

University of Michigan – Department of Nuclear Engineering and Radiological Sciences
NERS 590 - Nuclear Safeguards

3 credit-hours

Course Description

The course will include a description of the history of nuclear safeguards methods, international safeguards policy, and techniques and currently used neutron and gamma ray measurement systems in the areas of nuclear material safeguards.

The students enrolled in the course will attend weekly lectures at UM, taught by UM faculty and invited guest speakers. Then, they will take part in the week-long training offered at the Safeguards Laboratory (SL) at Oak Ridge National Laboratory (ORNL). This training provides hands-on testing, evaluation, and validation of radiation measurement equipment, as well as training for integrated safeguards methods, procedures, and instrumentation. The SL is a National User Facility open to everyone: U. S. Citizens and foreign guests. Through the training at the SL, UM students will have the opportunity to interact with staff that includes internationally recognized nuclear engineers, certified health physicists, nondestructive analysis experts, and international safeguards experts. The experience will include experiments with fissile material. Funding for this trip has been secured to cover travel, lodging, and meal expenses for each student. Group travel to and from ORNL will be organized. Tentative dates for the Fall 09 trip are November 1 – 7.

Upon returning to UM, the students will be required to prepare a report and give an oral presentation (in groups) detailing their experience at the SL of ORNL.

Pending final approval, the course will be counted as a laboratory course for UM graduate students. Students should make arrangements with other instructors to obtain permission for the one-week absence from UM.

15 students

Course Topics

- History of nuclear safeguards
- General techniques in nondestructive assay
- Nuclear materials - overview
- International safeguards policy
- Typical safeguards instruments (neutron and gamma ray detection systems)
- Data analysis

ORNL syllabus

- NPT and global nuclear nonproliferation regime
- International Safeguards and overview of safeguards instrumentation
- Basics of NDA
- Detection and characterization of nuclear materials
- Uranium enrichment measurements
- Laboratory exercises
 - a. Handheld gamma-ray detectors
 - b. Uranium enrichment measurements
 - c. Neutron measurements (Active Well Coincidence Counter (AWCC))

Topics by Day (preliminary)

1. Monday

- a. Introductions / Safety
- b. International Nuclear Weapon Nonproliferation Regime/International Safeguards
- c. Basics of NDA
- d. Uranium Enrichment Measurement Methods and Software
- e. Uranium Enrichment and Handheld Instrumentation Exercises

2. Tuesday

- a. Holdup Lectures and Demonstrations
- b. Holdup Calibrations
- c. Tour

3. Wednesday

- a. Holdup Measurement Exercises
- b. Tour

4. Thursday

- a. Neutron Detection/AWCC Lectures
- b. AWCC Exercises
- c. Tour

5. Friday

- a. In-situ Object Characterization (ISOCS) Lecture
- b. ISOCS Measurement Exercises