LAB ID and/or LABORATORY NAME:	
ASSESSOR NAME:	**DATE:**

CONTINUOUS RADON MONITOR (CRM) by Proportional Counting

Method Number: ELAP method code 7037

SOP Number:

Revision Number:

SOP Date:

Personnel / Data Records observed:

CRM Model Number(s):

General LLD: < 1 pCi/L

Question	Y	N	NA	Codes	Comments
RADON IN AIR					
1. Are both of the following EPA publications available at the lab:					
a. Protocols for Radon and Radon Decay Product Measurements in Homes? (EPA 402-R92-003)				**N002**	
b. Indoor Radon and Radon Decay Product Measurement Device Protocols? (EPA 402-R92-004)				**N003**	
2. Does the facility monitor Radon levels in air for a minimum of 48 continuous hours, process the collective data and interpret the result for the client (rather than merely distributing devices)?				**N004**	
3. Is a written standard operating procedure (SOP) available? (Duplication of the protocols will not suffice.)				**N005**	
a. Does the analyst follow the manufacturer's instructions, the US EPA protocols and the lab's SOP?				**N072**	
4. Is a written quality assurance project plan (QAPP) appropriate to each device available?				**N006**	
5. Does the data collection log include:					
a. Date and time of deployment?				**N007**	
b. Date and time of removal?				**N008**	
c. Condition of the devices?				**N009**	
d. Attainment of closed building conditions? 1. Delayed start, if implemented				**N010** **N010A**	
e. Exact location of device (i.e., building, room and sampling position) within the property being monitored?				**N011**	
f. Serial number, model number, and manufacturer of the detector?				**N012**	
g. Unique identifier of client and client's address (if different from testing location)?				**N013**	
h. Condition of crawl space vents?				**N014**	
i. Performance of a "Routine Instrument Check" (to include, but not limited to, zeroing the integrator, ensuring correct date and time indications, and fully charged battery)?				**N253**	
6. Are monitoring devices deployed and retrieved by trained employees of the radon laboratory?				**N015**	
7. When monitoring devices are set out and picked up by different				**N016**	

Question	Y	N	NA	Codes	Comments
persons, is this noted in the record?					
8. Is a qualifying statement used if the lab does not control the monitoring process (i.e., placed and/or retrieved by persons other than trained lab personnel)?				**N017**	
9. Are all devices deployed for 48 continuous hours if the measurement is used for remedial action or to determine the need for further measurements? a. In cases where closed conditions have not been met, is there a 12-hour delayed start or extended monitoring period of at least 60 hours after closed conditions have been implemented?				**N018** **N021**	
10. Is the technical director of the laboratory aware of the device's Lower Limit of Detection (LLD), and has the background level been determined?				**N019**	
FIELD DATA					
1. Is the field data record (instrument field sheet) maintained?				**N166**	
QUALITY CONTROL					
1. Is the device an US EPA approved unit?				**N251**	Record CRM Model number.
2. Is the device capable of detecting at least 1 pCi/L?				**N252**	
3. Have all elements of the QC protocol been addressed in the QA Plan? a) background reading b) accuracy relative to a known reference standard via annual calibration c) precision of duplicates d) cross-checks				**N171**	
SYSTEM CALIBRATION and CROSS CHECKS					
1. Has either the manufacturer or the user (through an approved calibration service provider) calibrated the complete system in a radon chamber before being put into service and after any repairs or modifications?				**N177**	
2. Has the calibration been performed at least annually?				**N178**	

Question	Y	N	NA	Codes	Comments
3. Is a record of annual calibrations available? a. Does the calibration account for instrument adjustments, background measurements, and use of traceable standards?				**N179** **N179A**	
4. Is the detector cross checked semi-annually against another recently calibrated instrument? a. Is a record of the semi-annual cross check available?				**N180** **N180A**	
5. Do all detectors have individual calibration (correction) factors? a. Are calibration (correction) factors applied correctly to each radon monitoring job?				**N182** **N182A**	
BACKGROUND MEASUREMENTS					
1. Is the background count measured in a low radon environment every 20th 48-hour measurement?				**N185**	
2. Is the background measured below 2 pCi/L?				**N184**	
DUPLICATE MEASUREMENTS					
1. If two or more detectors are available, are duplicate measurements taken? a. Is the side-by-side measurement performed at a frequency of one (1) in ten (10) analyses? b. Is the side-by-side measurement available for review?				**N187** **N181** **N181A**	
2. Are duplicate measurements made in at least 10% of the total number of measurement locations, or 50 each month, whichever is smaller? a. If field duplicates are taken, are the field locations selected for duplicate measurements distributed systematically throughout the entire population of samples?				**N188** **N193**	
3. Is the precision of the duplicate data from radon levels measured at 4 pCi/L or above within 10% Relative Standard Deviation (RSD: for a long-term series of duplicate measurements), or 14% Relative Percent Difference (RPD: for a single pair of duplicates)?				**N189**	

