



ADVANCED REACTOR SAFEGUARDS

SMR and Microreactor PPS Design and Response Strategies

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PRESENTED BY

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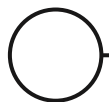
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Motivation and Objectives



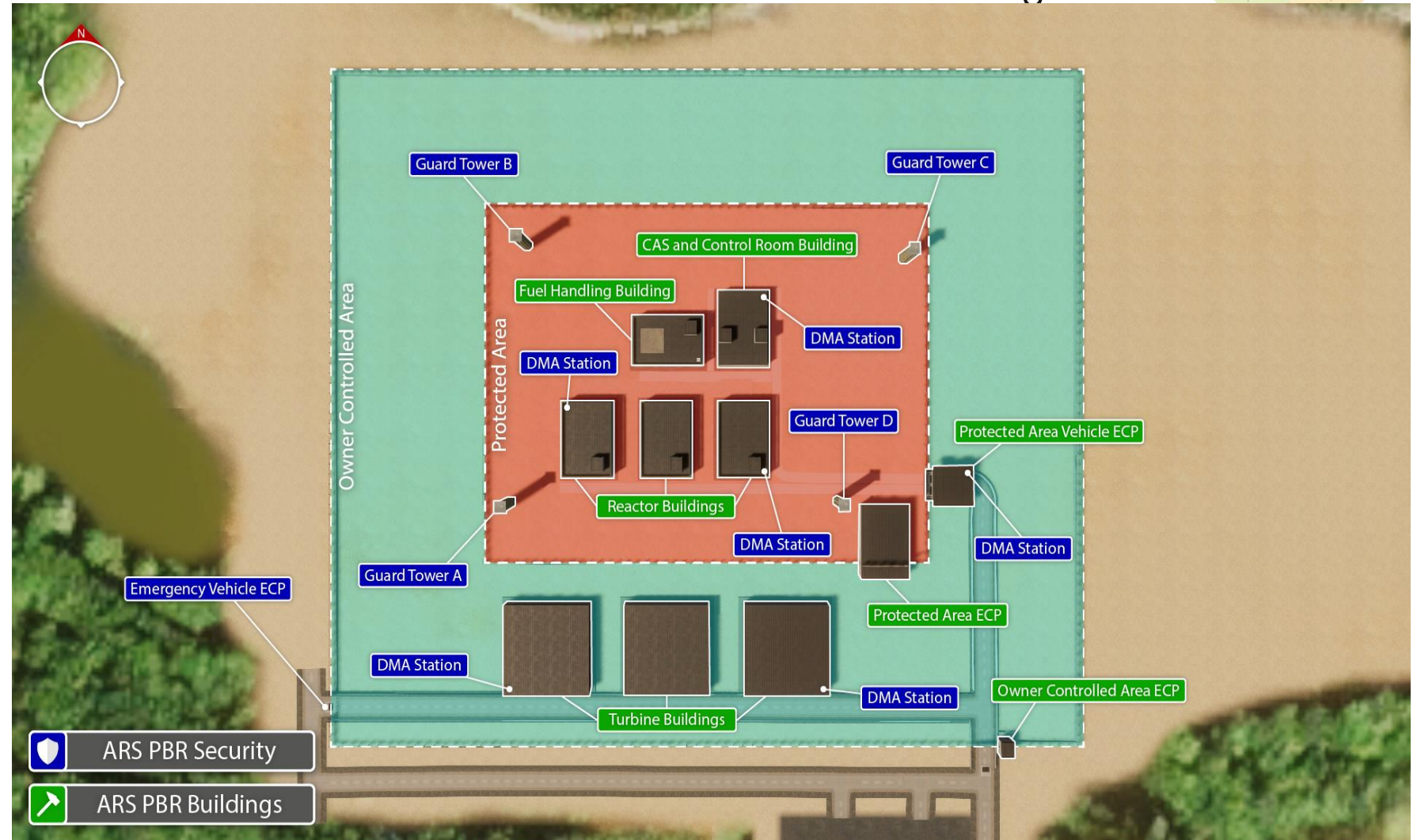
- SMR and microreactor vendors have expressed interest in
 - Reduced site footprints
 - Reduced physical protection system infrastructure
 - Reduced operations & maintenance costs
 - Reduced number of full time security personnel
- Our motivation is to conduct technical design and analysis to inform vendors on designing cost-efficient physical protection systems (PPSs)
 - Demonstrating a methodology for designing effective PPSs
 - Integrating advanced technology to reduce PPS infrastructure
 - Effectively reducing security staffing headcounts



