COURSE SYLLABUS

Radiological Monitoring & Protection

RW 214-01

Arts & Sciences
New Mexico Junior College
5317 Lovington Highway
Hobbs, New Mexico 88260
1. General Course Information

   a. Course Title: Radiological Monitoring & Protection
   b. Course Number: RW 214-01
   c. Semester/year: Fall/2003
   d. Credit Hours: 4 Hours
   e. Instructor: Olav Amundsen
   f. Office Phone: 505 392 5335 ext 265
   g. Office Hours: by appointment
   h. Prerequisite: RW-123, or by consent of instructor

2. Course Description

   In this course, students will be introduced to contamination control and monitoring in the radiological work setting. This course covers contamination control, airborne sampling, respiratory protection, radioactive source control, environmental monitoring, access control, work area setup, and radiological work coverage. The proper handling of radioactive materials on a daily basis is a key element of the course. Three lecture hours per week.

3. Course Rationale/Transferability

   This course is an undergraduate level course designed to introduce the student to hands on protection and monitoring utilizing protection and monitoring equipment. This course has no guarantee of transferability to other New Mexico Schools or out-of-state institutions. Students are advised to check with the receiving institutions if they intend to transfer to another institution.

4. Required/Suggested Course Materials


   Other material listed with each module under section 7- Specific Course Objectives/Competencies within this document.
5. **Grading Policy**

Each student is evaluated by homework assignment/pop quizzes, written examinations, reports and projects. Final grades will be determined by averaging three graded areas based on the following scale. A grade of 80% or better is necessary for certification.

- Written Examinations: 40% of overall grade
- Homework / Pop Quizzes: 50% of overall grade
- Final Exam: 10% of overall grade

Upon completion of the afore mentioned averaging grades will be administered as follows:

- A = 90-100
- B = 80-89
- C = 70-79
- D = 60-69
- F = 59-00

6. **General Course Objectives/Competencies**

This course is an undergraduate level course designed to further enhance the skills of the student in a more practical setting. The importance of monitoring and protection is the essential factor in handling radioactive materials. The course is divided into seven modules. These modules focus on (1) contamination control, (2) airborne sampling, (3) respiratory protection, (4) radioactive source control, (5) environmental monitoring, (6) access control and work area setup and (7) radiological work coverage. The course will prepare the students for more site specific academic training. The course will include a field trip to an institution with radioactive sources. The course focuses more on practical matters and not so much on physical science.
7. Specific Course Objectives/Competencies

Course Title: Radiological Monitoring & Protection
Module Title: Contamination Control
Module Number: 2.05

Objectives:

2.05.01 Define the terms "removable and fixed surface contamination," state the difference between them and list common methods used to measure each.

2.05.02 State the components of a radiological monitoring program for contamination control and common methods used to accomplish them.

2.05.03 State the basic goal of a contamination control program and list actions that contribute to its success.

2.05.04 State the basic principles of contamination control and list examples of implementation methods.

2.05.05 List and describe the possible engineering control methods used for contamination control.

2.05.06 State the purpose of using protective clothing in contamination areas.

2.05.07 List the basic factors which determine protective clothing requirements for personnel protection.

References:

3. 10 CFR 835

Instructional Aids:

3. Overheads
4. Overhead projector/screen
5. Chalkboard/whiteboard
6. Lessons learned
Course Title: Radiological Monitoring & Protection
Module Title: Air Sampling Program/Methods
Module Number: 2.06

Objectives:

2.06.01 State the primary objectives of an air monitoring program.

2.06.02 Describe the three physical states of airborne radioactive contaminants.

2.06.03 List and describe the primary considerations to ensure a representative air sample is obtained.

2.06.04 Define the term "isokinetic sampling" as associated with airborne radioactivity sampling.

2.06.05 Identify the six general methods for obtaining samples or measurements of airborne radioactivity concentrations and describe the principle of operation for each method.
   a. Filtration
   b. Volumetric
   c. Impaction/impingement
   d. Adsorption
   e. Condensation/dehumidification
   f. In-line/flow-through detection

2.06.06 Describe the general considerations for selection of an air monitoring method.

2.06.07 State the purpose of the five primary types of airborne radioactivity samplers/monitors:
   a. Personal air samplers (breathing zone)
   b. High volume/flow rate air samplers
   c. Low volume/flow rate air samplers
   d. Portable continuous air monitors
   e. Installed continuous air monitoring systems

2.06.08 List the factors that affect the accuracy of airborne radioactivity measurements and describe how these factors affect sample accuracy.

