Connecticut Department of Public Health
School Radon Testing Guidance

Purpose: This guidance document has been prepared to provide NRPP and NRSB certified radon measurement professionals with instructions on how to properly test for the presence of radon in schools.

Background

- Radon is a naturally occurring radioactive gas that can increase a person's risk of developing lung cancer. It comes from the natural breakdown of uranium which is found in soil and rock all over the United States. Radon travels through soil and enters buildings through cracks and other holes in the foundation.

- Radon is colorless, odorless, and tasteless. Therefore, the only way to know whether an elevated level of radon is present in any room of a school is to test.

- The U.S. Environmental Protection Agency's (EPA) investigation of radon in schools was initiated in 1988 with a study of schools in Fairfax County, Virginia. As the result of a nationwide survey of radon levels in schools, it is estimated that nearly one in five U.S. schools (one in seven CT school based on surveillance data) have at least one ground contact room with short-term radon levels above 4 pCi/L; the level at which the EPA suggests mitigation.

- It is recommended that all school buildings nationwide be tested for radon. EPA estimates that more than 70,000 schoolrooms in use today have high short-term radon levels.

- Pursuant to Connecticut General Statute Section 10-220 (d), *prior to January 1, 2008, and every five years thereafter, every school building that is constructed, extended, renovated, or replaced on or after January 1, 2003… shall be inspected and evaluated for radon levels in air...*

Initial Approach

☐ Meet with the school's facility manager to obtain a floor plan of the building and to discuss school structure and dynamics. Ask if school is under renovation currently or if renovations are planned for the near future. Schedule testing after all renovations are complete. Also, meet with school's principal or superintendent to discuss EPA protocols regarding risk communication with students, parents, and staff.

☐ Conduct a walk through inspection to determine all ground contact areas of the building, testing locations, number of test devices needed and record the information on the floor plan of the building.

☐ Develop a pre-test communication plan. The school administration shall conduct an informational meeting with staff and representatives of parent and teacher organizations to provide an overview of the scheduled radon testing. The measurement professional responsible for radon testing should attend to address any questions/concerns.

☐ Distribute notices in advance of testing. Two weeks prior to the scheduled radon testing, the school administration shall notify staff and parents of students with a letter (See Attachment A template) informing them of the scheduled radon testing and conditions necessary to ensure reliable test results. Radon educational materials can be distributed with the letter.

The *Radon in Schools* pamphlet is available in electronic format and can be emailed to staff or posted on the school's website prior to testing (See Attachment B pamphlet).

Initial Testing

Placement of Testing Devices

Radon test measurements shall be conducted in all frequently occupied rooms in contact with the ground, side walls in contact with the ground, and in rooms over crawlspaces, tunnels or parking garages. Frequently occupied rooms are areas of the building that are occupied on a regular basis for more than 4 hours a day. Test areas that are not currently occupied, but can potentially become occupied in the future.

Determining the Number of Test Devices Needed:

☐ Obtain a sufficient number of short term, passive test devices to conduct initial radon testing in all frequently occupied rooms that come in contact with the ground within the school. The lowest occupied level will be tested unless the school is built into a hillside in which case upper floors may need to be tested as well. Frequently occupied rooms are usually classrooms, offices, laboratories, cafeterias, libraries, and gymnasiums. Areas such as restrooms, hallways, stairwells, elevator shafts, utility closets, and storage closets need not be tested. Use the attached work sheet to calculate the number of test devices required (See Attachment C work sheet).

☐ Duplicates and blanks shall accompany <u>all</u> testing activities to provide assurance of the quality of the measurements.

- Duplicates are pairs of detectors deployed in the same location, side-by-side, and 4 inches apart for the same measurement period. They shall be placed in **10%** of all measurement locations in a school building to measure precision.
- Blanks are unexposed detectors used to determine whether the manufacturing, shipping, storage or processing of the detector has affected the accuracy of the measurements. Field Blank detectors are left in the school building unexposed/unopened during the testing period. They are opened up and immediately rewrapped/closed at the end of the exposure period. The number of blanks shall be **5%** of the detectors deployed or 25 whichever is less.

