Purdue University
School of Health Sciences

HSCI 49000/59000, POL 42900
INTRODUCTION TO NUCLEAR AND RADIOLOGICAL SOURCE SECURITY

Fall 2017
T, Th, 3:00-4:15 pm, PHYS 111

Course Director and Instructor

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Course Description

HSCI 49000, 59000, POL 429000; Semester: 01 (Fall 2017), Credit: 3.0, Type: Lecture

This course focuses on the basic elements of nuclear and radiological source security. It examines methods for planning and evaluating nuclear security activities at the State and facility level, establishing nuclear security culture in different types of nuclear and radiological installations, and examines nuclear cyber and information security measures. Issues and approaches for nuclear security concerns, both state-level (e.g., nonproliferation and deterrence) and asymmetric concerns (e.g., nuclear smuggling and nuclear terrorism) will be addressed. The integration of safety and security and the use of alternative technologies will also be covered. Group exercises and simulations in applied nuclear security scenarios will complement lectures given by a number of national and international experts. This course is designed for both "technical" (engineering and science) and "non-technical" (policy) students and the interaction between students of different backgrounds is encouraged.

****This course is generously supported by a Stanton Foundation grant****

Overall Course Goal

The course will introduce the student to the basic elements of nuclear and radiological source security.

Overall Course Objectives

After completion of this course, students will have a broad picture of nuclear security components and their interconnections, and of the planning of nuclear security activities at the State and facility level.

Course objectives:

- To introduce students to the basic concept of nuclear security
- To introduce students to the basics of nuclear security planning at the facility and state level.

- Introduce students to proliferation efforts, framing them within the historical and security-related context
- Create a foundational understanding of relevant security, safeguards and nonproliferation treaties and agreements
- Leverage existing technical knowledge in coming to policy conclusions
- Develop both a regime and state specific knowledge base
- Illustrate understanding through technical and policy oriented exercises
- Expand relevant technical knowledge base as well as introduce students to new instrumentation and concepts

Expectations

Students are expected to arrive ready for discussion. This course is set up to facilitate student participation with information from the readings, lectures and assignments will be used as a material for group discussions.

All papers assigned are to be typed and include full citations. Students may choose their preferred citation style (APA, MPA or Chicago) but it must remain consistent throughout the paper. An assortment of citation tools are available online, a link to Zotero is listed below though feel free to use your preferred method of building your bibliography

Zotero Citation Tool: http://www.zotero.org/

Class Grading Policy

1) Assignments/Homework, in total, will represent 25% of the overall class grade.

a) Students should expect between 8 and 10 homework assignments (which may include reading summaries) during the semester. Students are encouraged to work together on homework (except where noted otherwise), but the final product should be completed independently. Homework problems can and may be the basis for test questions.

b) Problem sets should be typed, where possible. Answers involving computations should state the relevant formulas, and give a complete and clear series of steps used to arrive at the answer, which should be clearly indicated. Answers to questions should be in narrative form, using complete sentences where appropriate, with proper spelling and grammar. All terms and abbreviations should be defined. All relevant information should be included. Proper scientific terminology should be used. The answers as well as the steps taken to arrive at them should be clear on the first reading. Numerical quantities must indicate the units where appropriate. All answers are to be circled. Problem sets will be graded both on technical content and clarity of presentation.

c) All homework assignments must be completed. Assignments are due in class on the due date (typically one week after the assignment is given). Late assignments will be penalized 10% per day. The maximum penalty (after one week), will be 50%. After that time, the student is to turn in the homework or receive a 0% for that assignment.

d) Homework problems will be graded on either a correct or incorrect basis with partial credit. Questions completed correctly will be awarded an appropriate number of points. Assignments will typically include several multi-part questions. Students are encouraged to write out the

assigned questions. At the discretion of the instructor, solutions, which are given without an explanation of the solution method, may be marked as wrong regardless of correctness. The student is encouraged to carry units along with the solution of the problem, and provide a neat easy to follow answer. Homework which is too difficult to follow will be returned with a zero grade until completed in an acceptable fashion.