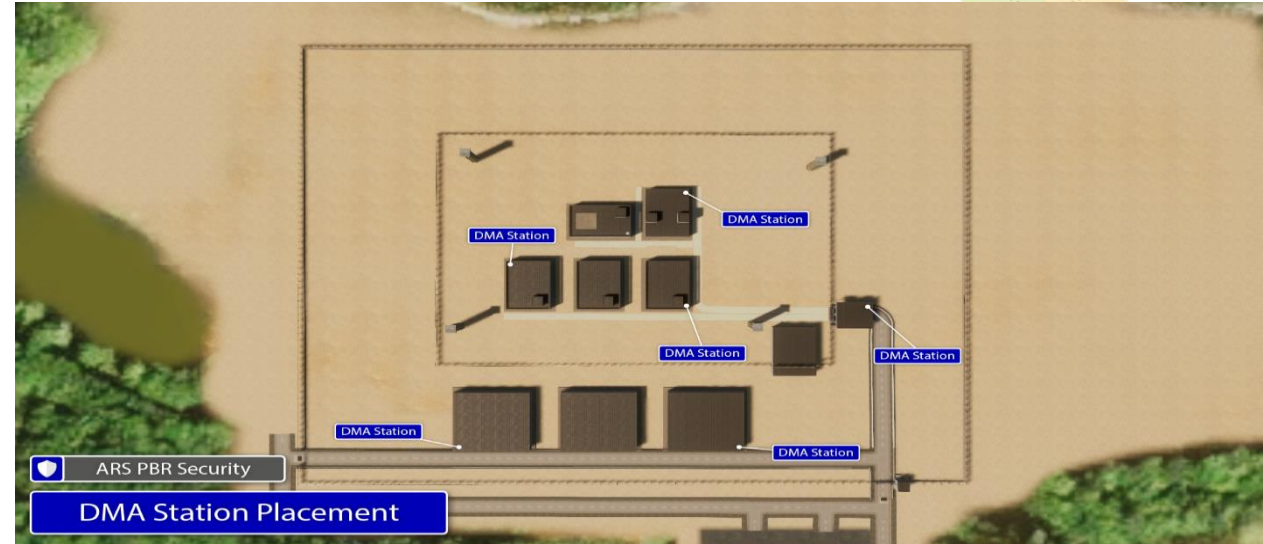
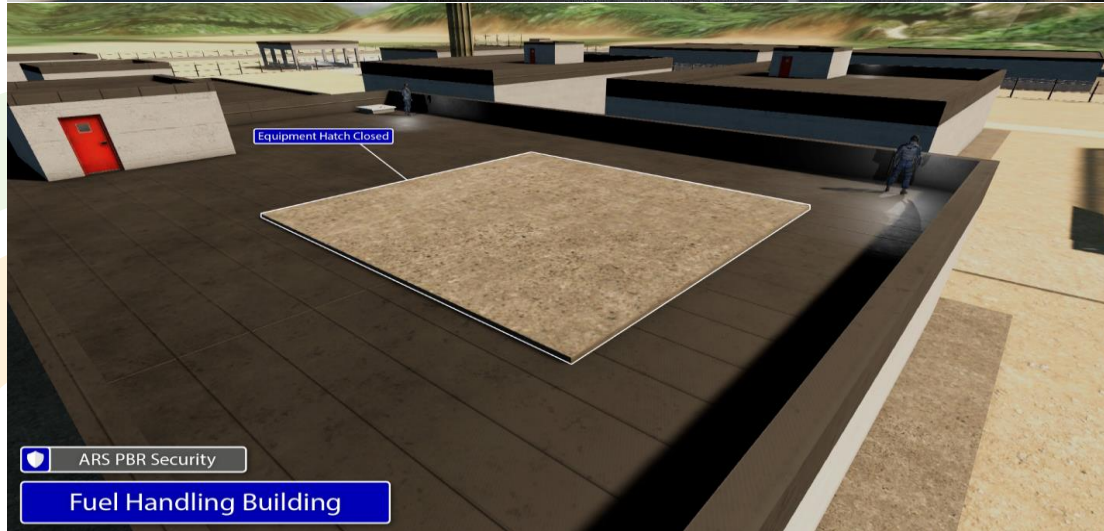
Pebble Bed Reactor



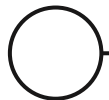
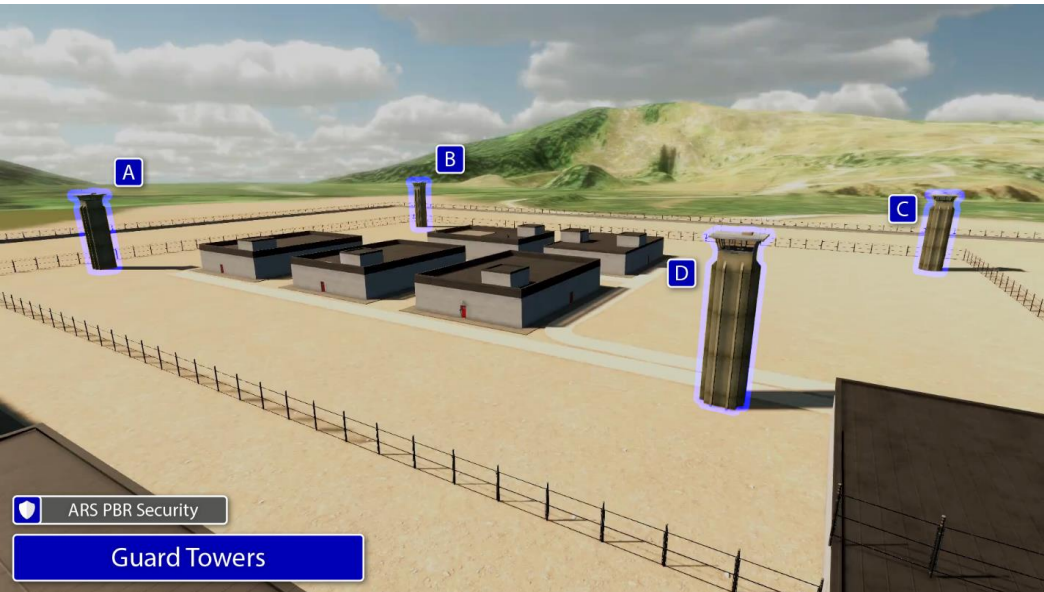
- DMA → External Intrusion Detection
- OCA Boundary
- PA Boundary
- 4 Response Towers
- 1 Roving Guard that can access roofs
- OCA entry control point for large vehicle searches
- PA entry control point for detailed vehicle inspections
- 6 Vital Areas