Duplicate and blank testing devices must be shipped and labeled in the same manner as the other testing devices so that the analytical laboratory cannot distinguish them. For example, a test device is placed in Room 233 accompanied by a duplicate test device. The location name marked on the tracking sheet for the first device is “Room 233” while the location name marked on the tracking sheet for the duplicate device is “Room 233D.” A location name of “Duplicate of Room 233” for the second device is not acceptable. Blanks should be named in a similar way, such as “Room 233B” as opposed to “Blank of Room 233.”

☐ Spikes are detectors that have been exposed in an approved chamber to a known concentration of radon. Spikes shall be included in one testing activity per month to measure bias in the normal measurement process. Count the total number of test devices placed in all of the schools where testing has occurred or is planned for the designated month. The number of spikes shall be **3%** of the detectors deployed during that month with a maximum of 6 spikes per month.

- Spikes are used to measure lab bias. Ask your device manufacturer or check the NRSB or NRPP websites for a spiking service referral and use a private radon chamber (laboratory). The three laboratories that provide this service is listed below:

Bowser-Morner, Inc.
Calibration, Performance Test, and Spike Chamber
4514 Taylorsville Road
Dayton, OH 45424
Telephone: (937) 236-8805 Ext 249
radon@bowser-morner.com
http://www.bowser-morner.com

Radon Safety Institute of Canada
Calibration, Performance Test, and Spike Chamber
102-110 Research Drive
Saskatoon, SK Canada
Telephone: (800) 263-5803
info@radiationsafety.ca
http://www.radiationsafety.ca/

KSU Radon Chamber
Performance Test and Spike Chamber
2323 Anderson Ave. Suite 300
Manhattan, KS 66502
Telephone: (785) 532-6026 or (785) 532-4992
radonchamber@ksu.edu
https://ksuradonchamber.org/

- The test devices will be exposed in the chamber at a certain level that will be provided by the spike service laboratory. The test devices should be exposed in the chamber for the same amount of time you plan on conducting testing in your designated school. The spiked test devices shall be shipped via overnight delivery to arrive in time to include in your sample shipment.

- Like duplicates and blanks, the spiked test devices must be shipped and labeled in the same manner as the other testing devices so that the analytical laboratory cannot distinguish them. The spiked test devices shall be named so as to be recognized by the tester but blind to the lab.

Test Conditions Required:

Choose a testing period that represents the normal occupied operating conditions for the building.

☐ Testing shall be preceded by 12 hours of closed building conditions.

☐ Testing shall be conducted:

- under closed building conditions for a minimum of 48 hours,
- during the coldest months of the year: between November 1 thru March 31,
- on weekdays that do not include holidays or vacation breaks, while school is in session and HVAC systems are operating normally.

☐ Testing shall **not** be conducted:

- during abnormal weather conditions such as major storms or unusually high winds
- during weekends and Holidays when the school is not in session
- during structural changes or renovations to a school building or during modifications to or replacement of the HVAC system.
- if the school is scheduled for any type of renovation in the near future that may potentially affect the air movement inside the building. Schedule radon testing activities after all renovations, including HVAC system modifications, have been completed.

How to Test:

☐ All school rooms must be tested on the same start date. Canister identification numbers, locations, and start date/time will be recorded on a device tracking sheet provided by the laboratory or the DPH Radon Program (see sample Attachment D tracking sheet).

☐ Place a brightly colored notification sheet under the test device stating that a radon test is in progress (See Attachment E example).

☐ Test devices must be placed:

- 20 inches above the floor,
- 3 feet away from any exterior doors or windows,
- 3 feet away from any exterior or interior wall,
- 4 inches away from other objects,
- away from any drafts, vents, appliances (e.g. computers, projectors, etc.),
- away from heat sources, areas of high humidity, out of direct sunlight, and where they are least likely to be disturbed.

The devices should be left in place for three or four days to ensure optimum results. Testing should take place over a minimum of 2 days/48 hours, but shall not exceed 7 days.

Place one device for every 2,000 square feet in large areas, such as gymnasiums.

Retrieval of Testing Devices

☐ Retrieve all testing devices from each location in the school building on the same day and complete the device tracking sheets by recording the end date/time. Record comments on the tracking sheet if the devices appear to have been tampered with or if windows are found to be open upon retrieval.

☐ Make photocopies of the tracking sheets to keep as a record of the testing event.

☐ Package all testing devices securely so as to ensure proper shipment. Mail devices to the analytical laboratory immediately after retrieval or the next morning at the latest. Follow laboratory instructions regarding shipment. The lab may or may not require a copy of the tracking sheets in the shipment parcel.