2.06.09 Describe the site air monitoring program that includes monitoring frequencies, calculational methods, applicable derived air concentration limits, and methods for determining radon interference.

References:

1. Air Sampling/Survey Methods, General Physics Corp., Lesson 1003.

**Instructional Aids:**

7. Overhead projector/screen
8. Chalkboard
9. Whiteboard
4. Lessons learned

Course Title: Radiological Monitoring & Protection
Module Title: Respiratory Protection
Module Number: 2.07

Objectives:

2.07.01 Explain the purpose of respiratory protection standards and regulations.

2.07.02 Identify the OSHA, ANSI, and DOE respiratory protection program requirements.

2.07.03 Identify the standards which regulate respiratory protection.

2.07.04 Describe the advantages and disadvantages (limitations) of each of the following respirators:
   a. Air purifying, particulate removing filter respirators
   b. Air purifying, Chemical Cartridge and Canister respirators for Gases and Vapors
   c. Full-face, supplied-air respirators
   d. Self-contained breathing apparatus (SCBA)
   e. Combination atmosphere supplying respirators

2.07.05 Define the term protection factor (PF).

2.07.06 State the difference between a qualitative and quantitative fit test.

2.07.07 State the recommended physical functions the subject must perform during a respirator fit test.

2.07.08 State how the term protection factor (PF) is applied to the selection of respiratory protection equipment.

2.07.09 State the general considerations and considerations for the nature of the hazard when selecting the proper respiratory protection equipment.

2.07.10 Identify the types of respiratory equipment available for use at your site.

2.07.11 Identify the quality specification breathing air must meet.

References:

5. "Limits for Inhalation of Radon Daughters by Workers", ICRP Publication 32.
14. ANSI Z88.2-1992
15. CGA G7.1-1989

Instructional Aids:

10. Overhead projector and screen
11. Chalkboard
12. Markerboard
4. Lessons learned

Course Title: Radiological Monitoring & Protection
Module Title: Radioactive Source Control
Module Number: 2.08

Objectives:

2.08.01 Describe the requirements for radioactive sources per 10 CFR 835.
2.08.02 Identify the characteristics of radioactive sources that must be controlled at your site.
2.08.03 Identify the packaging, marking, and labeling requirements for radioactive sources.
2.08.04 Describe the approval and posting requirements for radioactive materials areas.
2.08.05 Describe the process and procedures used at your site for storage and accountability of radioactive sources.

References:


Instructional Aids:

1. Overheads
2. Overhead projector and screen
3. Chalkboard/whiteboard
4. Lessons learned
Module Title: Environmental Monitoring
Module Number: 2.09

Objectives:

2.09.01 State the goals of an environmental monitoring program.

2.09.02 State the exposure limits to the general public as they apply to environmental monitoring.

2.09.03 Define the term "critical nuclide."

2.09.04 Define the term "critical pathway."

2.09.05 State locations frequently surveyed for radiological contamination at outdoor waste sites associated with your site and the reasons for each.

2.09.06 Define the term "suspect waste site," and how they can be identified.

2.09.07 Describe the methods used for environmental monitoring at your site.

References:

3. DOE Order 5400.5.
5. 40 CFR 141 (Safe Drinking Water Act).

Instructional Aids:

13. Overheads
14. Overhead projector/screen
15. Chalkboard/whiteboard
16. Lessons learned
Course Title: Radiological Monitoring & Protection
Module Title: Access Control and Work Area Setup
Module Number: 2.10

Objectives:

2.10.01 State the purpose of and information found on a Radiological Work Permit (RWP) including the different classifications at your site.