PBR PPS Attributes



PBR PPS Attributes



PBR Staffing Plan



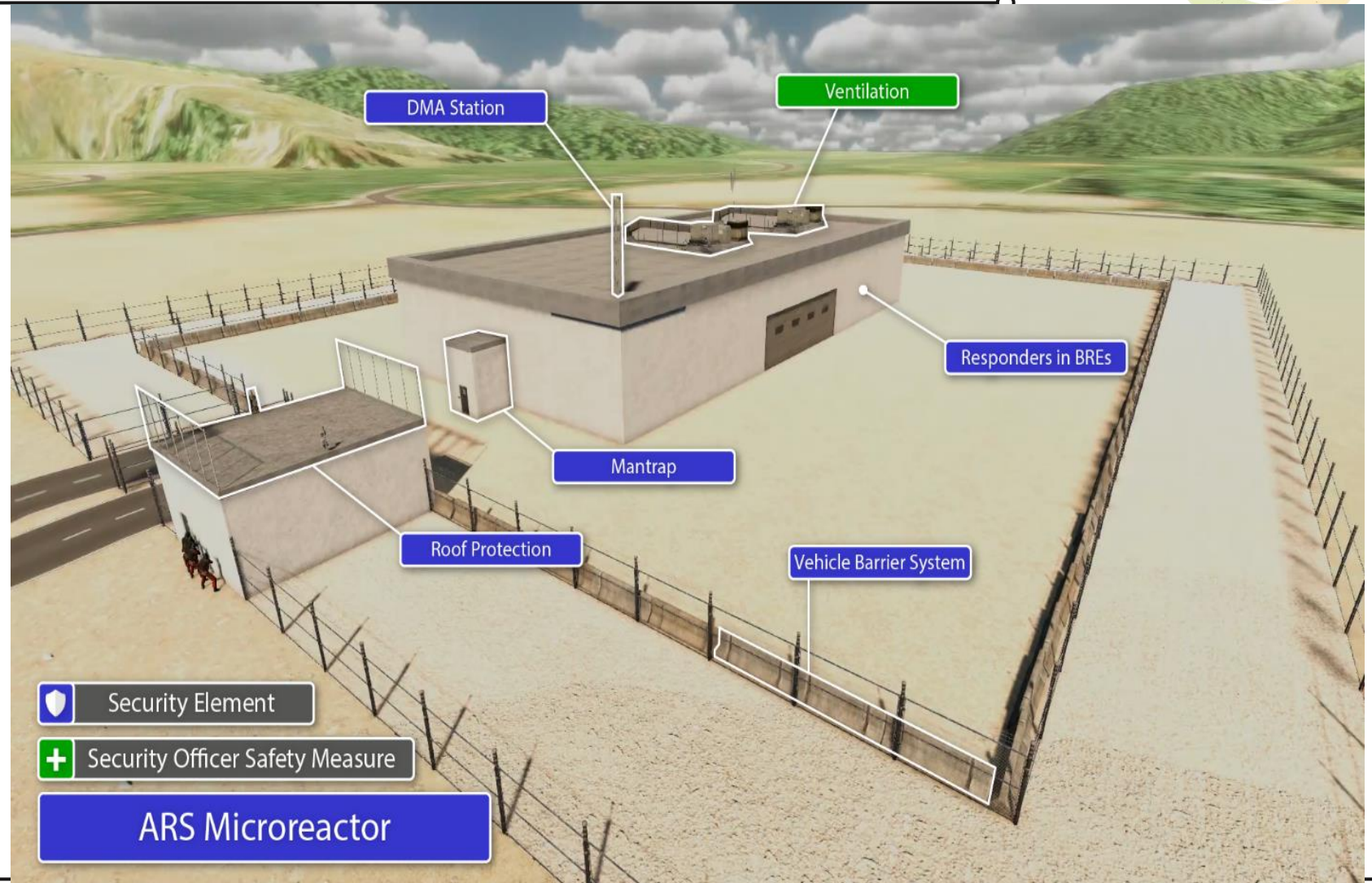
System Effectiveness Positions (Requiring Exemptions)

Position	24/7 12 hr. Rotating Shift	FTE
Security Shift Supervisor	1	4
Field Supervisors (One Response Team Leader)	2	8
Alarm Station Operators (CAS/SAS)	3	12
Armed Responders	6	24
Armed Security Officers (Personnel, vehicle, and material processing)	3	12
Total	15	60