- Overnight or two-day delivery is preferred for out of state labs.
- Communicate with the analytical laboratory. Provide the lab with a schedule of your planned testing activities especially if the test device shipment is large and testing retrieval is on a Friday.

Interpretation of Initial Results

☐ Review the results of the initial testing and highlight any results that are equal to or greater than 4.0 pCi/L.

☐ Compare the duplicate results by calculating the Relative Percent Difference (RPD).

$$\textbf{\textit{RPD}} = \frac{\left| \textit{Initial Result} - \textit{Duplicate Result} \right| \times 100}{\textit{Average of Both Results}}$$

If results 4.0 pCi/L or greater differ by 25% or more, the data quality should be questioned. In this case, you should call the processing laboratory to investigate the situation further. Notify the school that a few results are in question, therefore, the room(s) associated with the questionable duplicate may need to be retested.

☐ Check to be sure that the blank results are at or close to 0.0 pCi/L to ensure accuracy of the device. If they are not, call the analytical laboratory and/or test device supplier to investigate further. Notify the school that the problem is being investigated.

☐ Check to be sure that the spike results are accurate by calculating how close the measured value is to the target value.

$$\frac{\textit{Target Value-Measured Value}}{\textit{Target Value}}$$

The calculation should be + or – 10%. If the measured value is way off from the target value, investigate further and notify the school that the problem is being investigated.

☐ Obtain additional short-term test devices for follow-up testing in rooms with radon results equal to or greater than 4.0 pCi/L. Confirm elevated results within 30 days of the initial test by deploying a test device in the same location to obtain an average. Don't forget to include additional QA/QC measurements (duplicates and blanks) in the follow-up testing activities.

☐ Provide a summary of initial test results to the school administration.

☐ If initial test results are greater than 20 pCi/L, the school administration shall notify parents and staff within one week of receiving the results.

→ The **EPA does not recommend that schools use a single short-term test as the basis for determining whether action needs to be taken to reduce radon levels. A follow-up measurement to confirm an initial short-term measurement of 4.0 pCi/L or higher should be conducted before making such a decision.**

Follow-Up Measurements

Follow-up, confirmatory testing is required in rooms where initial radon levels are equal to or greater than 4.0 pCi/L.

☐ Follow-up testing (when needed) shall start within 30 days after receiving the initial test results. Test devices must be placed in the same location and under the same conditions as the initial measurement.

Interpretation of Follow-Up Test Results

☐ Take action to reduce the radon level if the average of the initial and follow-up measurement is 4.0 pCi/L or greater.

☐ Provide the school administration with a complete report that includes all results and interpretations.

☐ Recommend that the school administration hire a radon mitigation professional certified by NRPP or NRSB to reduce elevated radon levels identified through testing. The updated CT DPH list of qualified mitigation professionals is available on the CT DPH Radon Program website: www.ct.gov/dph/radon.

Completion and Reporting

☐ The Initial School Radon Measurement Reporting Form shall be filled out by the qualified radon measurement professional and signed by a school designee and then submitted to the DPH Radon Program within ten business days of receipt of the written report (see Attachment F Reporting Form). The form should be emailed to DPH.RadonReports@ct.gov preferably, faxed to 860-509-7295 or sent to the following address:

Attn: School Radon Testing Program
State of Connecticut
Department of Public Health, Radon Program
410 Capitol Avenue, MS # 12-RAD
P.O. Box 340308
Hartford, CT 06134

If you email or fax the reporting form, do not mail a duplicate hard copy.

☐ School administrators shall notify parents and staff of radon testing results in a brief summary as soon as possible, but no later than one month after follow-up test results are received. A copy of the complete report shall be kept in the main office of the school for parents and staff to view. If elevated radon levels exist, the notification should include the school's plan to reduce the levels.

Five-Year Radon Re-Evaluation of CT Public Schools

All CT Public Schools are required to have a radon evaluation every five years.

Radon re-evaluation in CT schools shall be conducted using the same protocols as the initial testing, but in a limited number of locations as follows:

- If, during the initial testing, all radon test results in school rooms showed no elevated levels (all measurements were less than 4.0 pCi/L), then ten percent (10%) of the first floor and below ground areas of the building shall be retested every five (5) years after the initial testing. A different ten percent (10%) of the building must be tested every five (5) years thereafter.

