-1868 "Nuclear Security Assessment Methodologies for regulated facilities"addressed M&S in security assessment.
In this presentation, I would like to share our experience in M&S. KINAC, has a regulation role with NSSC (ROK's regulatory body) in physical protection, have convened a project to model all the nuclear power plant using a software tool AVERT and to performs vulnerability assessments in the Republic of Korea from 2014 to 2019
First, it is a substantial job to model all the nuclear power plant, which has thousands of physical protection elements, and hundreds of thousands of 3D modeling elements. You have to model building interior/exterior layout, infrastructures and terrain. Old facilities, like Kori-1 nuclear power plant built in 1977, is very difficult get these information, hence many features of modeling should be produced from pictures, rough sketches, and imagination.
Also, this substantial modeling data should be optimized for a reasonable size and analysis speed. At the near end of project, we should modify all the previous modeling to apply our new know-how to optimize modeling.
Second, it is difficult to acquire qualified data libraries of physical protection elements. States with data libraries does not reveal this information because it could show vulnerability of the physical protection elements. Moreover, data of element are not fixed entity. It is interacting other elements and conditions. E.g. the sensing probability of infrared sensors depends on adversary's penetration methods, tools, skill, weather and delay. If enough delay is provided sensing probability is increases.
To get part of data libraries. we should perform experiments on sensors and barriers in security research, Test and Training facility in INSA/KINAC. To cover other data libraries, we designed and discussed to assign appropriate value and equations. E.g. sensing probability depends on distance and time to stay.
Third, 3D geometric modeling verification problems arises. We have to carefully compare the collected data and modeling results to verify geometric model. A common mistake is that a space is created at the bottom of a fence due to interference with a terrain. Thus the path through this space eventually become shortest cut, usually in curved terrain. In a case, vehicle penetrate inside a protected area through this space.
Fourth, we verified and validated our results of simulation with the Force-On-Force (FOF) exercise. As a regulatory organization, KINAC assesses operator's FoF exercises, which should be performed once a year at the nuclear power plant site. However, responders and adversaries did not show reasonable move. Because once detected all responders instantly come to adversary, we have to build invisible wall disappearing after some time to simulate the case when responders need time to prepare.
Still, this simulation requires substantial efforts of the specialized expert, even starting from the completed model. Also, the simulation does not guarantee accuracy for the scenario we did not performed, e.g. waterborne attack.
Finally, after several years of stabilization, we got pretty decent modeling having reasonable similarity to FoF exercises. The benefit of M&S is as follows.
1. Very good for the awareness of governmental officers and operators.
2. Very easy to simulate all the other possible scenarios
3. Get confidence on overall effectiveness in PPS
Further we will expand application of M&S from FoF exercises to review of security plans, and inspection on physical protection system.

State

Republic of Korea

Gender

Male

Authors: KANG, YEONUK (KINAC (KOREA)); JANG, Sung Soon (KINAC); Ms BAEK, Insun (KINAC)

Presenter: JANG, Sung Soon (KINAC)

Track Classification: PP: Physical protection systems: evaluation and assessment