COWLEY COLLEGE
& Area Vocational Technical School

COURSE PROCEDURE FOR

RADIATION SAFETY
NDT3456 3 Credit Hours

Student Level:
This course is open to students on the college level in either the freshman or sophomore year and to high school vocational students.

Catalog Description:

NDT 3456 - RADIATION SAFETY (3 hrs)
This course is designed to give the student complete instruction in working safely with gamma and x-radiography. The course meets requirements set forth by the NRC and the State of Kansas.

Prerequisites:
NDT3451 Introduction to Nondestructive Testing or instructor approval.

Controlling Purpose:
This course is designed to impart the understanding of radiation interaction with matter. The focus will be on the interaction of radiation with human tissue. Public and work place safety will be continuously emphasized.

Learner Outcomes:
Upon completion of this course the student will be able to:

1. Calculate the dosage of radiation received at a given location.
2. Calculate shielding of X and gamma rays.
3. State the effects of radiation on man.
4. List the regulation agencies.
5. Be aware of action taken in a radiation accident.
6. Take and pass (80%) a radiation safety examination similar to national certification examinations.
7. Correctly apply safety attitudes and procedures associated with radiographic testing that will insure a safe work place environment.

The learning outcomes and competencies detailed in this course outline or syllabus meet or exceed the learning outcomes and competencies specified by the Kansas Core Outcomes Groups project for this course as approved by the Kansas Board of Regents.

Units Outcomes and Criterion Based Evaluation Key for Core Content:

The following defines the minimum core content not including the final examination period. Instructors may add other content as time allows.

Evaluation Key:

A = All major and minor goals have been achieved and the achievement level is considerably above the minimum required for doing more advanced work in the same field.

B = All major goals have been achieved, but the student has failed to achieve some of the less important goals. However, the student has progressed to the point where the goals of work at the next level can be easily achieved.

C = All major goals have been achieved, but many of the minor goals have not been achieved. In this grade range, the minimum level of proficiency represents a person who has achieved the major goals to the minimum amount of preparation necessary for taking more advanced work in the same field, but without any major handicap of inadequacy in his background.

D = A few of the major goals have been achieved, but the student's achievement is so limited that he is not well prepared to work at a more advanced level in the same field.

F = Failing, will be computed in GPA and hours attempted.

N = No instruction or training in this area.

UNIT 1: Why Is Safety Important

Outcomes: Upon completion of this unit, the student will be able to successfully state the value of safety in radiography.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Explain the need for safety in the workplace. List and describe radiation accidents and the results.
						Site two examples of radiation accidents before 1900.
						Understand the concept of ALARA.

UNIT 2: Properties Of Matter

Outcomes: Upon completion of this unit, the student will be able to successfully apply the properties of matter to radiation safety.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Explain electromagnetic radiation interactions with parts of the atom.
						Explain how electromagnetic radiation interacts with human cells.
						Differentiate between particle and electromagnetic radiation effect on tissue

UNIT 3: Interaction Of Radiation With Matter

Outcomes: Upon completion of this unit, the student will be able to successfully list and describe the interactions of radiation with humans and with metals.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Illustrate two examples of electromagnetic radiation man is exposed to (two types of background radiation).
						Explain how electromagnetic radiation interacts with metals to produce a radiograph.
						Explain the concept of ionization in man and metals. Explain how ionization is different in man than metal.
						Explain how electromagnetic radiation interacts in the human body, and describe the changes it causes.

UNIT 4: Biological Effects Of Radiation

Outcomes: Upon completion of this unit, the student will be able to successfully describe biological effects of radiation.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						List and describe the two categories of radiation effects (prompt and delayed).
						Compare the differences of particle and electromagnetic radiation damage on workers.
						List State requirements (quarterly/yearly) for radiation dose limits for workers.
						Predict the amount of damage to a worker if exposed to over 500, 1000, and 3000 rem of radiation received at varying time intervals.

UNIT 5: Controlling Personal Exposure Through Time & Distance

Outcomes: Upon completion of this unit, the student will be able to successfully calculate safe boundary sites using time and distance.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Calculate boundary areas for workers. 5mr/h area
						Calculate boundary areas for the general public. 2mr/h area
						Calculate the amount of time workers could remain in an area with a given intensity of radiation present.
						Calculate the distance necessary to reduce a given amount of radiation to a safe level for workers.
						Combine calculations for a given source strength, and distance, to determine the amount of time possible for workers to remain in a given area.
						Given a curie strength new and age now for iridium and cobalt determine the dose rate at one foot and three given distances from each source.

