

Advanced Nuclear Security Systems Engineering



UNM NUCLEAR SECURITY PROGRAM SPRING 2022

With nuclear and radiological materials poised to play a significant role in national and international plans to develop safe, secure, clean, and affordable power—as well as in scientific and medical innovation—it is critical that facility designers, operators, and regulators understand advanced concepts for engineering security systems. The Advanced Nuclear Security Systems Engineering, as part of the UNM Nuclear Security Program, was developed to prepare the next generation of nuclear security experts for the challenges of this global need.

Course Description

This course serves as an advanced, comprehensive study of the principles, concepts, technologies, and practices used in designing and analyzing nuclear security systems. Design applications will include traditional nuclear power plants, small modular reactors, research reactors, and fuel processing plants, in both domestic and international contexts. In addition, this course aims to emulate a typical security engineer's working environment. Students will explore interdisciplinary engineering methods to address problems with no closed-form solutions and develop sufficient, practical security solutions for critical nuclear infrastructure.

Course Goals

This course will improve student's abilities to design and analyze security systems for nuclear facilities using the following aspects:

- **Knowledge:** Students will learn advanced principles and concepts/processes for engineering security system design, the concepts needed for analyzing security systems, and will apply engineering design and analysis processes to security systems.
- **Skills:** Students will become skilled in designing security systems for various nuclear facilities, applying security systems analysis processes, and with security system design and analysis software.
- **Values:** Students will discuss the importance of performance measure tradeoffs in security system design and appreciate the importance of considering diverse perspectives for security systems used at nuclear fuel cycle facilities.

COURSE DETAILS

Level: Graduate; undergraduates in last year of engineering degree also eligible

Credits: 4 CEU

Start: January 18, 2022

Times: Tu/Thu, 4:30-5:45 pm
MT

Location: Online

Cost: \$1200

To register:

Log on to [Advanced Nuclear Security Systems](#)

- Review the course description and select Add to Cart
- Pay for the course with a credit card by selecting Checkout; to use a purchase order, call (505) 277-0077



| Week | Topics | Assignment Info |
|------|---|---|
| 1 | Nuclear Security Design & Analysis: Core Concepts <ul style="list-style-type: none"> Course Introduction; Introduction to nuclear fuel cycle activities Introduction to Global Best Practices in Security Engineering (DEPO) | |
| 2 | Nuclear Security Design & Analysis: Setting the Operational Context <ul style="list-style-type: none"> Review of Advanced Engineering Design for Complex Systems & Applications for Nuclear Security (STPA, HAZCADS, MLN) Introduction to hypothetical RR, SMR, NPP, Reprocessing Facility & Economic and Budget Considerations | Class 3: Students divide into groups and choose a hypothetical facility Class 4: Students determine placement of hypothetical facility |
| 3 | Nuclear Security Design & Analysis: Evaluation Techniques <ul style="list-style-type: none"> Vulnerability Assessment, System Effectiveness Calculation & Considerations Path Analysis Techniques & Force-on-Force Analysis Techniques | |
| 4 | Deriving Threat-Related Requirements <ul style="list-style-type: none"> Threat Assessment & Design Basis Threat Security System Design Strategies/Groups to brief on facility and facility location | Class 8: Quiz 1 Class 9: Students brief on facility location |
| 5 | Designing to Meet Detection Requirements <ul style="list-style-type: none"> Internal Intrusion Detection Systems & External Intrusion Detection Systems Integration with/Operations of Central Alarm Station | Class 10: Quiz 2 |
| 6 | Designing to Meet Delay Requirements <ul style="list-style-type: none"> Developing Delay Systems (e.g., passive vs. active) Vehicle Barriers & Personnel Barriers | Class 12: Quiz 3 |
| 7 | Designing to Meet Guard and Response Requirements <ul style="list-style-type: none"> Determining Guard and response force sizing & responsibilities Guard and response force communications & capabilities & Coordination with additional/off-site response forces | Class 14: Quiz 4 |
| 8 | Path Analysis Techniques <ul style="list-style-type: none"> Path Analysis Techniques & Available software tools (MPVEASI/PATH TRACE) Group Design Discussions | Class 16: Quiz 5 |
| 9 | Vulnerability Assessment Processes <ul style="list-style-type: none"> Vulnerability Assessment Processes & Available software tools (Scribe3D) Group Design Discussions | Class 18: Quiz 6 |
| 10 | Mid-Semester Briefs <ul style="list-style-type: none"> Groups #1, #2 and #3 present (15 + 5 each) Groups #4, #5 and #6 present (15 + 5 each) | Groups will be assigned to give a mid-semester brief of facility design |
| 11 | Addressing Performance Challenges <ul style="list-style-type: none"> Protecting digital controls of physical operations & Unmanned Aerial Systems in Nuclear Security System Design Performance Testing/Sustainability | Class 22: Students brief on path analysis tools used |
| 12 | Designing to Meet NMAC Requirements <ul style="list-style-type: none"> NMAC Considerations for "Item Facilities" (technologies/procedures) NMAC Considerations for "Bulk Facilities" (technologies/procedures) | Class 24: Students brief on vulnerability analysis tools |
| 13 | Emerging Challenges <ul style="list-style-type: none"> Cybersecurity, UAS/CUAS Long-term sustainability & Group Design Discussions | |
| 14 | FINAL Design Briefings (week 1) <ul style="list-style-type: none"> Groups #1 (30 + 10) & Groups #2 (30 + 10) Groups #3 (30 + 10) & Groups # 4 | Students will be assigned a date for brief of overall security design |
| 15 | FINAL Design Briefings (week 2) <ul style="list-style-type: none"> Groups #5 (30 + 10) & Groups #6 (30 + 10) | Students will be assigned a date for brief of overall security design |

CONTACT INFORMATION:

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