Question	Y	N	NA	Codes	Comments
4. Are the data from duplicates available (e.g., control charts)?				**N190**	
5. Are the acceptance limits for duplicates determined?				**N191**	
RECORD KEEPING					
1. Are the following record(s) kept for 5 years by the measurement organization:					
a. A copy of the final report including measurement results and the statement outlining any recommendations concerning retesting or mitigation provided to the building occupant or agent?				**N237**	
b. The address of the building monitored including zip code?				**N238**	
c. The exact locations of all deployed measurement devices? (Examples: room sketches, detailed written description)				**N239**	
d. Exact start and stop dates and times of the measurement period required for analysis?				**N240**	
e. A description of the device used including the device identification number and serial number, if applicable?				**N241**	
f. A description of the condition of any permanent vents?				**N242**	
g. The name of the service organization used for calibrations and the certificates of calibration?				**N243**	
h. The name of the individual who conducted the test along with their associated training records?				**N244**	
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?				**N245**	
j. A description of any non-interference controls and copies of signed non-interference agreements?				**N246**	
k. A record of any quality control measurements associated with the test?				**N247**	
l. The written authorization from the client enabling the lab to report results to a third party (if applicable)?				**N254**	
REPORTING					
1. Is the US EPA average reported to the client?				**N260**	First four (4) hours is omitted.

Question	Y	N	NA	Codes	Comments
a. Are results reported to the client with % uncertainty?				**N261**	
2. Is the %Uncertainty determined by the following calculation: %Uncertainty = 100% X [1/(SQRT of counts)], where counts are determined as the [cph per 1pCI/L)] x (radon level measured expressed in pCi/L x EPA avg hrs of test) a. Are reported results having uncertainties greater than 10% qualified? b. Do reported values reflect the minimum reportable concentration? (example: For Sun Nuclear #1027 and #1028, this level would be 0.9 pCi/L for the EPA average of a 48 hour sample.)				**N250** **N255** **N256**	
3. Does the report contain the advisory of 10 NYCRR 16.130 for properties tested within New York State having measured radon gas levels >20 pCi/L or 0.1 working level?				**N257**	
4. For labs within NYS, does the laboratory report all of its radon monitoring data to the State according to 10 NYCRR 16.130?				**N258**	
5. Are field duplicate readings, if available, reported in an acceptable manner? (See EPA 402R92-003).				**N259**	

10 NYCRR 16.130 Radon testing and reporting.

(b) General requirements.

(2) When any radon screening or long-term testing result exceeds 20 pCi/l or 0.1 working level as defined in section 16.2(a)(145) of this Part, the radon testing firm shall advise the customer, if a resident of this State, in writing to contact the New York State Department of Health, Bureau of Environmental Radiation Protection, for further technical advice and assistance.

(3) A radon mitigation firm shall report to the department in writing, within 30 days following the end of a reporting period, a summary of the number of homes mitigated in the State during that reporting period. Reporting periods shall be from January 1st to June 30th and July 1st to December 31st of each year. The report shall include the dates for which the report is made and the number of buildings for which mitigation was performed for the reporting period in each county or ZIP code area in the State.

****The relative sensitivities per 1 pCi/L for commonly encountered Rn monitors are as follows:**

2.5 cph for Sun Nuclear Model #1027 and #1028
3.0 cph for Sun Nuclear Model #1030 (to be confirmed)
18 cph for Femtotech,
69 cph for Pylon CRMs

NOTES:

(The following paragraphs are from the updated **EPA 402R92-004** "Indoor Radon and Radon Decay Product Measurement Device Protocols")

- Users of continuous monitors must perform sufficient instrument **background measurements** to establish a reliable instrument background and to act as a check on instrument operation.

- The two previous editions of these protocols (U.S. EPA 1986, 1989a) used the value coefficient of variation (COV), defined as the standard deviation divided by the mean, as the expression used for **the goal (at 4 pCi/L or 0.02 WL) of 10 percent for precision.** The COV should decrease with increasing concentration. This edition explains that there is a variety of ways to calculate and express precision, including the COV and the relative percent difference, defined as the difference between two duplicates divided by their mean. It is important to monitor precision over the entire range of radon levels that are encountered routinely in the measurement program, and that a systematic and documented method for evaluating changes in precision be part of the standard operating procedures. **While a limited precision error is desirable (e.g., COV of < 10% at 4 pCi/L), it is most important to maintain the total error of any individual device (including both errors in precision and accuracy) to within ± 25 percent of the "true" radon or decay product concentration for concentrations at or above 4 pCi/L)**.

It is important to emphasize to the technical director of the Rn lab the **DIFFERENT MEANINGS** between the 10% Rel. Std. Deviation (or 'COV' as mentioned in the paragraph above) and the simple 14% RPD.

- **The 10% RSD limit** is calculated from many measurements (20 minimum) taken over an extended period of time. It is NOT appropriate to try to evaluate this number based upon the readings of a single pair of duplicate measurements. In real terms, it is a number used for evaluating the **"LONG TERM PRECISION"**, **taken over AT LEAST 20 MONITORING EVENTS, using co-located devices.** In mathematical terms, it is the "typical" or "standard" deviation calculated from **ALL THE DIFFERENCES** (may use raw difference or relative percent difference) **BETWEEN ALL THE INDIVIDUAL PAIRS** of duplicate measurements. The standard deviation is therefore derived from many events, at many different Rn levels, using duplicate measurements taken by more than one device during several deployments.

- **The 14% RPD limit** is a simple calculation based solely upon **the difference between ONE PAIR** of readings taken during **ONLY ONE monitoring event.**