U.S. Nuclear Regulatory Commission
37th ANNUAL REGULATORY
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RIC 2025

CHARTING THE NEXT 50 YEARS

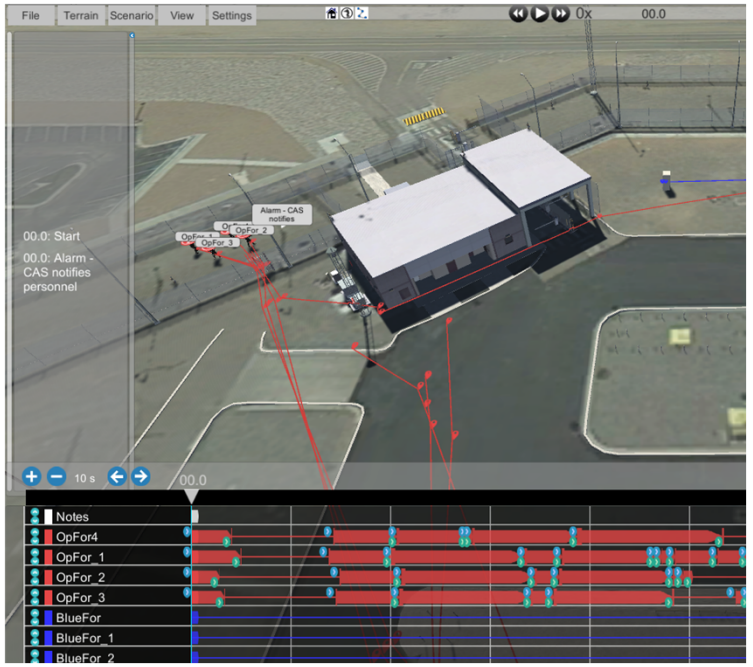
Use of Physical Protection Modeling and Simulation Tools to Optimize Security Plans

MARCH 11-13

BETHESDA NORTH MARRIOTT
HOTEL & CONFERENCE CENTER

Physical Security M&S Tools

- Modeling and simulation (M&S) is a tool industry is using to efficiently conduct physical security assessments
  - The capabilities of M&S tools have advanced significantly from their first use in the 1970s
  - M&S assessments can be performed rapidly and consistently
  - M&S tools complement force-on-force exercises
- Sites are benefiting from the use of M&S tools
  - Nuclear power plants—optimizing physical protection strategies
  - Advanced reactor designers—efficiently building and evaluating design plans