UNIT 6: Controlling Personal Exposure Through Shielding

Outcomes: Upon completion of this unit, the student will be able to successfully state the uses of shielding in radiography.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						List and describe reduction factors (HVL and TVL) of industrial materials such as tungsten, lead, concrete, steel.
						Given a specific source and shielding material, calculate the amount of shielding necessary to reduce radiation to a safe level.
						Calculate the reduction that a calumniator with a given reduction value (HVL) would provide.
						Perform calculations to determine curie strength now, and dose on the back side of a given shielding when a radiographer is present for a given time.
						Determine the amount of shielding necessary to reduce radiation to 1/2 or 1/10 the initial level.

UNIT 7: Monitoring Devices For Radiography

Outcomes: Upon completion of this unit, the student will be able to successfully list and describe the uses of monitoring devices.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Demonstrate correct use of a survey meter. List and describe the State and Federal requirements for survey meter calibration. List and describe the settings, and range of a survey meter.
						List and describe the differences in the workings of a film badge and a TLD. List and explain the records and forms that are maintained with a TLD or film badge.
						Diagram and explain the workings of a pocket dosimeter, and an alarm rate meter. State the requirements for record keeping and calibration of the dosimeter and alarm rate meter. Demonstrate correct charging of a dosimeter.
						List and describe the terms used in measuring radiation. Roentgen, Milliroentgen, Gray Sievert, Curie, Bacquerel, REM, RAD. Perform calculations converting English readings to the SI units.

UNIT 8: Why Accidents Happen

Outcomes: Upon completion of this unit, the student will be able to successfully explain the causes of accidents in radiography.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Explain the primary reason accidents happen and what can be done to avoid them.
						List and describe two accidents and the resulting injuries to radiographers.
						Explain the dosages (amount and how soon) when the State or NRC must be notified (number of REM) if a worker is exposed to excessive radiation.
						State the requirements for a company to notify workers when an excess dose has been received.

UNIT 9: What To Do In An Accident

Outcomes: Upon completion of this unit, the student will be able to successfully state what is to be done when an accident has happened.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Apply safety training quickly and effectively to control an area where there is a "source out" condition.
						Demonstrate the ability to calculate dosage received when a source of a given strength has become disconnected in the guide tube. Students simulate a recovery and reconnect to understand what is required of a retrieval team.
						Explain the dosages (amount and how soon) when the State or NRC must be notified (number of REM) if a worker is exposed to excessive radiation.

UNIT 10: Regulating Agencies

Outcomes: Upon completion of this unit, the student will be able to successfully list and describe the duties of regulation agencies.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Differentiate between State and National agency requirements.
						List the agency and one person in the State of Kansas radiation control agency. List and compare the areas in 10 CFR (19-20-34) to requirements for the State of Kansas.
						Locate the State and Federal regulations that pertain to radiation safety on the internet.
						Demonstrate the ability by passing (90-100%) a practical test designed to meet state requirements for safe operation of the x-ray systems used at the college.

Projects Required:

As assigned

Textbook:

Contact Bookstore for current textbook.

Materials/Equipment Required:

None

Attendance Policy:
Students should adhere to the attendance policy outlined by the instructor in the course syllabus.

Grading Policy:
The grading policy will be outlined by the instructor in the course syllabus.

Maximum class size:
Based on classroom occupancy

Course Timeframe:
The U.S. Department of Education, Higher Learning Commission and the Kansas Board of Regents define credit hour and have specific regulations that the college must follow when developing, teaching and assessing the educational aspects of the college. A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work for approximately fifteen weeks for one semester hour of credit or an equivalent amount of work over a different amount of time. The number of semester hours of credit allowed for each distance education or blended hybrid courses shall be assigned by the college based on the amount of time needed to achieve the same course outcomes in a purely face-to-face format.

Refer to the following policies:

402.00 Academic Code of Conduct
263.00 Student Appeal of Course Grades
403.00 Student Code of Conduct

Disability Services Program:
Cowley College, in recognition of state and federal laws, will accommodate a student with a documented disability. If a student has a disability, which may impact work in this class which requires accommodations, contact the Disability Services Coordinator.