Contribution ID: **78** Type: **Paper**

Evaluation of the Effectiveness of Physical Protection System for Nuclear and other Radioactive Materials Used in Research Institutes

Monday 10 February 2020 11:45 (15 minutes)

Small quantities of nuclear and other radioactive materials are used in educational institutions worldwide in education, research, health care, agriculture and industry. In practice it is often desirable to protect the critical infrastructure (buildings, materials and equipment) from malicious acts caused by humans and the protection is usually provided by complex Physical Protection System (PPS). The PPS is a security system which integrates people, procedures and equipment for the protection of assets against theft, sabotage or any other malicious acts. It is designed to achieve a set of objectives according to a plan and must be analyzed to ensure that it meets the objectives of physical protection. The objective of the study is to create an Adversary Sequence Diagram (ASD) and evaluate the PPS effectiveness for the Most Vulnerable Path (MVP) into the research laboratory. The effectiveness of PPS (PE) is the metric for a PPS performance and it is defined as the product of two probabilities: Probability of Interruption (PI) and Probability of Neutralization (PN). The value of PI can be determined by a software namely, Estimate of Adversary Sequence Interruption (EASI). The detection and delay components of the PPS, along with the respective value of Probability of Detection (PD), mean delay time (tD), and Probability of Communication (Pc) are measured along a specific adversary path and are used as inputs in the Adversary Sequence Diagram (ASD). The Response Force Time (RFT) is used to decide the Critical Detection Point (CDP) in the ASD. The CDP is defined as that point along the path to the target, detection beyond which might result in the success of the adversary. The estimation of PN requires data on the threat and the response force. Threat data include threat type, number of adversaries and their capabilities and a specific target. The response force data contain the information about weapons, number of guards and response time for each target. In the present work, the evaluation of PPS designed for a research laboratory in a university campus against sabotage is presented. Adversary's intent is to reach the radioactive material storage vault in the research laboratory and conduct sabotage. The analysis includes the path travelled by the adversary from fence or gate (off-site) to the target through various detection and delay elements of the PPS. The assumed RFT is 110 seconds and PC is 0.95. The CDP is set at 133 seconds at the lab door. The calculated value of PI is 0.98. The high value of PI represents that adversary's success probability will be very small if they attack through this path. For the PN calculation, we assume adversary is an insider with a pistol. The response force includes one watchman with pistol and two persons in alarm response team. With these inputs the value of PN = 0.96. Therefore PE will be 0.94 i.e. the PPS is 94% effective. So, the effectiveness of the PPS at a research laboratory in a university campus is evaluated by estimating PI and PN. The considered sabotage scenario and the evaluation of the PPS effectiveness serve as an academic exercise which was found useful to demonstrate to the students about how PPS evaluation can be done.

State

India

Gender

Female

Authors: Dr KALRA, Kawalpreet (Amity University); Prof. GOEL, Alpana (Amity University); Prof. S. CHIRAYATH, Sunil (NSSPI, Texas A & M University)

Presenter: Prof. GOEL, Alpana (Amity University)

Session Classification: Physical protection systems: evaluation and assessment

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