Radiation Monitoring Equipment

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Types of Monitoring

- Both Occupational & Environmental
  - Require different instruments & techniques
- Gamma Dose
- Radon
- Radon Decay Products
  - Potential Alpha Energy Concentration (PAEC)
- Long Lived Alpha Activity in Dust
- Alpha Surface Contamination
Radiation Monitoring Equipment

GAMMA DOSE
Occupational Gamma Exposure
Environmental Gamma Baseline

- Large Areas
  - Airborne survey
  - Ground truthing
    - Vehicle mounted survey
    - Hand held spot checks
    - Soil sampling
  - Gamma dose plus U-238, Ra-226, K-40
Environmental Gamma Baseline

- Small Areas
  - Grid Survey (5-10m)
  - NaI detector
  - Better with GPS input
  - Measurements at 1m
  - 1 minute averaging
  - Input into GIS system and produce contour map
Output from GIS system
Radon in Air

- Predominantly environmental
- Passive
  - Track Etch
- Instrument
  - Portable (less sensitive)
  - Caravan mounted (high sensitivity)
- Most common
  - Baseline survey with several passive around site for 1-2 years
Radon Emanation

• Charcoal cups
  • Activated charcoal
  • Heated to purge
  • Placed in cup
  • Placed on soil & sealed for known time (24 hours)

• Accumulator drum
  • Drum (or void space) placed on soil & sealed
  • Left for 24 hours
  • Volume sucked out into either instrument or Lucas cells
Radiation Monitoring Equipment

RADON DECAY PRODUCTS
Occupational – Grab Sampling

• Most common for underground
• Gives quick result
• Can then action shut down of areas
• Several different methods
  • Borak
  • Tsivoglou
  • Rolle
Occupational – Continuous Sampling

- Gives complete diurnal variation
- Collects shift average data not just instantaneous
- Expensive
- Maintenance Issues
- Can be heavy to carry
- More common area
Diurnal Variation of RnD

RnD Concentration, PAEC (uL/m^3) vs Time

- Boost Jan 20
- IX Jan 22
- IX Jan 23
- Elut Jan 25
- IX Jan 27
Radiation Monitoring Equipment

DUST
Occupational LLAA

- Personal and Area dust samples
- 25mm membrane filters
- IOM or seven hole sample head
- 2L/min
- Breathings zone
- Whole shift is possible
Occupational LLAA

- Leave sample in moisture free location for 1-2 days
  - RnD to decay
  - In theory 5 days
- Count on alpha sample counter
- Using efficiency determine Bq/m$^3$
Calibration of Flow & Optional Weight
Environmental Dust

- High Volume Air Samplers
  - Best but most expensive and need power
- Low Volume Air Samplers
  - Can be expensive
- Passive Dust
- All analysed for
  - U-238, Th-230, Ra-226, Pb-210
Radiation Monitoring Equipment

**ALPHA SURFACE CONTAMINATION**
Surface Contamination

- Checking work areas
  - Especially crib rooms & offices
- Checking personnel
- Clearance of items before leaving site
- Instruments
- Wipes & Gross alpha Counting
Alpha Scintillation Detectors

- Very sensitive
- Think Mylar foil
- When damaged light enters and will not detect
- Need training to use
- Not good for exploration sites
Exploration Clearance Surveys

- G-M pancake detector best
- Will not detect below 1Bq/cm²
- Clearance typically 0.4Bq/cm²
- Measures alpha, beta & gamma
- Ruggad
Traceability of Measurement

- Always important to remember that monitoring is predominately for calculating dose
- If dose is to be accurate each measurement must be accurate
- Each individual system must be traceable back to a known value
- If any part is incorrect then the final result is incorrect
- When calibrating need a certificate that demonstrates the source
Overview

• Many types of Monitoring Equipment
• Many types of Monitoring Parameters
• Selection is critical to ensure measurements are representative
• Calibration is critical to ensure measurements are accurate
• Always remember
  • Traceability to a known source