2.10.02 State responsibilities in using or initiating a RWP.

2.10.03 State the document that governs the ALARA program at your site.

2.10.04 Describe how exposure/performance goals are established at your site.

2.10.05 State the conditions under which a pre-job ALARA review is required at your site.

2.10.06 State the conditions under which a post-job ALARA review is required at your site.

2.10.07 State purpose of radiological postings, signs, labels, and barricades; and the RCTs responsibilities for them.

2.10.08 Identify the following radiological postings at your site, requirements for posting/barriers, and requirements for entry:

   a. Radiological Buffer Area
   b. Radiation Area
   c. High Radiation Area
   d. Very High Radiation Area
   e. Hot Spot
   f. Contamination Area
   g. High Contamination Area
   h. Airborne Radioactivity Area
   i. Fixed Surface Contamination
   j. Soil Contamination
   k. Radioactive Material Area
   l. Underground Radioactive Material Area

2.10.09 Describe good practices, support equipment to use, and common discrepancies in setting up radiological areas.

2.10.10 List discrepancies frequently observed in containment devices.

2.10.11 Describe good practices in setting up portable ventilation systems and count rate meters.

2.10.12 List the requirements individuals should follow while working in RBAs.

2.10.13 State the requirements for removing or releasing materials from any radiological area.
References:

2. DOE Radiological Control Standard (1998)

Instructional Aids:

1. Overheads
2. Overhead projector/screen
3. Chalkboard/whiteboard
4. Lessons learned
Course Title: Radiological Monitoring & Protection
Module Title: Radiological Work Coverage
Module Number: 2.11

Objectives:

2.11.01 List four purposes of job coverage.

2.11.02 Explain the differences between continuous and intermittent job coverage.

2.11.03 Given example conditions, identify those that should require job coverage.

2.11.04 Identify items that should be considered in planning job coverage.

2.11.05 Identify examples of information that should be discussed with workers during pre-job briefings.

2.11.06 Describe exposure control techniques that can be used to control worker and technician radiation exposures.

2.11.07 Describe the in-progress radiological surveys that should be performed, at your site, under various radiological conditions.

2.11.08 Describe site requirements for documentation of in-progress radiological surveys.

2.11.09 Explain actions that should be taken if surveys show radiological conditions significantly different from that expected.

2.11.10 Describe contamination control techniques that can be used to limit or prevent personnel and area contamination and/or reduce radioactive waste generation.

2.11.11 Describe job coverage techniques that can be used to prevent or limit the spread of airborne radioactive material.

2.11.12 Describe overall job control techniques in maintaining control of radiological work.

2.11.13 State the reasons to stop radiological work activities in accordance with the DOE RCS.

References:

1. DOE Radiological Control Standard (1998)

Instructional Aids:

1. Overheads
2. Overhead projector/screen
3. Whiteboard/chalkboard
4. Lessons learned

8. General/Miscellaneous
See attached General Information Sheet / Institutional Page

9. **Critical Incident and Evacuation Plan with Evacuation Route Map**

See attached; New Mexico Junior College Emergency/Critical Incident Information sheet and campus map.

10. **Course Outline**

   a. **Class Dates**
      
      To be arranged

   b. **Instructional Aids:**
      
      1. Overheads
      2. Overhead projector/screen
      3. Chalkboard/whiteboard
      4. Computer Lab

   c. **Examinations**

      In addition to the final exam, a minimum of one exam for each module will be administered during the semester. The test date and specific course material covered by the exam will be announced during class by the instructor at the start of each module. Examinations must be taken at the scheduled time. If a student is aware that she/he will not be able to take the exam at the scheduled time, then prior to the exam date he/she must reschedule a special examination with the professor. Any other absences from examination will be retaken only if the professor decides it was a valid excuse, otherwise, a grade of “0” will be recorded.

   d. **Late Papers, Homework or Projects**

      Five points per day will be deducted from the grade for late work. Possible field trips associated with class projects will be announced and scheduled as early as practical.

   e. **Tardiness**

      Students are expected to be seated at the time each lecture is scheduled to begin.

   f. **Withdrawal**

      You may officially withdraw from this class on or before the end of the class with a grade of “W”. Last date of withdrawal will be posted by instructor at the beginning of the class.

   g. **Audits**
No student may “audit” the class after having signed up for credit. In other words, you may not change from credit status to audit status once the course has commenced.

**h. Attendance**

Students are not required to attend lectures, but will have to take all exams and deliver all homework.