

Quality Assurance & Quality Control [QA/QC]

CHAPTER FIVE 5

Review

Chapter Outline

- 5.0 Chapter 5: Quality Assurance and Quality Control
 - 5.1. Roles & Responsibilities
 - 5.1.1. Management Commitment to Quality Assurance and Quality Control
 - 5.1.2. Quality Assurance Officer
 - 5.1.3. Standard Operating Procedures
 - 5.1.4. Record Keeping
 - 5.1.5. Chain of Custody
 - 5.2. Quality Control Measurements
 - 5.2.1. Calibrations
 - 5.2.2. Spikes
 - 5.2.3. Duplicates
 - 5.2.4. Background
 - 5.2.5. Blanks
 - 5.3. Measurement Uncertainties
 - 5.3.1. Interference
 - 5.3.2. Compliance Procedures
 - 5.3.3. Minimizing Indoor Radon Fluctuations
 - 5.4. Measurement Error Analysis
 - 5.4.1. Accuracy and Bias
 - 5.4.2. Precision
 - 5.4.3. Control Charts for Precision
 - 5.5. Developing a Quality Assurance Program

Chapter Learning Objectives

- ☐ Summarize the purpose of a Quality Assurance program (QAP) and a Quality Control Program
- ☐ Explain the difference between Quality Control measures and Quality Assurance uncertainties and how to prevent them.
- ☐ Explain the difference between precision & accuracy.
- ☐ Identify the primary methods of calculating precision error and cite the formulas.
- ☐ List the primary quality control measurements.
- ☐ Identify the required QA log information.

- 1) Accuracy vs. precision
 - Accuracy = Systemic errors due to a consistent bias (in one direction or another) from the true value or reference point.
 - Precision = Random errors due to a lack of precision in measurement.
 - Accuracy = Systemic errors due to a consistent bias (in one direction or another) from the true value or reference point.
 - Precision = Random errors due to a lack of precision in measurement.
- 2) Performance ratio: Measured value \div target value (true value)
- 3) Precision error and how to document it:
 - Random (precision) errors are inherent in the limited precision of the measuring device, the operator, and the statistical nature of counting radiation. It is important to assess these errors because radon and working level measurements typically do not produce exactly the same results, even for simultaneous (duplicate) co-located measurements. The objective of performing simultaneous or duplicate measurements is to assess the precision error of the measurement method, or how well two side-by-side measurements agree.
- 4) One method of calculating precision:
 - STD = Standard Deviation measures the statistical range from the average measurement. One method of calculating precision for 3 or more devices:
 - Coefficient of Variation (COV)
 - COV = standard deviation divided by the mean
- 5) One method of calculating precision for 2 devices:
 - Relative Percent Difference
 - RPD = difference divided by the mean [average] x 100
- 6) 5 important QA measurements
 - Calibration
 - Duplicate
 - Spikes (known)
 - Semi-Annual Cross Checks
 - Background
 - Laboratory blanks
 - Field blanks
- 7) Acceptable precision errors between duplicate (side-by-side) measurements for different devices:
 - Charcoal canisters less than 10%
 - Continuous radon monitor less than 10%
 - Electret ion chambers less than 10%
 - Continuous WL monitor less than 10%
 - Alpha track detectors less than 20%, but dependent on the total area of the detector analyzed
 - Grab samples less than 30%

- 8) Required QA log information:
- a) The permanent record of each measurement should include the following:
 - b) A copy of the final report, including measurement results, and a statement describing any recommendations concerning retesting or mitigation provided to the client, the occupant, the building owner or his/her representatives.
 - c) The address of the building measured including zip code. A diagram of the measurement space noting the exact locations of all measurement devices deployed and any information that would allow for future data comparisons and interpretations.
 - d) Exact start and stop times of the measurement period as required for analysis.
 - e) Type of instrument used and serial number or identification number.
 - f) A description of the condition of any permanent vents, such as crawlspace vents or combustion air supply to combustion appliances.
 - g) The name and license number of the service or analysis organizations used to analyze devices.
 - h) The name and license number of the individual who conducted the test.
 - i) A description of any variations from or uncertainties about standard measurement procedures, closed-building conditions or other factors that may affect the measurement result.
 - j) A description of any non-interference controls used and copies of the signed non-interference agreements.
 - k) A record of quality control measures associated with the test such as the results of simultaneous or diagnostic measurements.

- 9) Relative Percent Difference = Difference ÷ Average X 100

$$\text{RPD} = \frac{\text{Difference}}{\text{Average}} \times 100$$

- 10) Working Level Month = Working Level X Hours ÷ 170 Hours

$$\text{WLM} = \text{WL} \times \text{Hrs.} \div 170 \text{ Hrs.}$$