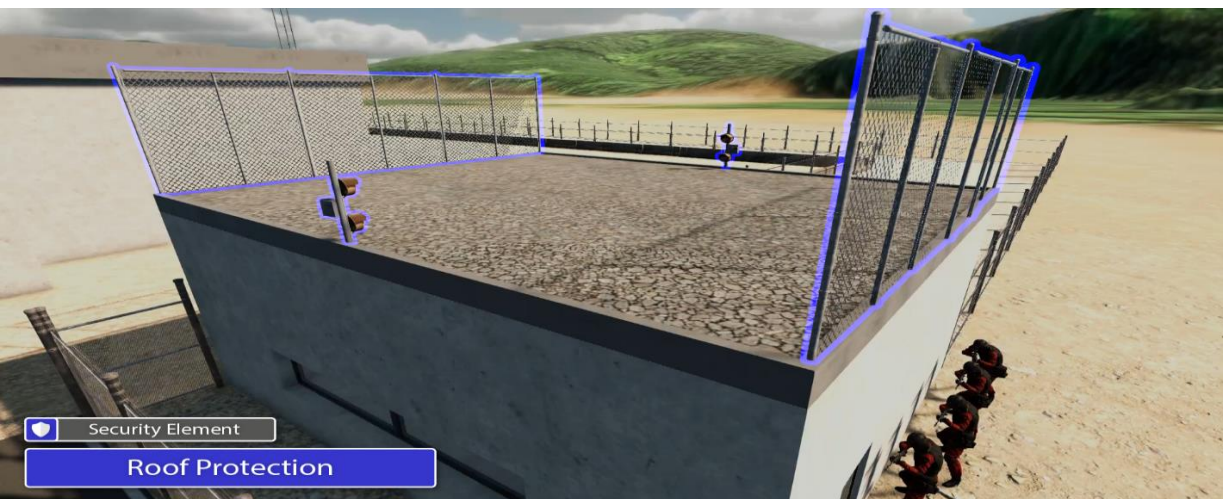
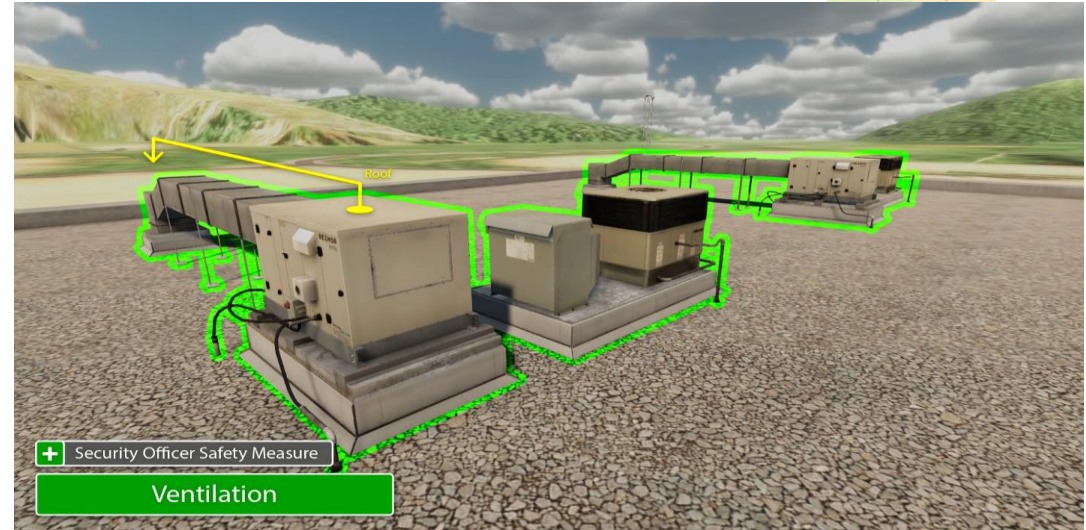
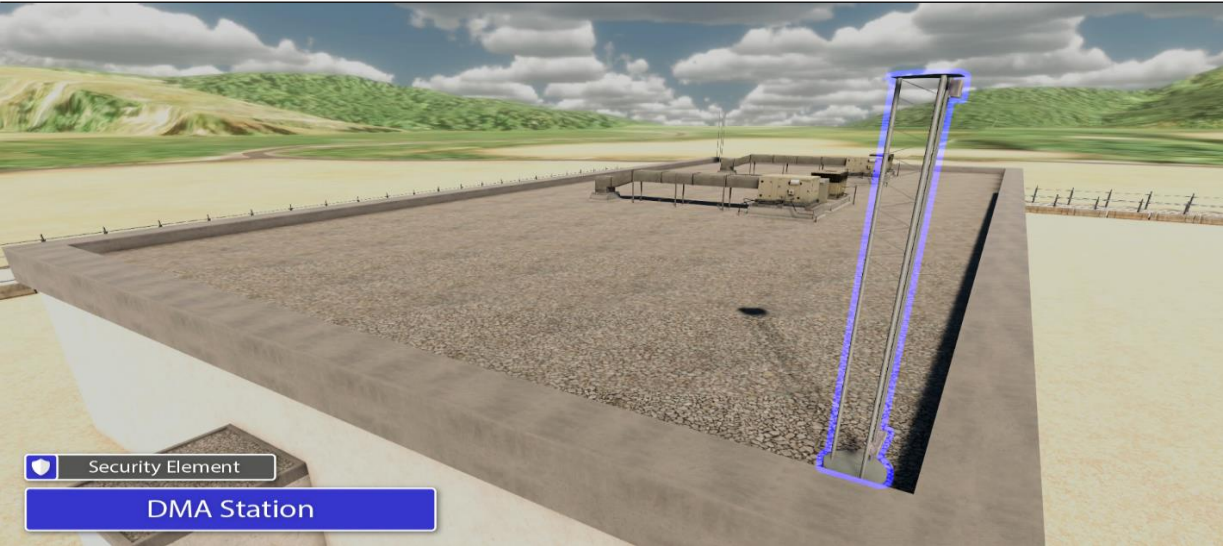
Microreactor



