

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

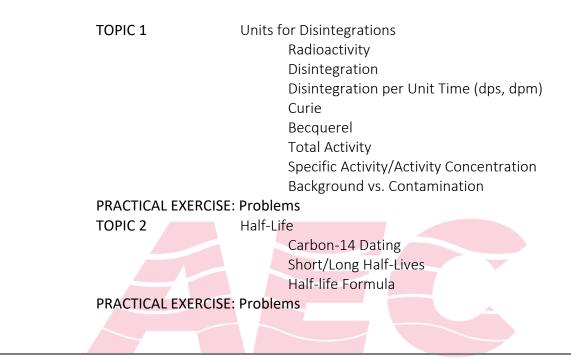
TOPIC 1	The Beginning
TOPIC 2	Discovery of Radiation
	Henri Becquerel
	Wilhelm Roentgen
	Madam Curie
	(Plus others)
TOPIC 3	Development of Nuclear Technology
	Development of Maclear Teennology
	Manhattan Project
	Manhattan Project
	Manhattan Project Albert Einstein
	Manhattan Project Albert Einstein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

LESSON 2: RADIATION FUNDAMENTALS

TOPIC 1	Energy Spectrum
	lonization
	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
	Émission 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



LESSON 4: INTERACTION OF RADIATION WITH MATTER

TODICA		
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:	Probler	ns



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)



PRACTICAL EXERCIS	SE: Problems
TOPIC 3	Shielding
	HVL and TVL
PRACTICAL EXERCIS	SE: Problems
TOPIC 4	As Low As Reasonably Achievable (ALARA)
TOPIC 5	Administrative Controls and Levels
	Administrative Controls
	Establishing administrative limits
	Engineering (Mechanical) Controls
	Signs, labels and postings
TOPIC 6	Radiation Dose Limits
	Radiation Workers
	Members of the Public (MOP) study
TOPIC 7	
TOPIC 7	Monitoring External dose
	Personnel Monitoring Devices
	OSLDs/TLDs/Film Badges
	Pocket Dosimeters
TOPIC 8	Monitoring Internal Dose
	Bioassays
	Direct and in vitro
TOPIC 9	Active Monitors (reading real time)
	Pocket Ion Chamber

LESSON 7: PORTABLE SURVEY METERS

TOPIC 1	Types
	Geiger-Mueller (GM)
	Scintillator
	Comparing instrumentation for hazards:
	BIOLOGICAL, CHEMICAL and NUCLEAR
TOPIC 2	Reading Results
	CPM vs. DPM
	Scales and displays
	Radiation Levels
TOPIC 3	Efficiency and Calibration
	Efficiency
	Calibration
TOPIC 4	Operating a Survey Meter
	Battery check/Calibration check/Check source
	Establish Background



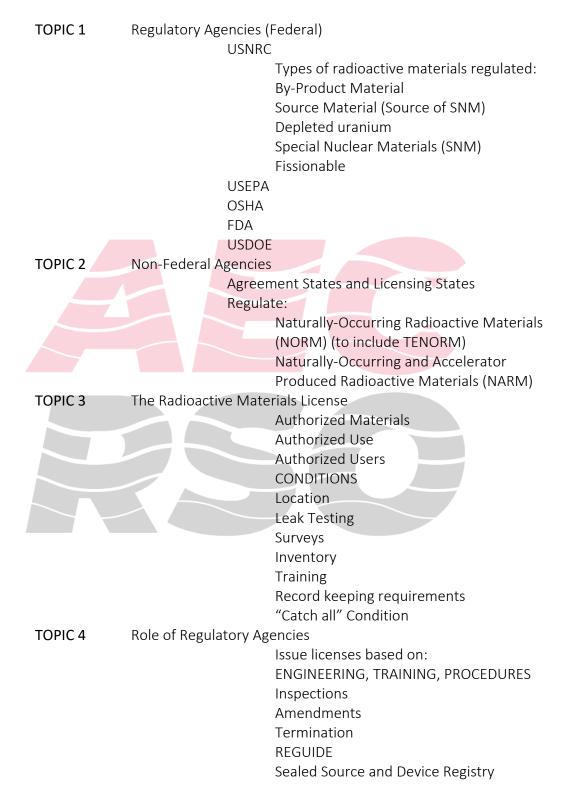
cpm vs. mR/hour High to Low scales End window LAG Time (GM) Use & Care

LESSON 8: IMPLEMENTING A RADIATION PROTECTION PROGRAM

TOPIC 1 TOPIC 2	Establish a Radiation Protection Manual (RPM) Scope of Authorized Work
TOPIC 3	Role of Personnel
	Radiation Safety Officer (RSO)
	Advanced Authorized User (40-hour)
	Authorized User (less than 40-hour, usually 8-hour)
TODICA	Ancillary workers
TOPIC 4	ALARA philosophy emphasized
TODICE	Time, Distance and Shielding
TOPIC 5	Contamination Control
	Fixed, Removable & Airborne
TODIOG	Friskers, glovebox & step-off pads
TOPIC 6	Wearing of PPE & Personnel monitoring
	Protective clothing
	Protective masks
TOPIC 7	Performing Personnel Monitoring
TOPIC 8	Emergencies and Spills
	Major Spills
	Minor Spills
TOPIC 9	Storage/Disposition of radioactive wastes
TOPIC 10	Posting and Notification
TOPIC 11	Radiation Work Permit
	Tools for the RSO
	Documents task
	Can be used in lieu of personnel badges
TOPIC 12	Record Keeping



LESSON 9: REGULATORY AUTHORITY





LESSON 10: ENSURING COMPLIANCE

TOPIC 1	Annual ALARA review	
TOPIC 2	Delegation of Authority	/
TOPIC 3	Facilities Management	
	Record Keeping	(Maintaining LOGBOOK)
	Instrument calib	pration
	Inventory	
	Surveys	
	Transfer/shipme	ent documents
	Leak tests (for s	ealed sources)
TOPIC 4	Training	
	Training of new	personnel and refresher
TOPIC 5	Set up a Personnel Mor	nitoring Program
TOPIC 6	Radiation Work Permit	(RWP)
	Pros & Cons	

LESSON 11: TRANSPORTATION

TOPIC 1	Regulations
	Items required to be trained in HAZMAT site specific to the facility
	to include: Type of packages: Type A, Type B, LSA, Strong-tight
	container
	Definition of Package
	Reportable Quantities
	Bill of Lading
	Labels, markings and placards
	Exempt quantities
	Receiving/Shipping radioactive materials
	Opening packages
	What to do for damaged items
	Roles of RSO / Authorized Users