8-Hours
Basic Radiation Protection Training for Authorized Users of Fixed and Portable Gauges

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
Role of Personnel
What are Gauges and How do they Work?
Tasks to Perform on Gauges
Radiation Work Permit (RWP) for Gauges
Radiation Safety Concerns Regarding Gauges
Record Keeping
Transporting and Shipping Gauges
Test

HISTORY OF RADIATION DISCOVERY, HISTORICAL EVENTS & EMERGENCE OF REGULATORY AGENCIES

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

RADIATION FUNDAMENTALS

- Atomic Structure
  - Nuclear
    - Proton
    - Neutron: Extra-nuclear
  - Electron: Classification
- Atomic Number
- Atomic Weight
- 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

RADIOACTIVITY AND HALF-LIFE

- Units for Disintegrations
  - Radioactivity
  - Disintegration
  - Disintegration per Unit Time (dps, dpm)
  - Curie
  - Becquerel
  - Total Activity
  - Specific Activity/Activity Concentration
- Half-Life
  - Carbon-14 Dating
  - Radioactive Decay

INTERACTION OF RADIATION WITH MATTER

- Energy Disposition in the Body
  - REM
  - Sievert
  - Dose rates
- Energy Disposition in Air
  - Interactions
  - Ionizations
  - Excitation
  - Energy Deposition in Air
  - Roentgen
  - Exposure Rates
- Energy Disposition in Matter
  - Gray
  - Relative Biological Effectiveness (RBE)
  - Linear Energy Transfer (LET)

RADIATION IN BIOLOGY

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

RADIATION PROTECTION

- Principles of Exposure Control
  - Time
  - Distance (Inverse Square Law)
  - Shielding
  - As Low As Reasonably Achievable (ALARA)

- Shielding
- Administrative Controls and Levels
  - Administrative Controls
  - Establishing administrative limits
  - Engineering (Mechanical) Controls
  - Signs, labels and postings
- Radiation Dose Limits
  - Radiation Workers
  - Members of the Public (MOP) study
- Monitoring External dose
  - Personnel Monitoring Devices
  - OSLDs/TLDs/Film Badges
  - Pocket Dosimeters
- Active Monitors (reading real time)
  - Pocket Ion Chamber

PORTABLE SURVEY METERS

- Types
  - Geiger-Mueller (GM)
  - Scintillation
  - Comparing instrumentation for hazards: BIOLOGICAL, CHEMICAL and RADIOLOGIAL
- Reading Results
  - CPM vs. DPM
  - Scales and displays
  - Radiation Levels
- Efficiency and Calibration
  - Efficiency
  - Calibration
- 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

IMPLEMENTING A RADIATION PROTECTION PROGRAM

- Establish a Radiation Protection Manual (RPM)
- Scope of Authorized Work
- Role of Personnel
  - Radiation Safety Officer (RSO)
  - Advanced Authorized User (40-hour)
  - Authorized User (less than 40-hour, usually 8-hour)
  - Ancillary workers

REGULATORY AUTHORITY

- Non-Federal Agencies
  - Agreement States and Licensing States
  - Regulate:
    - Naturally-Occurring Radioactive Materials
    - Naturally-Occurring and Accelerator Produced Radioactive Materials (NARM)
- The Radioactive Materials License
  - Specific License and General License
  - Authorized Materials
  - Inspections
- Role of Regulatory Agencies
  - Issue License
  - Inspect
  - Sealed Source and Device Registry
- ALARA Review
  - Notice To Employees
  - New Personnel and Refresher Training Requirements

FIXED AND PORTABLE DENSITY GAUGES

- Fixed Gauges
  - Parts of the Gauge
  - Operating Principle

	Types of Gauges
Portable Gauges	Types of Radiation Materials
	Concerns and Requirements
Shutter Operations	Operation
	Checks
	Lock Out/Tag Out
Gauge Condition	Categories
	Survey
	Leak Testing Procedures
Gauge Care and Maintenance	
	Confined Spaces Tasks
Personnel and Roles	
Radiation Work Permit for Gauges	
	How it is applied to gauges?
	Pros and Cons
Installation and Relocation	
	What is it?
	Who can do it?
	How, When and Who?
Transportation	Procedures
	Labels
	Overpack
	General & Specific Licensees
	Placarding
Activation Analysis	Procedures
	Cf-252 Characteristics
	Cf-252 Operating Principle

TEST 50 Questions

MATH REVIEW (Available for students to peruse and update their math skills)

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)