- If the initial measurements were equal to or greater than 4.0 pCi/L, radon mitigation was required to reduce levels.

  ☐ Schools rooms that have had radon mitigation systems installed require re-evaluation of the mitigated rooms every two years to ensure the system is working to reduce the radon levels. This is considered part of normal building maintenance and does not require the submission of a CT DPH *Re-Evaluation Form*.

☐ Schools rooms NOT needing mitigation require a re-evaluation every five years in 10% of the original rooms tested and a different 10% in each future re-evaluation period. Complete and sign the School Radon Re-Evaluation Report Form (See Attachment F). The form should be emailed to DPH.RadonReports@ct.gov preferably, faxed to 860-509-7295 or sent to the following address:

Attn: School Radon Testing Program
State of Connecticut
Department of Public Health, Radon Program
410 Capitol Avenue, MS # 12-RAD
P.O. Box 340308
Hartford, CT 06134

If you fax the form, do not send a duplicate copy in the mail.

For more information or technical guidance, please contact the State of Connecticut Department of Public Health Radon Program at:

Phone: 860-509-7300
Fax: 860-509-7295
Website: www.ct.gov/dph/radon

ATTACHMENT A

Template Letter

(Date)
(Name of School)
(Street Address)
(Town, State, Zipcode)

Dear Parents and Staff:

The administration of the (insert name of school) would like to provide you with notification that initial radon-in-air testing will be conducted on (insert date). According to Connecticut General Statute 10-220(d), schools are required to inspect and evaluate the indoor air quality of school buildings by 2008. This required inspection and evaluation of indoor air quality includes evaluation of radon in air and water.

(insert radon professional company) will conduct the radon testing. To test for radon in air, small canisters containing charcoal will be placed in each of the occupied rooms that are in contact with the ground. These canisters will be left in place for three school days. You will be informed of radon test results and interpretations as soon as possible. In the event that high radon levels are found, steps will be taken to correct the problem using methods suggested by the United States Environmental Protection Agency.

Please read the enclosed educational pamphlet describing radon and the school testing program effort. If you have further questions or concerns regarding radon, please feel free to contact the (local health department) at (XXX) XXX-XXXX, or the State of Connecticut Department of Public Health Radon Program at (860) 509-7367.

Thank you, in advance, for your cooperation.

Sincerely,

_____ (Name)

Superintendent of Schools or Principal of School

ATTACHMENT B

Pamphlet

Radon In Schools

Every School Should take this Simple Test.

CONNECTICUT DEPARTMENT OF
PUBLIC HEALTH

Keeping Connecticut Healthy

www.dph.state.ct.us

ATTACHMENT C

Work Sheet

School Radon Testing Program
Work Sheet for Determining the Number of Test Kits Needed

Item 1. Number of frequently occupied rooms less than 2,000 square feet in contact with the ground:

_____

Item 2. List rooms that exceed 2,000 square feet and their size estimate, then divide by 2,000 to calculate the number of test kits needed for each large room:

	Large Rooms	A= Size Estimate (in square feet)	B= Divide A by 2,000 square feet to get value for B	C= Round B up to a whole number
(For Example)	*Gymnasium*	*13,491*	*13,491 / 2,000=6.7455*	*7*
1				
2				
3				
4				
5				
6				
7				
8				
9				

Item 3. Add up all values in the C column to calculate how many additional tests kits are needed:

_____

Item 4. Add Items 1 and 3 to determine the amount of test kits needed not including duplicates and blanks:

D= _____

Item 5. Take the value figured in Item 4 and multiply it by 0.10 to calculate the number of duplicates needed (Round up to the nearest whole number):

E= _____

Item 6. Take the value figured in Item 4 and multiply it by 0.05 to calculate the number of blanks needed (Round up to the nearest whole number):

F= _____

Item 7. Add up the values in Items 4,5, and 6 to figure out total number of test kits needed:

D + E + F = _____

ATTACHMENT D

Tracking Sheet

SCHOOL TESTING PROGRAM TRACKING SHEET

School Name: _____ Weather Conditions: _____
School Location: _____ *Type of Radon Test (AC, LS, AT, CR): _____

Name of Tester: _____ Telephone #:_____
Mailing Address: _____
_____

Detector ID #	Location	Start Date	Start Time	End Date	End Time	Additional Comments

