System Dynamics Approach for the Evaluation of Intrusion Protection at Nuclear Facilities

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The physical protection system is getting focused since after the event of 9/11 in 2001. IAEA, Sandia National Lab in USA as well as KAERI have started new research projects regarding to the physical protection system. These new researches focus on the evaluation of the system based on the consensus that the evaluation of the physical protection system has not been proper in many senses.

This paper covers the newly developed evaluation tool based upon the system dynamics technique. The intrusion problem has dynamic complexity due to the non-linearity, tightly coupled and counterintuitive behavior of the complex system. System dynamics models can represent the dynamic complexity and interaction of multiple characteristics over time.

The tool consists of three modules; input module, dynamic module, and output module. In the input module, users can add or delete the components of the physical protection system and also change the procedures. The dynamic module represents the dynamic behavior between the intruders' activities and responses of the physical protection system including guards. The output module summarizes the evaluation information of the presumed physical protection system.

The tool has two simulation modes; interactive mode and automatic mode. The interactive mode is a kind of gaming mode, and users as intruders play against the physical protection system. In this way the users can grasp the vulnerability of the system in hand. In the automatic mode, Monte Carlo simulation is carried out and the output module summarizes the results. (See Figure 1)

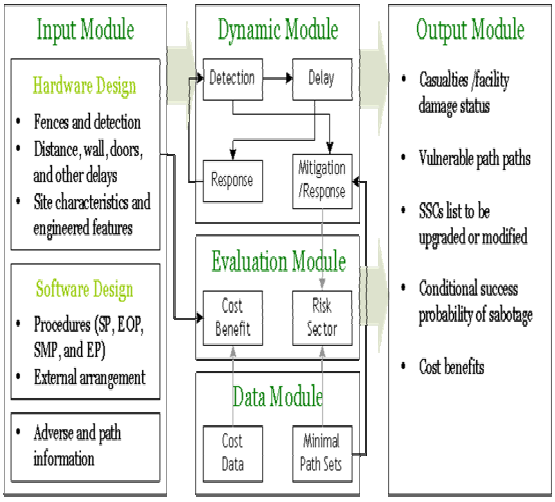

Figure 1. Main Structure of the Simulator

The main concept of the simulator was developed as international co-research work between Korea Government and IAEA, and the major elements were developed by NNCA in 2005. The interface and structure of the simulator are being revised in 2006 reflecting the experiences.