2) There will be one exam total (1 midterm). The exam will be delivered in early-October.

a) Test will cover topics on homework, lectures, and assigned reading. .

b) The exam will be worth 25% of the final class grade.

c) At the discretion of the instructor, any evidence of dishonesty are grounds for failing tests or examinations, and subject to other university disciplinary actions.

3) Participation/Discussion

a) Each class a brief overview will be presented by a student

b) Class participation and discussion is encouraged during class (especially for exercises) and will account for 25% of the final grade

4) Final Group Paper/Project

a) Details are provided in a separate document

b) The report/presentation will be due the last week of classes.

c) The project will be worth 25% of the final class grade.

You are expected to participate actively in the class with appropriate questions or comments. You are also encouraged to keep up with the reading assignments and homework. I encourage you to participate actively in the class with appropriate questions or comments.

Don't hesitate to seek help if you have any questions about the material, the course in general, your grades, etc. Your job as a student is to learn as much as possible from this course. My job is to help you in that pursuit!

Final Class Grade

a) Grades will be based on:

Homework/Assignments	25%
Participation/Discussion	25%
Exam	25%
Final Group Project	25%

b) Tentatively, grades will be earned based on a straight scale grading policy:

$\geq 98\%$ .....A+
$\geq 93\%$ .....A
$\geq 90\%$ .....A-
$\geq 88\%$ .....B+
$\geq 83\%$ .....B
$\geq 80\%$ .....B-
$\geq 78\%$ .....C+
$\geq 73\%$ C
$\geq 70\%$ .....C-

≥ 60% .....D
< 60% .....F

c) The instructor reserves the right to change the grading scale, and assignment weighing. Such changes will be:

i) based on professional judgment

ii) applied across the board to all students

iii) in favor of the students

For the purpose of final grading, fractions of a percentage will not be rounded up.

Example: Penny scores 80.5, 75.2, and 90.7 respectively on her three examinations and 92.5 for her homework. Her grade is computed as (80.5+75.2+90.7+92.5) x 0.25 = 84.725 = 84% i.e. Grade B.

Graduate and undergraduate students will take the course together, however assessment will differ in the following ways:

1. **Graduate students will have to answer additional questions on the exam. Undergraduate students will have the opportunity to answer the graduate student questions for extra credit.**
2. **Graduate students will be required to take a leading role in the final group project/paper and will be assessed on their leadership and organizational skills.**
3. **Graduate students will have to submit a longer, more detailed final group project/paper.**
4. **Assignments will be divided between undergraduate and graduate students. Graduate students will have to answer more questions and the level of detail in the answers will be assessed to a higher standard.**

Disabilities

Our program is committed to all students achieving their potential. If you have a disability or think you have a disability (physical, learning disability, hearing, vision, psychiatric), which may need a reasonable accommodation, please contact the Disability Resource Center and notify the instructor.

Disability Resource Center
Young Hall, Room 830
155 South Grant Street
West Lafayette, IN 47907-2050
765-494-1247 for appointments
https://www.purdue.edu/drc/

Mental Health Well-being

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765) 494-6995 and http://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or through its counselors physically located in the Purdue University Student Health Center (PUSH) during business hours.

Course Webpage

https://mycourses.purdue.edu

All course related materials and announcements are available on the Blackboard course webpage listed above. Lectures and assignments (when applicable) can be downloaded each day before class. Please speak with the instructor if you are not familiar with the Blackboard platform.

Attendance and Classroom Policies

Lectures are scheduled for Tuesdays and Thursdays from 3:00-4:15 pm in PHYS 111. Attendance is strongly encouraged but not required. Skipping lectures and/or not reading assignments may have a negative impact on your final grade. As per the attendance sections of the Purdue University student regulations:

> "The University expects that students will attend classes for which they are registered. At times, however, either anticipated or unanticipated absences can occur. The student bears the responsibility of informing the instructor in a timely fashion, when possible. The instructor bears the responsibility of trying to accommodate the student either by excusing the student or allowing the student to make up work, when possible. The University expects both students and their instructors to approach problems with class attendance in a manner that is reasonable."