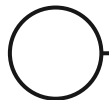
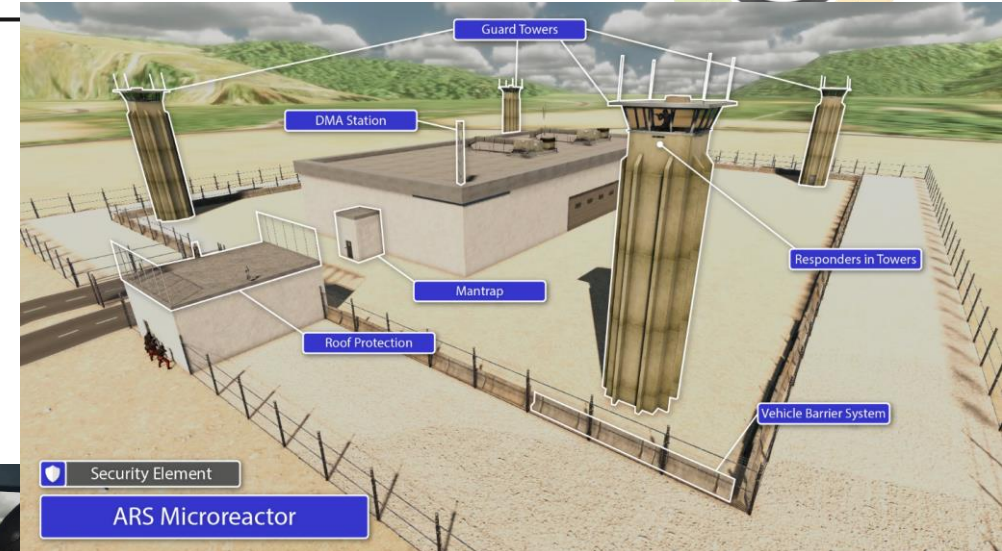
- DMA → External Intrusion Detection
- OCA Boundary
- PA Boundary
- 4 different scenarios analyzed
 - 4 internal responders
 - 3 internal responders
 - 2 internal responders
 - 4 responders in towers
- One ECP
- Two Vital Areas



