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Performance Assessment of Physical Protection System at Wolsong Nuclear Power Plant using SAVI code

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1. Introduction

The 9/11 event in the U.S.A has increased international terror possibilities against nuclear facilities including nuclear power plants(NPPs). It is necessary to assess the performance of existing physical protection system(PPS) at nuclear facilities based on such malevolent acts. A PPS is a complex configuration of detection, delay, and response elements. Several techniques are available to analyze a PPS and evaluate its effectiveness. Sandia National Laboratory(SNL) in the USA was developed a System Analysis of Vulnerability to Intrusion (SAVI) computer code for this purpose. It is powerful software for evaluating the effectiveness of PPS against outsider threats.

This study presents the performance assessment of the PPS at Wolsong NPP using SAVI code. The first is that the SAVI constructs the site-specific Adversary Sequence Diagram (ASD) of the PPS. This provides a methods of graphically representing the PPS composed of physical areas and Protection Elements(PEs) at Wolsung NPP. The code determines the most vulnerable path of an ASD as a measure of effectiveness, and calculates the probability of interruption for paths on ASD. Finally the results can suggest the possible physical protection system upgrades to the most vulnerable paths for Wolsung NPP.

2. Methods

2.1 SAVI computer code

The calculation steps of the SAVI code are as follows[1]:

a) Identify targets & Construction a site-specific ASD
b) Define safeguards at each PE in ASD
c) Assign delay and detection values to each safeguard
d) Define adversary characteristic
e) Define response force characteristic
f) Analyze and review results

The analysis results provide information on Probability of Interruption (PI), Critical Detection Point (CDP) and Time Remaining after Interruption (TRI) for the most vulnerable path and a specified response force time. The interpretation of these could suggest the need for sensitivity analysis of data that has been input to the code, as well as possible PPS upgrade to the most vulnerable path.[2]

2.2 Description of PPS at Wolsong NPP

The PSS at Wolsong NPP was selected and analyzed. Wolsong NPP meets requirements of general nuclear power plant in domestic.

- The Wolsong NPP is bound on the north and west by inland and the east and south by sea.
- The perimeters are protected by dual fences with guard posts and established fences with CCTV and intrusion detection sensors.
- Main entrance/exit gate is operated by a control-center with armed persons.
- Security gates are monitored by CCTV.

2.3 Adversary Penetration Scenario

Adversaries penetrate scenario is classified into three case.

1) Adversaries intrude into Wolsong NPP through main gate.
2) Adversaries intrude into Wolsong NPP through inland.
3) Adversaries intrude into Wolsong NPP through sea.

Figure 1 shows is three adversary penetration scenarios used for Wolsong NPP.

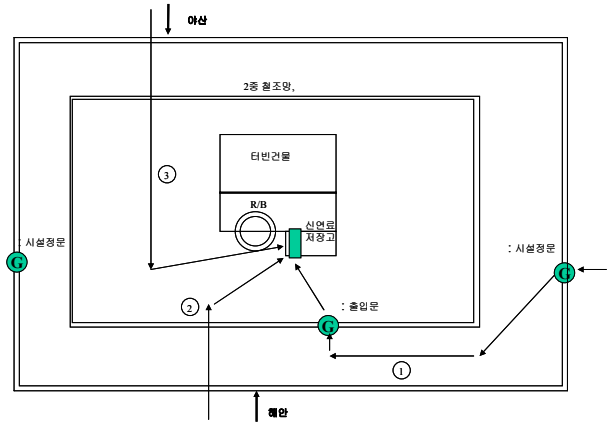

Figure 1. Adversary penetration scenario on Wolsong NPP

2.4 Site-Specific ASD for PPS at Wolsong NPP

The object of site-specific ASD is to correctly model the PPS that exists at a site.[2] Figure 2 shows site-specific ASD that is constructed by using Wolsong NPP and it shows an intrusion path. This path starting from offside has 6 physical area and 7 protected layers. The adversary attempts to sequentially defeat an element in each protection layer as he traverses a path through the facility to target.

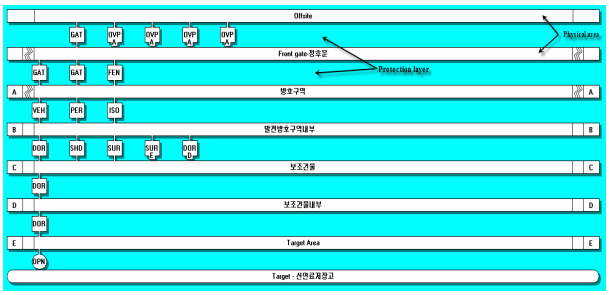

Figure 2 Site-specific ASD for Wolsong NPP

2.5 Analysis of PPS at Wolsong NPP using SAVI code

The input data for analysis is as follows;

- Threat type is terrorist foot.
- Intrusion method is only intrudes force/stealth.
- Response strategy is containment.
- Response Force Time (RFT) set up 180 seconds.

Figure 3 shows analysis diagram of SAVI code. The analysis result shows that the CDP is located at Door (DOR) between power plant protection area and secondary building. TRI is 7seconds, PI=0.0197, cumulative path delay time after CDP is 187 seconds. The PI is calculated very lower because non-detection probability is greater than detection probability.

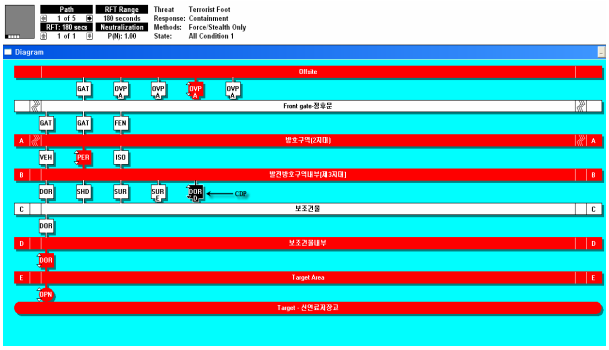

Figure 3 Analysis diagram of SAVI

3. Conclusion

This paper presented the performance assessment of the PPS at Wolsong NPP using SAVI code. Using the code, the site-specific ASD was constructed for the PPS. Then, the most vulnerable path of an ASD was determined for a measure of effectiveness. The probability of interruption for paths on ASD was calculated.

The resulting PI is calculated very lower because non-detection probability is greater than detection probability. The analysis results would help to improve and/or upgrade the existing physical protection system based on these most vulnerable paths for Wolsung NPP.

REFERENCES

[1] Ann Bouchard, SAVI Coures South Korea, Cooperative Monitoring Center, p. 25-1-25-10, 2001.
[2] SNL, Physical Protection System Design, Workshop Material on Physical Protection System Methodology, 1996