No video-recording will be allowed. Cell phones shall be turned off during the lectures and exams.

Emergency contingency plans: In the event of a major campus emergency (or adverse winter weather event), course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Any information about such changes in this course will be available using the instructor's email and/o phone numbers (on front page) or the class website

Attached to the syllabus is an "Emergency Preparedness for Classrooms" sheet that provides additional preparedness information. Please review the sheet and the Emergency Preparedness website for additional emergency preparedness information.

Academic Dishonesty Policy

Ethics is an important issue in any walk of life. The professions of Health Physics and Medical Physics, Nuclear Engineering, Public Policy, and indeed every profession, demand high ethical standards of its constituents. This is because ethics applied by an occupational or environmental health professional can determine the length and quality of life enjoyed by those individuals and groups that they encounter, assess, and protect. Just as many professions have Codes of Ethics, you, as students have a Code of Ethics, or Honor Code at Purdue (see below). The instructor looks forward to a class with the characteristics of high ethical standards and enthusiastic interest in the material.

Incidents of academic misconduct in this course will be addressed by the course instructor and referred to the Office of Student Rights and Responsibilities (OSRR) for review at the university level. Any violation of course policies as it relates to academic integrity will result minimally in a failing or zero grade for that particular assignment, and at the instructor's discretion may result in a failing grade for the course. In addition, all incidents of academic misconduct will be forwarded to OSRR, where university penalties, including removal from the university, may be considered.

Academic Integrity: Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

Academic and personal misconduct by students in this class are defined and dealt with according to the procedures in the Regulations Governing Student Conduct, Disciplinary Proceedings, and Appeals (http://www.purdue.edu/studentregulations/student_conduct/regulations.html).

Purdue Honors Pledge

"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

Student Course Evaluation

Student course evaluations will be conducted in a manner that maintains the integrity of the process and the anonymity of respondents. The instructors would welcome thoughtful, yet critical review, with as much detail as possible. Since access to any evaluation is not available to the instructors until after grades have posted, we would ask that as specific examples or suggestions be provided.

Course Schedule

Note: The listed schedule is tentative and it may be necessary to adjust the schedule forward or backward, depending on progression through the material. In addition, the instructor travels from time to time to participate in professional meetings and conferences, so class cancelations are possible. You will be reminded of changes via Blackboard. See attached Lecture Schedule (spreadsheet) for class dates, lecture content, and assignments.

Text

Required Texts:

None

Recommended References:

1. Doyle, James E. (editor), Nuclear Safeguards, Security and Nonproliferation, Elsevier Publishers, USA, 2008.

2. International Atomic Energy Agency, The Physical Protection of Nuclear Material and Nuclear Facilities, INFCIRC/225 Rev. 4 (corrected), Vienna (1980). (Available at http://www.iaea.org/Publications/ Documents/Infcircs/1999/infcirc225r4c/rev4_content.html.)
3. International Atomic Energy Agency, Amendment to the Convention on the Physical Protection of Nuclear Material, IAEA International Law Series No. 2, Vienna (2006). (Available at http://wwwpub. iaea.org/MTCD/publications/PDF/Pub1275_web.pdf.)
4. International Atomic Energy Agency, Code of Conduct on the Safety and Security of Radioactive Sources, Vienna (2004). (Available at http://www-ns.iaea.org/tech-areas/radiation-safety/codeofconduct.htm.)
5. International Atomic Energy Agency, Nuclear Security Series No. 7: Nuclear Security Culture. http://wwwpub. iaea.org/books/IAEABooks/7977/Nuclear-Security-Culture, Vienna (2008).
6. World Institute for Nuclear Security, WINS International Best Practice Guide 1.4 – Nuclear Security Culture, Rev. 3. 2016.
7. Readings (papers, reports, etc.) will be distributed throughout the semester.

