



Radiation Safety Associates, Inc.

HEALTH PHYSICS TECHNICIAN LEVEL I -- BASIC

COURSE OUTLINE

MATH REVIEW

- Basic algebra review
- Using the scientific calculator
- Significant digits
- Zeros
- Rounding numbers
- Determining the significant digits or decimal places to record
- Averaging a series of numbers
- Consistency of units
- Exponential functions
- Multiplication
- Division
- Power functions
- Radicals
- Logarithms
- Linear graphs
- Procedures for graphing
- Slope
- Logarithmic graphs
- Logarithmic vs. linear graphing
- Bar graphs
- Interpolation & extrapolation
- Nomographs

RADIOACTIVITY & DECAY

- Radioactivity
- Decay
- Half-life: the rate of radioactive decay
- Decay constant
- Decay equation
- Chart of the Nuclides
- Decay Data Tables
- Radioactive Series
- Properties
- Artificially occurring series
- Other radionuclides
- Decay chains
- Methods of radioactive decay
- Alpha decay
- Beta decay
- Beta minus
- Positrons
- Auger electrons

- Electron capture
- Internal conversion
- Gamma rays
- X rays
- Isomeric transition
- Conservation of mass, charge, & energy
- Specific activity

RADIATION INTERACTIONS WITH MATTER

- Charged particle interactions
- Ionization
- Excitation
- Bremsstrahlung
- Photons
- Photoelectric effect
- Compton scattering
- Pair production
- Neutron interactions
- Fast neutron interactions
- Slow neutron interactions

UNITS OF MEASURE

- Radioactivity
- Radiation
- Radiation exposure vs. radiation dose
- Radiation exposure: the roentgen
- Absorbed dose: the rad
- The rem
- Dose & dose rate
- Determination of dose & dose rate
- Source Activity Vs. Gamma Exposure Rate
- SI Units

RADIATION DETECTION & MEASUREMENT

- Gas-filled detectors
- Pulse size considerations
- Ionization chambers
- Proportional counters
- Limited proportionality region
- Geiger-Mueller (GM)
- Continuous discharge region

- Scintillation detectors
- Liquid scintillation detectors
- Solid scintillation devices
- Photomultiplier tubes
- Semiconductor detectors
- Detector applications
- Portable survey meters
- Laboratory instruments
- Portal monitors
- Personnel contamination monitors
- Whole body counters
- Basic radiation spectroscopy
- Processing
- Spectrometer
- Single channel analyzer
- Multi-channel analyzers
- Energy calibration
- Channel coefficient
- Detector efficiency
- Efficiency calibration

BIOLOGICAL EFFECTS OF RADIATION

- Radiosensitivity & radioresistance
- Dose Response
- Stochastic & nonstochastic effects

REGULATIONS & GUIDES

- History of protective standards
- ICRU, ICRP, & NCRP
- Radiation exposure concerns
- Basic recommendations
- Federal policy
- Regulating agencies
- Other organizations
- Regulations & guides
- 10 CFR 19, "Notices, Instructions & Reports to Workers: Inspection & Investigations"
- 10 CFR 20, "Standards for Protection against Radiation"

Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material"
10 CFR 70, "Domestic Licensing of Special Nuclear Material"
10 CFR 71, "Packaging & Transportation of Radioactive Material"
10 CFR 74, "Material Control & Accounting of Special Nuclear Material"
Regulatory Guides
NUREGs
American National Standards Institute (ANSI) Standards
Information Notices

EXTERNAL EXPOSURE CONTROL & SURVEYS

ALARA

Current 10 CFR 20
Revised 10 CFR 20
Current ALARA-related regulatory guides
Surveys
Current 10 CFR 20
Revised 10 CFR 20
Current survey-related regulatory guides
Survey form contents
Posting & Control
Current 10 CFR 20
Revised 10 CFR 20
Administrative Controls
Radiation Exposure Control

DISTANCE & SHIELDING

Distance
Point sources
Line & plane sources
Shielding
Beta
Gamma
Neutron

CONTAMINATION CONTROL

Radiation vs. contamination
Survey methods
Loose contamination
Total contamination
Wipe test evaluation
Statistical considerations in a Counting program
Standard deviation
Confidence levels
Minimum detectable count rate (MDCR)
Application of MDCR
Minimum detectable activity (MDA)
Survey frequency & limits
Protective clothing
Self-frisk
Personnel decontamination
Survey evaluation
Posting & control of contaminated areas
Equipment & area decontamination

AIR SAMPLING & EVALUATION

Types of airborne contaminants
Sample collection
Air sample accuracy
Total sample volume
Efficiency of collection medium
Counting efficiency
Representative sample
Calculation of airborne concentrations
Lower Limit of Detection (LLD)

INTERNAL EXPOSURE CONTROL & DOSE ASSESSMENT

ALARA
Annual limit on intake (ALI)
Derived air concentration
Maximum permissible concentration
Assessing body burden
Whole body counting
Radiourinalysis
Fecal analysis
Bioassay Programs
Calculating Internal Dose
Removing Internal Contamination
Internal Exposure Control
Required Postings
Rope boundaries
Airborne radioactivity area

SOURCE HANDLING TECHNIQUES

Regulations & procedures
10 CFR 20
10 CFR 30
10 CFR 70
10 CFR 74
Definitions
Sealed source
Special nuclear material
Procedural compliance
Fundamentals of excellence
Pitfalls
Industry events
Responsibilities
Exempt vs. Nonexempt
Quantities of Radioactive Material
Master index
Use & precautions
Lost sources
Labeling
Loss
Disposal
Leak testing
Storage limitations
SNM receipt & movement

RADIOACTIVE MATERIAL CONTROL & DISPOSAL

Receiving packages
Type A quantity or less
Greater than type A quantity
Container labels
Exemptions from labeling
Requirements
Disposal of empty radioactive
material containers
Storage & control
Posting
Exceptions from posting
requirements
Loss or theft of licensed
material
Definition
Radwaste Minimization
Radwaste Treatment
Storage for decay
Evaporation
Dilution & release
Filtration & deionization
Incineration
Compaction
Solidification
Waste Disposal
Packaging
Physical form
Type A containers
Type B containers
Warning labels on packages
Contamination limits on
packages
Radiation limits during
transport
Vehicle placarding
Other methods

APPLICATIONS

X Ray machines
Production
Filtering
Medical radionuclides
Diagnosis
Therapy (radiation oncology)
Linear accelerators
Nuclear reactors
Boiling water reactor
Pressurized water reactor
Nuclear fuel
Safety
Radiation sterilization
Other industrial sources
Isotopic neutron sources
Oil well logging
Level & density gauges

REFERENCES

GLOSSARY

Course offered at our Hebron, Connecticut facility in rotation with other radiation safety courses. For more information, see our website at <http://www.radpro.com/training/>, or contact us at 860.228.0487.