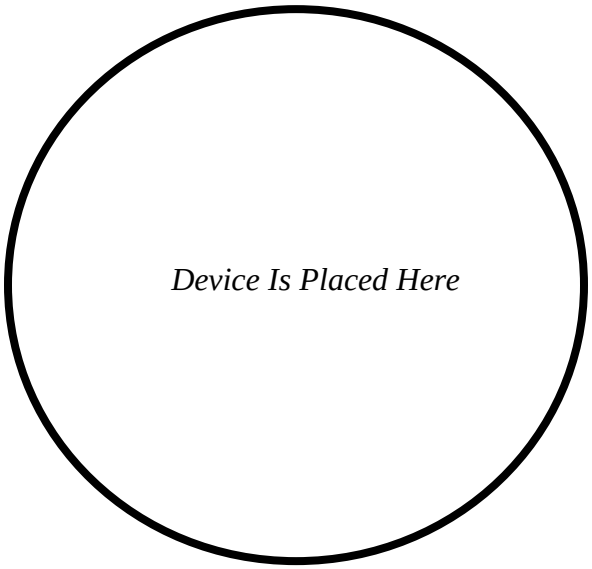
*Note: AC = Activated Charcoal Adsorption Device LS = Charcoal Liquid Scintillation
AT = Alpha Track Detectors CR = Continuous Radon Monitor

ATTACHMENT E

Example Warning Sheet

DO NOT TOUCH, MOVE, OR DISTURB UNDER ANY CIRCUMSTANCES!

(KEEP YOUR WINDOWS CLOSED)



RADON TESTING IN PROGRESS

(Canister and its contents are not harmful)

Please note if windows were opened at any time during the test and how long they were open or if the test was disturbed in any way…Thanks for your full cooperation.

_____

_____

_____

ATTACHMENT F

Reporting Forms

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH
RADON PROGRAM
INTIAL SCHOOL RADON MEASUREMENT REPORT FORM

Nov. 2010

The following form must be submitted to the Connecticut Department of Public Health Radon Program within ten (10) business days of providing a final written report of radon measurement activities to school personnel. Submit this signed form by mail OR fax to the Radon Program at the address listed below:
*Please use the *Re-Evaluation Report Form* when performing 5-year re-evaluations.

CT Department of Public Health Radon Program
410 Capitol Avenue, MS #51 RAD
Hartford, CT 06134-0308
OR
Fax: 860-509-7378

Name of School: _____

Address:
(Street, town, zip code) _____
_____
_____

Dates of Testing: _____

Testing Company: _____

Measurement Professional: _____
NEHA/NRSB Certification #: _____

Please provide the following summary information:

Total # of Rooms Tested: _____

Total # of Rooms Requiring Re-Testing: _____

Total # of Rooms Where Average Results Were at or above 4.0 pCi/L: _____

Radon measurement activities were carried out in accordance with United States Environmental Protection Agency protocols and the Connecticut Department of Public Health Radon Program's *School Radon Testing Guidance* at the location described above.

Signature of Measurement Professional	Signature of School Designee	Date

Phone: (860) 509-7367
Telephone Device for the Deaf (860) 509-7191
450 Capitol Avenue - MS # 51RAD
P.O. Box 340308 Hartford, CT 06134
An Equal Opportunity Employer

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH
RADON PROGRAM
SCHOOL RADON RE-EVALUATION REPORT FORM

Dec 2010

The following form must be submitted to the Connecticut Department of Public Health Radon Program within ten (10) business days of providing a final written report of radon measurement activities to school personnel. Submit this signed form by mail OR fax to the Radon Program at the address listed below:

CT Department of Public Health Radon Program
410 Capitol Avenue, MS #51 RAD
Hartford, CT 06134-0308
OR
Fax: 860-509-7378

Name of School: _____

Address:
(Street, town, zip code) _____

_____

_____

Measurement Company Name : _____

Please provide the following summary information:

Testing Dates: _____

Total # of Rooms Tested: _____

Total # of Rooms Requiring Re-Testing: _____

Total # of Rooms Where Average Results were at or above 4.0 pCi/L: _____

Radon measurement activities were performed at the location above in accordance with United States Environmental Protection Agency protocols and the Connecticut Department of Public Health Radon Program's *School Radon Testing Guidance.*

Measurement Professional / NEHA/NRSB #	Signature	Date
School Designee / Title	Signature	Date

Phone: (860) 509-7367
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