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LECTURE SCHEDULE

The date assigned to a particular topic may change due to unanticipated scheduling conflicts. This schedule should be considered tentative.

Week	Class Dates	Subject:
1	August 22 August 24	**Course Introduction, Basic Nuclear Physics** **Basic Nuclear Physics, cont.**
2	August 29 August 31	**Nuclear Fuel Cycle** **Introduction to Nuclear Security (NS)**
3	September 5 September 7	**Professor Aaron Hoffman, Purdue – Terrorism** **Professor Keith Shimko, Purdue – History of Proliferation**
4	September 12 September 14	**Interrelationship between safety, security, and safeguards** **N3S In-class activity**
5	September 19 September 21	**Legal framework for NS** **Nuclear threat by non-State actors**
6	September 26 September 28	**Counterterrorism** **Security - Country group report**
7	October 3 October 5	**CBRN weapons** **CBRN weapons**
8	October 10 October 12	**October Break – NO CLASS** **Basic elements of NS**
9	October 17 October 19	**Professor Harris away – NO CLASS** **Planning nuclear security at the State level**
10	October 24 October 26	**Professor Edward Waller, UOIT – Physical Protection Design** **Planning nuclear security at the Facility level**
11	October 31 November 2	**Detection and Response** **Detection and Response**
12	November 7 November 9	**Professor Craig Marianno, TAMU – Emergency Response** **Emergency Response**
13	November 14 November 16	**Information security** **Nuclear cyber security**
14	November 21 November 23	**NO CLASS** **Thanksgiving – NO CLASS**
15	November 28 November 30	**Security Culture** **Security Culture**
16	December 5 December 7	**Alternative Technologies** **Final Project presentations**
17	December 12	**Finals Week**

EMERGENCY PREPAREDNESS SYLLABUS ATTACHMENT

EMERGENCY NOTIFICATION PROCEDURES are based on a simple concept – if you hear a fire alarm inside, proceed outside. If you hear a siren outside, proceed inside.

- **Indoor Fire Alarms** mean to stop class or research and immediately **evacuate** the building.
  - Proceed to your Emergency Assembly Area away from building doors. **Remain outside** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.
- **All Hazards Outdoor Emergency Warning Sirens** mean to immediately seek shelter **(Shelter in Place)** in a safe location within the closest building.
  - "Shelter in place" means seeking immediate shelter inside a building or University residence. This course of action may need to be taken during a tornado, a civil disturbance including a shooting or release of hazardous materials in the outside air. Once safely inside, find out more details about the emergency*. **Remain in place** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.

**In both cases, you should seek additional clarifying information by all means possible…Purdue Emergency Status page, text message, Twitter, Desktop Alert, Alertus Beacon, digital signs, email alert, TV, radio, etc…review the Purdue Emergency Warning Notification System multi-communication layers at http://www.purdue.edu/ehps/emergency_preparedness/warning-system.html*

EMERGENCY RESPONSE PROCEDURES:

- Review the **Emergency Procedures Guidelines** https://www.purdue.edu/emergency_preparedness/flipchart/index.html
- Review the **Building Emergency Plan** (available on the Emergency Preparedness website or from the building deputy) for:
  - evacuation routes, exit points, and emergency assembly area
  - when and how to evacuate the building.
  - shelter in place procedures and locations
  - additional building specific procedures and requirements.

EMERGENCY PREPAREDNESS AWARENESS VIDEOS

- "Shots Fired on Campus: When Lightning Strikes," is a 20-minute active shooter awareness video that illustrates what to look for and how to prepare and react to this type of incident. See: http://www.purdue.edu/securePurdue/news/2010/emergency-preparedness-shots-fired-on-campus-video.cfm (Link is also located on the EP website)

MORE INFORMATION

Reference the Emergency Preparedness web site for additional information: https://www.purdue.edu/ehps/emergency_preparedness/