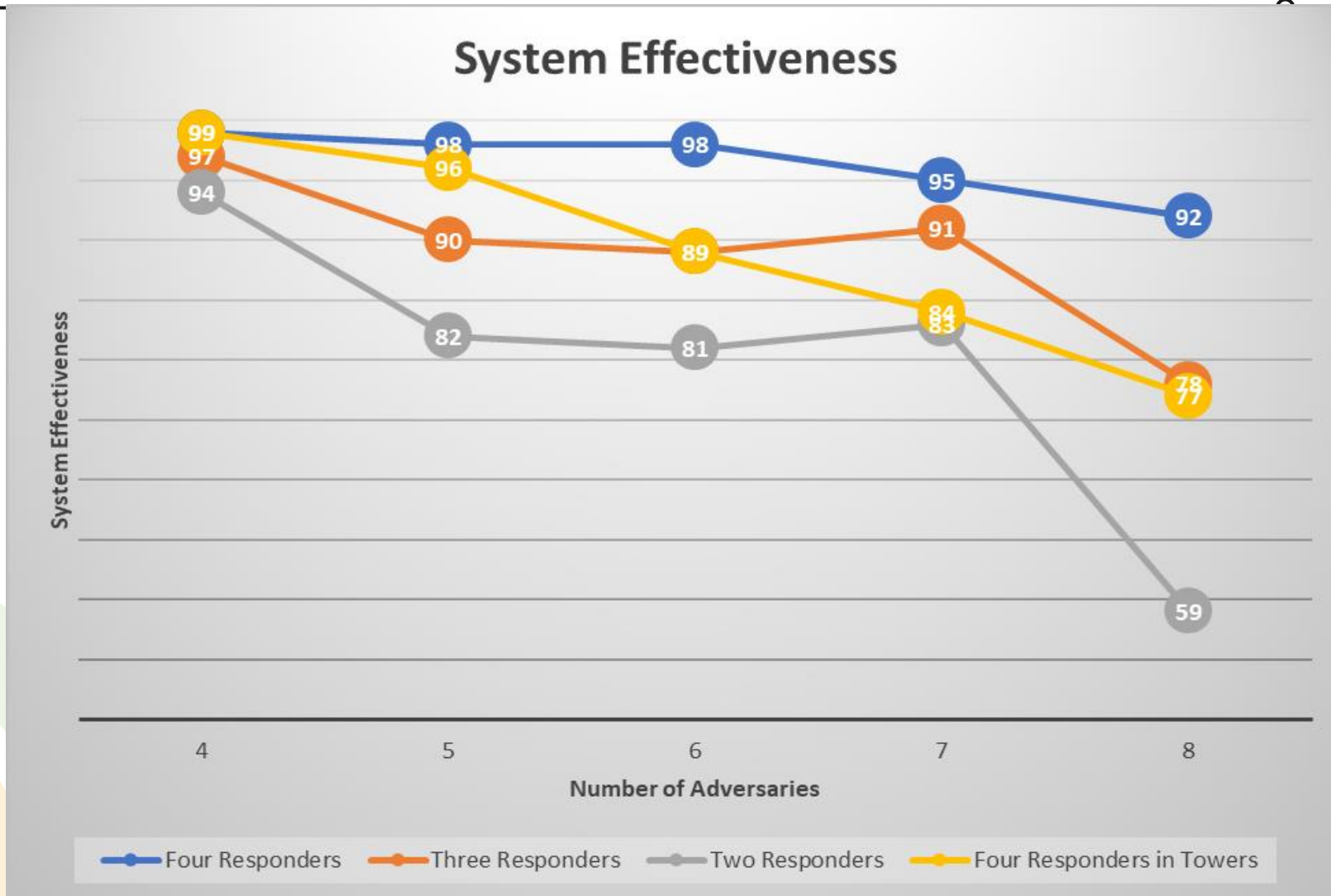
Microreactor PPS Attributes



Microreactor PPS Attributes



Microreactor System Effectiveness and Staffing Plan

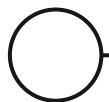


Microreactor Staffing Plan

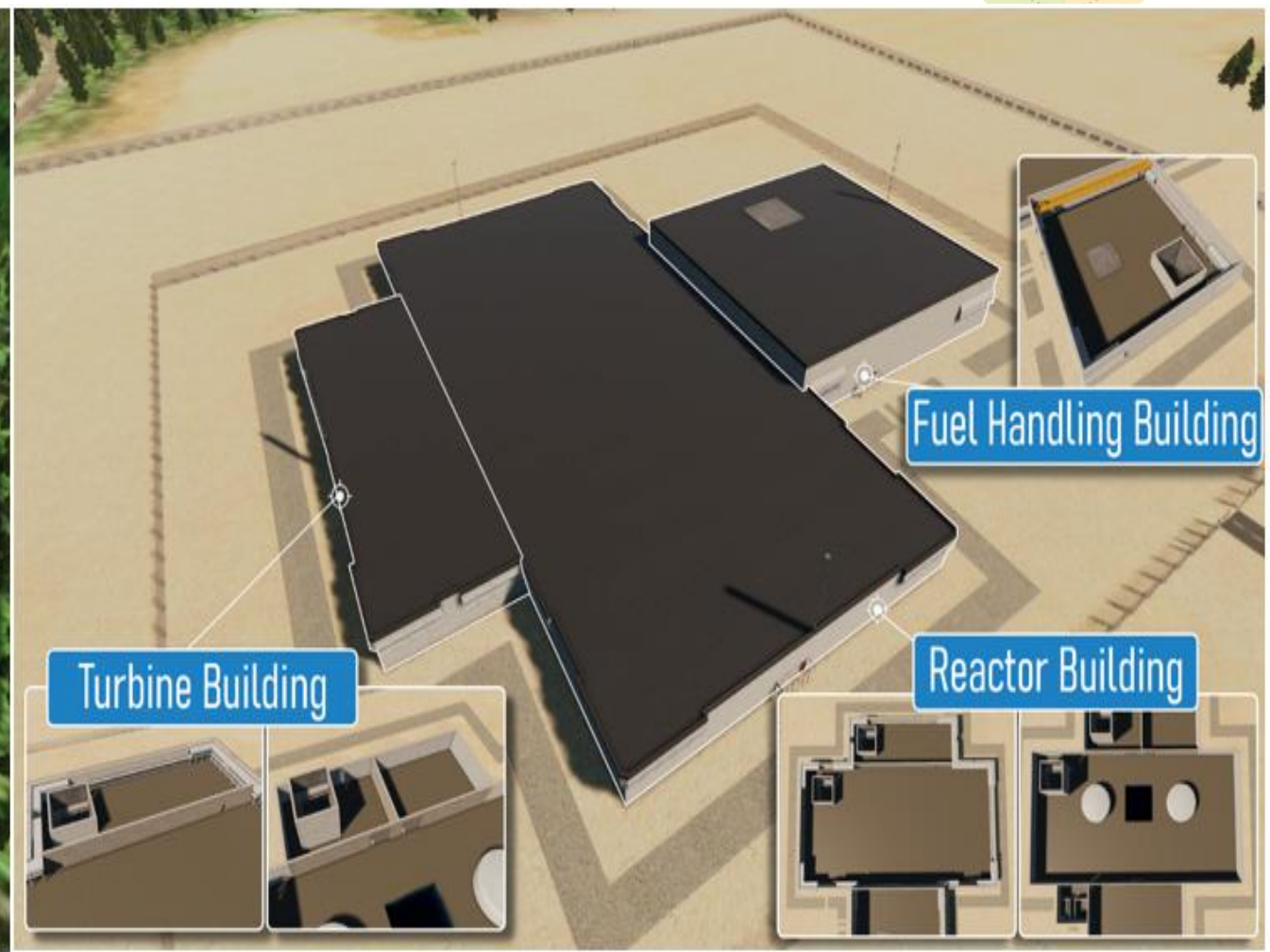
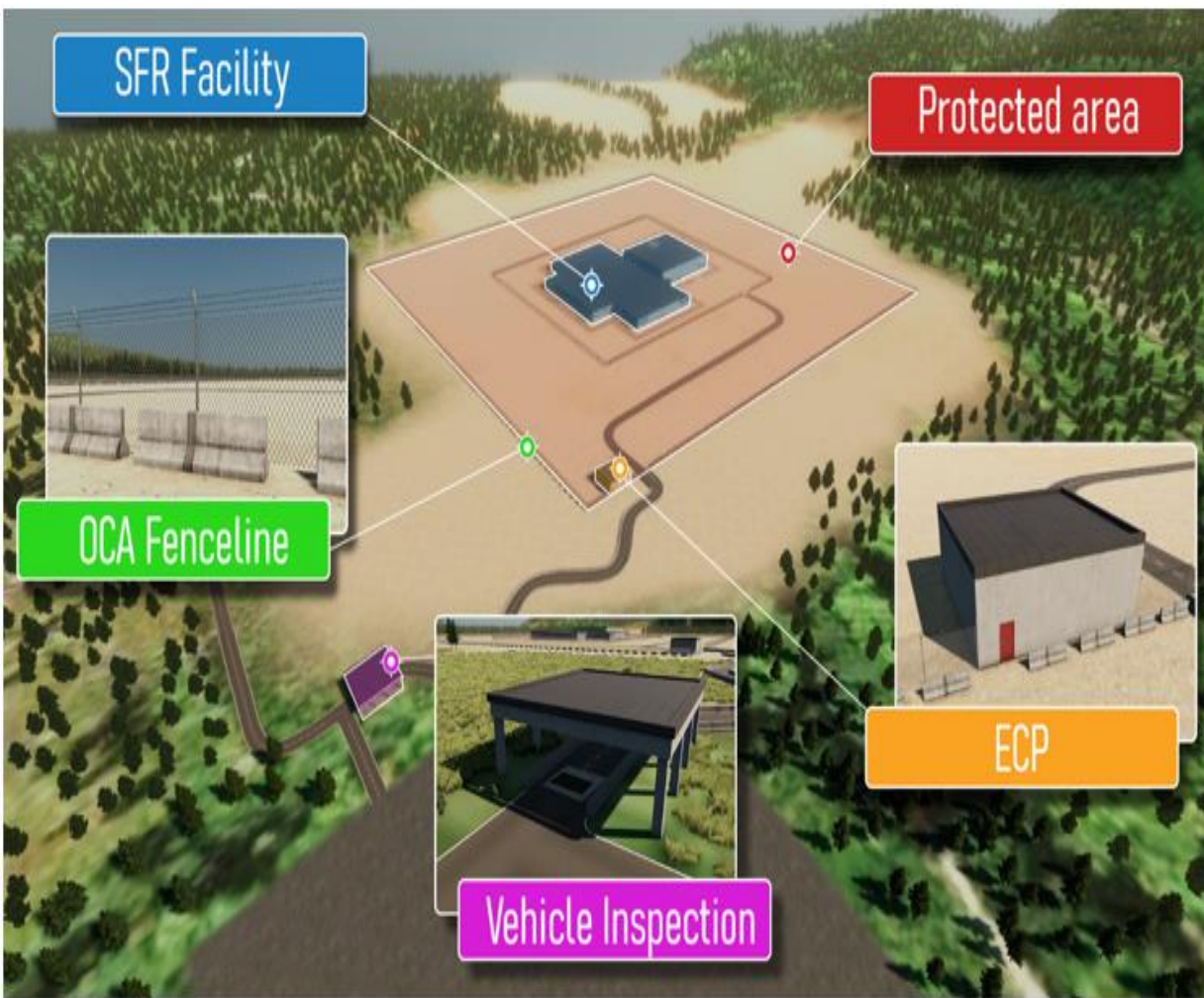


System Effectiveness Positions (Requiring Exemptions)

Position	24/7 12 hr. Rotating Shift	FTE
Security Shift Supervisor	1	4
Response Team Lead	2	8
Alarm Station Operators (CAS/SAS)	3	12
Armed Responders	5	20
Armed Security Officers (Personnel, vehicle, and material processing)	3	12
Total	14	56



