

I. Radiation, Radioactivity, Ions

A. Atomic Structure

1. Periodic Table
2. Electrons, Protons, Neutrons
3. Isotopes

B. Interactions with Matter

1. Ionization
2. Excitation

C. Radiation

1. Types - Alpha, Beta, Gamma, X- Rays
2. Penetrating Abilities
3. Process of Radioactive Decay
4. Half-Life

D. Background Radiation

1. Natural
2. Man-Made

II. Radon and Its Decay

A. Radon Characteristics

B. Radon Decay Product Characteristics

C. U-238 Decay Chain

1. Types of Radiation Emitted
2. Significance of Half-Life
3. Position of Rn-222 and Daughters

D. Risk Estimates (focus on Citizens Guide)

E. National Radon Programs

F. Comparative Radiation Standards

G. Common Health Risk Questions

III. Health Risk

A. History

B. Method of Lung Cancer Induction

IV. Radon Entry and Behavior

A. Overview

B. Mechanics of Radon Entry

1. Nearby Radium Source P 60d

a. Prevalence of Radium in Soils and Rock

-Radon Release into Soil Gas or Aquifer

b. Ranges of Soil Gas Radon Concentrations.

How Radon Moves through Soil and Rock

-Concentration Gradient Diffusion

-Pressure Driven Airflow

2. Transport Mechanism

a. Air Pressure Differentials

- Airflows Induced by Mechanical Equipment

- Airflows Induced by Temperature Differential

- Wind Induced Airflows

- Other Environmental Effects

- Pathways for Pressure Driven Transport

b. Radon Transport by Concentration Gradient Diffusion

c. Well Water Transport

d. Materials within the building

C. Indoor Radon Concentrations

1. The Fate of Indoor Radon

2. Daily and Seasonal Variations in Rn Concentrations

3. Ventilation Rates and Radon Concentration

a. Ventilation Rates

b. How Ventilation Rates Affect Rn Concentrations

c. Studies of Groups of Houses

Why the Simple Model Does Not Work for Groups of Buildings

d. Studies of Individual Houses

C. Scientific Basis for Risk Estimates

- 1. Miners Studies
- 2. Residential Studies
- 3. Animal Studies

-Why the Simple Model Doesn't Work for Individual

Buildings

Activity:

D. Risk Estimates (focus on Citizens Guide)

E. National Radon Programs

F. Comparative Radiation Standards

G. Common Health Risk Questions

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V. Intro to Measurement

A. Activated Charcoal

- 1. Canister
 - a. Open-Face
 - b. Diffusion Barrier
 - c. Bags
- 2. Vials - Liquid Scintillation
- 3. Protocols for Use
- 4. QC Procedures
- 5. Advantages/Disadvantages

B. Alpha Track

- 1. Description
- 2. Protocols for Use
- 3. QC Procedures
- 4. Advantages/Disadvantages

C. Electret Ion Chamber

- 1. Ion Chamber
- 2. Voltmeter
- 3. Measurement Process
- 4. Protocols for Use
- 5. QA Procedures

E. Grab Sampling

- 1. Radon
- 2. Radon Decay Product

VI. Measurement Protocols

A. Initial Measurement

- 1. Homeowner Guidance
- 2. Real Estate Guidance

B. Follow-Up Measurement

- 1. Homeowner Guidance
- 2. Real Estate Guidance

C. Interpretation of Results

VII. QA/QC

A. Terminology

- 1. Duplicates
- 2. Blanks
- 3. Spikes
- 4. Blinds - Single and Double
- 5. Calibration Measurements
- 6. Background Measurements
- 7. Precision
- 8. Accuracy

6. Advantages/Disadvantages

9. Bias

D. Continuous Monitor

B. Formulation of QA Plan

1. Alpha scintillation and Photo-Multiplier

C. Implementation of QA Plan

2. Ion Chamber

Refer to Appendix C for TCS Industries Inc. plan

3. Solid State Detectors

4. Protocols for Use

5. QC Procedures

6. Advantages/Disadvantages