



Radiation Safety Officer Training

24-Hours

SYLLABUS

PRESENTED BY:

Applied Environmental Consulting, Inc.

COURSE OVERVIEW

- History of Radiation
- Fundamentals of Radiation
- Radioactivity Measurements
- Half-Life
- Interaction with Matter and Biological Effects
- Dose and Dose Risks
- Radiation Protection Techniques
- Radiation Detection and Instrumentation
- Regulatory Authorities
- Ensuring Compliance
- Radiation Safety Officer Duties
- Use and limitations of the Radiation Work Permit (RWP)

MATH REVIEW

- How to use the Math Primer
- Basic Math
- Algebra Review
- Scientific Notation
- Exponents and Logarithms
- Using Your Calculator
- Radiation Math
- Radioactivity
- Half-Life
- Time, Distance and Shielding
- Radiation Work Permit (RWP)



LESSON 1: HISTORY OF RADIATION DISCOVERY, HISTORICAL EVENTS & EMERGENCE OF REGULATORY AGENCIES

TOPIC 1	The Beginning
TOPIC 2	Discovery of Radiation Henri Becquerel Wilhelm Roentgen Madam Curie (Plus others)
TOPIC 3	Development of Nuclear Technology Manhattan Project Albert Einstein Enrique Fermi Development of the Nautilus Development of the Atomic Energy Act

LESSON 2: RADIATION FUNDAMENTALS

TOPIC 1	Energy Spectrum Ionization Non-Ionizing
TOPIC 2	Atomic Structure Nuclear Proton Neutron: Extra-nuclear Electron: Classification Atomic Number Atomic Weight
TOPIC 3	Unstable Atoms & Emissions Characteristics of Radioactive Materials Unstable Detectable Spontaneous Emission Emission from nucleus of atoms Photons: Gamma Particles: Alpha, Beta, Neutron Emissions from outer shells of atoms Photons: X-ray



LESSON 3: RADIOACTIVITY AND HALF-LIFE

TOPIC 1	Units for Disintegrations Radioactivity Disintegration Disintegration per Unit Time (dps, dpm) Curie Becquerel Total Activity Specific Activity/Activity Concentration Background vs. Contamination
PRACTICAL EXERCISE: Problems	
TOPIC 2	Half-Life Carbon-14 Dating Short/Long Half-Lives Half-life Formula
PRACTICAL EXERCISE: Problems	

LESSON 4: INTERACTION OF RADIATION WITH MATTER

TOPIC 1	Energy Disposition in Air Interactions Ionizations Excitation Energy Deposition in Air Roentgen Exposure Rates
TOPIC 2	Energy Disposition in Matter RAD Gray Relative Biological Effectiveness (RBE) Linear Energy Transfer (LET)
TOPIC 3	Energy Disposition in the Body REM Sievert Dose rates
PRACTICAL EXERCISE: Problems	

LESSON 5: RADIATION IN BIOLOGY

TOPIC 1	Sources of Dose External Internal Man-made and Natural
TOPIC 2	Types of Dose Acute Fractionated Chronic
TOPIC 3	Types of Dose Effects Somatic Genetic Teratogenic
TOPIC 4	Variable in Dose Effects Amount of Dose Critical Organ Type of Radiation Individual Biological Variations Radio sensitivity and Radio resistance
TOPIC 5	Types of biological effects in The Cell Types of Biological Variations Radio sensitivity and Radio resistance
TOPIC 6	Types of Risks Definition Comparisons with other types of risks
TOPIC 7	Causes of dose Stochastic Non-Stochastic

LESSON 6: RADIATION PROTECTION

TOPIC 1	Time Principles of Exposure Control Time
PRACTICAL EXERCISE:	Problems
TOPIC 2	Distance (Inverse Square Law)



cpm vs. mR/hour
High to Low scales
End window
LAG Time (GM)
Use & Care

LESSON 8: IMPLEMENTING A RADIATION PROTECTION PROGRAM

TOPIC 1	Establish a Radiation Protection Manual (RPM)
TOPIC 2	Scope of Authorized Work
TOPIC 3	Role of Personnel <ul style="list-style-type: none">Radiation Safety Officer (RSO)Advanced Authorized User (40-hour)Authorized User (less than 40-hour, usually 8-hour)Ancillary workers
TOPIC 4	ALARA philosophy emphasized <ul style="list-style-type: none">Time, Distance and Shielding
TOPIC 5	Contamination Control <ul style="list-style-type: none">Fixed, Removable & AirborneFriskers, glovebox & step-off pads
TOPIC 6	Wearing of PPE & Personnel monitoring <ul style="list-style-type: none">Protective clothingProtective masks
TOPIC 7	Performing Personnel Monitoring
TOPIC 8	Emergencies and Spills <ul style="list-style-type: none">Major SpillsMinor Spills
TOPIC 9	Storage/Disposition of radioactive wastes
TOPIC 10	Posting and Notification
TOPIC 11	Radiation Work Permit <ul style="list-style-type: none">Tools for the RSODocuments taskCan be used in lieu of personnel badges
TOPIC 12	Record Keeping



LESSON 9: REGULATORY AUTHORITY

TOPIC 1	Regulatory Agencies (Federal) USNRC Types of radioactive materials regulated: By-Product Material Source Material (Source of SNM) Depleted uranium Special Nuclear Materials (SNM) Fissionable USEPA OSHA FDA USDOE
TOPIC 2	Non-Federal Agencies Agreement States and Licensing States Regulate: Naturally-Occurring Radioactive Materials (NORM) (to include TENORM) Naturally-Occurring and Accelerator Produced Radioactive Materials (NARM)
TOPIC 3	The Radioactive Materials License Authorized Materials Authorized Use Authorized Users CONDITIONS Location Leak Testing Surveys Inventory Training Record keeping requirements “Catch all” Condition
TOPIC 4	Role of Regulatory Agencies Issue licenses based on: ENGINEERING, TRAINING, PROCEDURES Inspections Amendments Termination REGUIDE Sealed Source and Device Registry

LESSON 10: ENSURING COMPLIANCE

TOPIC 1	Annual ALARA review
TOPIC 2	Delegation of Authority
TOPIC 3	Facilities Management <ul style="list-style-type: none">Record Keeping (Maintaining LOGBOOK)Instrument calibrationInventorySurveysTransfer/shipment documentsLeak tests (for sealed sources)
TOPIC 4	Training <ul style="list-style-type: none">Training of new personnel and refresher
TOPIC 5	Set up a Personnel Monitoring Program
TOPIC 6	Radiation Work Permit (RWP) <ul style="list-style-type: none">Pros & Cons

LESSON 11: TRANSPORTATION

TOPIC 1	Regulations <ul style="list-style-type: none">Items required to be trained in HAZMAT site specific to the facility to include: Type of packages: Type A, Type B, LSA, Strong-tight containerDefinition of PackageReportable QuantitiesBill of LadingLabels, markings and placardsExempt quantitiesReceiving/Shipping radioactive materialsOpening packagesWhat to do for damaged itemsRoles of RSO / Authorized Users
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