Sodium Fast Reactor

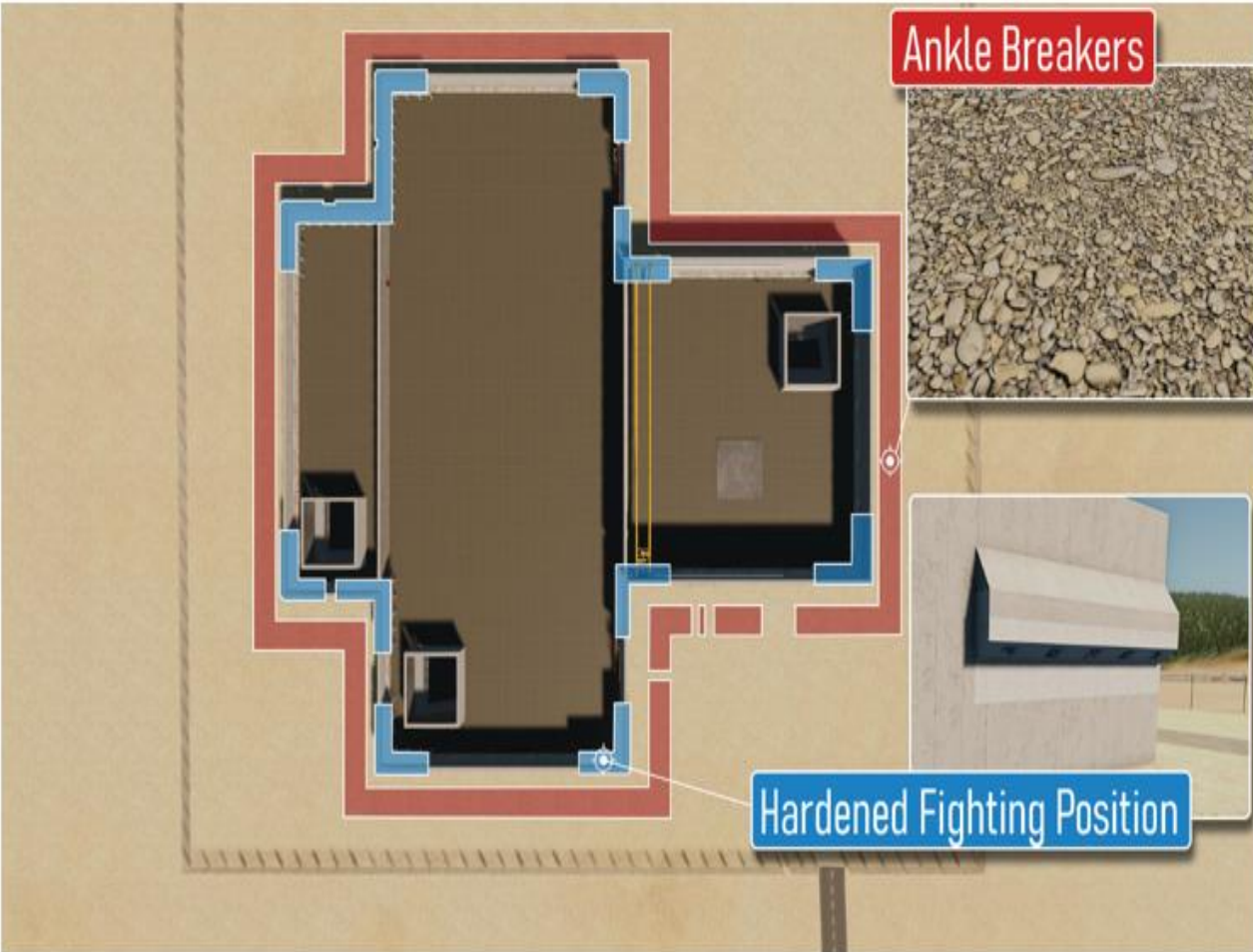


SFR Response Strategies



5 Armed Responders

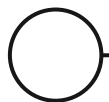
8 ROWS Platforms



ROWS and Response Results



- 5 responders showed to be effective in all scenarios across all adversary ranges
 - Responders were able to engage externally and internally (neutralized most adversaries before entry into the building)
- ROWS platforms only considered engagement interior to the building
 - Natural building construction for egress created vulnerabilities for the adversary
 - 2 more ROWS would be needed to increase the probability of neutralization one below-grade and one above-grade near the stairwells



SFR Staffing Plans

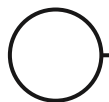


ROWS Response Staffing Plan

Position	24/7 12 hr. Rotating Shift	FTE
Security Shift Supervisor	1	4
Field Supervisor/RTL	2	8
Alarm Station Operators	3	12
ROWS Operators	4	16
Armed Security Officers (ECP, Vehicle Search, Escorts)	3	12
Total	13	52

Onsite Response Staffing Plan

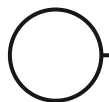
Position	24/7 12 hr. Rotating Shift	FTE
Security Shift Supervisor	1	4
Field Supervisor/RTL	2	8
Alarm Station Operators	3	12
Armed Responders	6	24
Armed Security Officers (ECP, Vehicle Search, Escorts)	3	12
Total	15	60



SFR Lessons Learned



- ROWS strategies should be integrated with the overall plant design and layout to include access points
- ROWS in this configuration may not lead to a drastic reduction in security staffing headcounts
- The single building design of the SFR did lead to a reduction in security system infrastructure cost
 - 1 vital area and reduced vital area entries
 - Less access control devices and less internal intrusion detection system technologies



Conclusions



- ROWS placement must consider facility design and adversary attack plans
- Effective response forces for SMRs and microreactors may be reduced and still reach high system effectiveness
- Staffing reductions is a large focus of all SMR and microreactor vendors
 - Primary focus is on responders
 - Armed Security Officers
 - CAS/SAS Operators
- Reaching high system effectiveness can be achieved through integrating facility designs and the PPS design