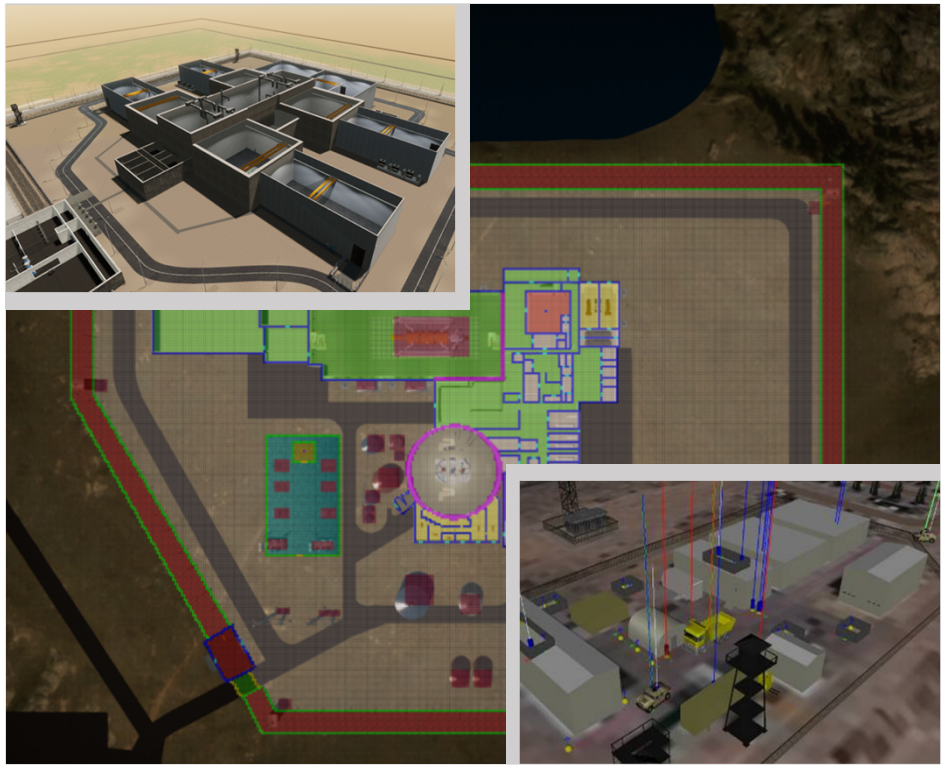


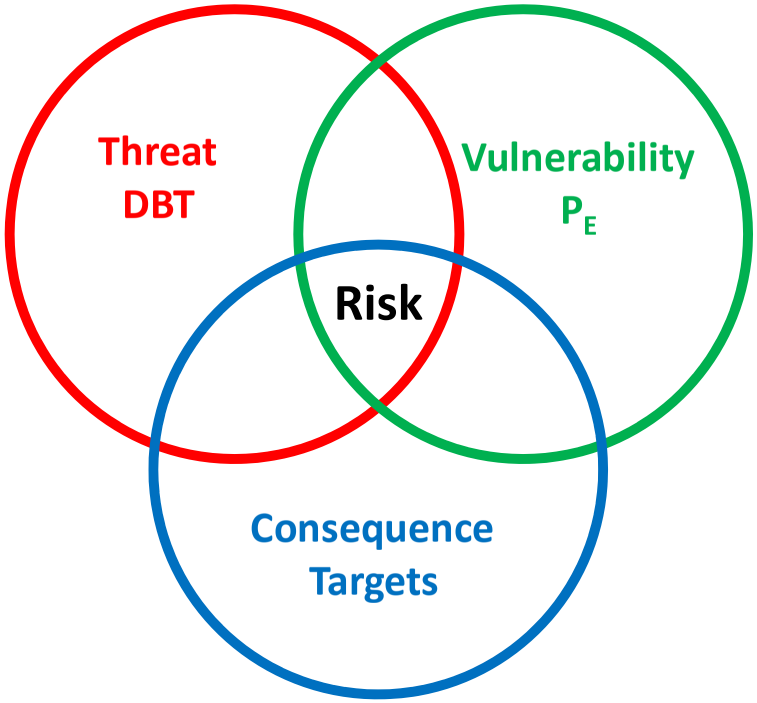
Physical Security M&S Tools (cont.)

- M&S tools can support both NRC and licensee assessments
  - Many iterations of physical protection system and plant design can be conducted to develop an effective physical protection system before proceeding with construction
  - Training of the NRC staff will inform licensing reviews and oversight activities
- M&S tools can be used for creating, adjusting, and evaluating physical protection system designs for other facilities
  - NRC-regulated nonpower reactors
  - NRC fuel cycle facilities

M&S Tool Types

- Digital Tabletop
  - Supports subject matter expert discussions and scenario development
- Pathway Analysis
  - Assesses probability of interruption (P_I)
- Combat Simulation
  - Assesses probability of neutralization (P_N)





Physical Security Risk

- Triple representation*
  - Threat, Vulnerability, Consequence
  - M&S tools evaluate potential adversary pathways and the probability of adversary defeat
- Only vulnerability, via system effectiveness (P_E), is determined in assessments
  - Threat is determined by the NRC as the design-basis threat (DBT)
  - Consequence is implied by targets

$$P_E = P_I \times P_N$$

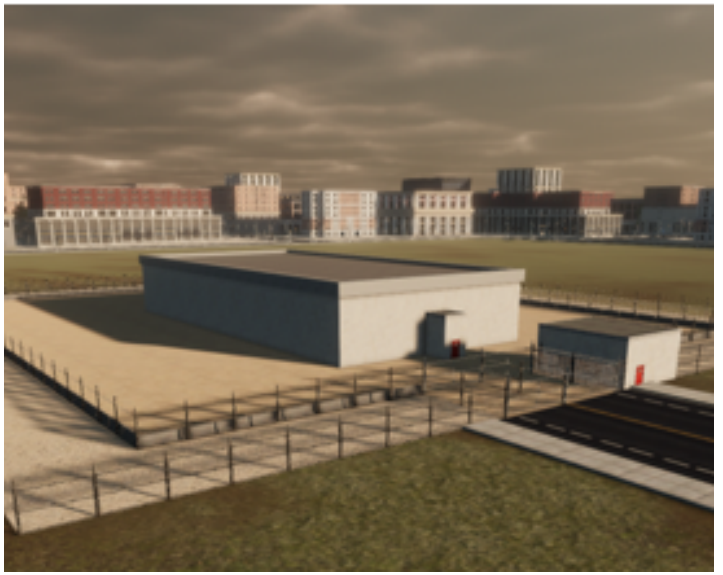
- A realistic value of P_E is always less than one

*Kaplan, Stanley, and B. John Garrick (1981), "On The Quantitative Definition of Risk," *Risk Analysis*, Vol. 1, No. 1, pp.11–27. ML12167A133

Data Needs for M&S Tools

- Probabilities of Hit/Kill
- Adversary Capabilities
- Plant Layout
- Response Times
- Barrier Delay Times
- Detection Probabilities
- Target Locations

- Ongoing collaboration between the Office of Nuclear Security and Incident Response and the Office of Nuclear Regulatory Research
- NRC engagement with industry on the use of M&S tools
  - Held public meeting in July 2023
  - Summary of public meeting is available
- Preapplication meetings with advanced reactor designers on the use of M&S tools
- Development of reports and staff training for calendar year 2025



Publicly Accessible Reports

Preliminary Assessment of Physical Protection Modeling and Simulation Tools—ML23346A027*

Integration of Safety, Security, and Safeguards During Design and Operations—A Technical Assessment and Regulatory Considerations for Advanced Reactor and Advanced Fuel Fabrication Facilities—ML24275A075

*Agencywide Documents Access and Management System accession number

The next slide shows a video describing collaborative efforts between the Office of Nuclear Regulatory Research and the Office of Nuclear Security and Incident Response on the development of policy for the use of physical protection modeling and simulation tools