

Appendix A

Calculations

CALCULATIONS AND VALIDATION

Results Calculations

The pCi/L value, error estimate, and lower limit of detection (LLD) are calculated by the computer for each test using the formulas given below:

The computer software was generated by Alpha Energy Laboratories and is proprietary.

Radon Calculation Formulas

1. Radon Concentration Estimate Formula

$$pCi/L = \frac{(G/M) - (B/M)}{C \times E \times e^{-\lambda t}}$$

2. Lower Limit of Detection (LLD)

$$LLD = \frac{4.65 \sqrt{(B/M)}}{C \times E \times e^{-\lambda t}}$$

3. Error Estimate Formula

$$pCi/L = \frac{1.96 \sqrt{\left[\frac{(G)}{M} + \frac{(B)}{M}\right]}}{C \times E \times e^{-\lambda t}}$$

4. Where:

pCi/L	=	Picocuries per liter
LLD	=	Lower Limit of Detection
G	=	Gross counts
B	=	Background counts
M	=	Length of count (minutes)
C	=	Calibration factor calculated from calibration curve
E	=	Counter efficiency
λ	=	$\ln 2 \div 3.82 = 0.181$, which is the Decay constant
t	=	$T_c - T_m$ (days)
T_c	=	Time when sample was counted (Date and time)
T_m	=	$T_b + 0.5 D$, which is the Mid-time of sample collection (Date and time)
D	=	Test duration = $T_e - T_b$ (days)
T_b	=	Start time of test (Date and time)
T_e	=	Stop time of test (Date and time)

Control Charts Calculations

1. Definitions

a. Individual Relative Error

$$IRE = \frac{MVi - TVi}{TVi} \times 100$$

Where:

IRE = Individual Relative Error
MVi = measured value
TVi = target value (radon chamber test concentration)

b. Standard Deviation

$$S = \frac{\sqrt{\sum_{i=1}^n (X_i - X_{ave})^2}}{\sqrt{n-1}}$$

Where:

s = standard deviation
n = number of samples
 X_i = sample value
 X_{ave} = average sample value

c. Relative Percent Difference

$$RPD = \frac{|X_1 - X_2|}{X_{ave}} \times 100$$

Where:

RPD = Relative Percent Difference
 X_1 = concentration observed with the second detector
 X_2 = concentration observed with the second detector
 X_{ave} = average concentration

Efficiencies Calculation

$$E = \frac{G - (B/10)}{2.22 \times S}$$

Where:

E = Detector Efficiency
G = Gross counts (1 minute)
B = Background counts (10 minutes)
S = Ra 226/Rn 222 source activity, pCi

Appendix B

Information Sheets/Chain of Custody Report Example



**ALPHA ENERGY
LABORATORIES**

2501 Mayes Road, Suite #100
Carrollton, TX 75006
(800) 324-5928
radon@alphaenergylabs.com

THIS SPACE FOR LAB ONLY

SHORT TERM RADON TEST INFORMATION SHEET

TEST INSTRUCTIONS ON BACK

Please read ALL instructions before beginning test. Instructional Video online at DrHomeAir.com/RadonVideo

Please print legibly in dark ink. Made a mistake? Print another copy at DrHomeAir.com/Forms

Instead of completing this sheet, you may register your test information online at DrHomeAir.com/Register

Last Name:

First Name:

Mailing Address:

City:

State: ZIP: Phone # - -

How would you like to receive your report?
Please mark ONE box with an "X"

Email Fax Mail

Test results also available
Online 24/7 at DrHomeAir.com/Results

Email:

Fax:

***** THE TEST SHOULD BE RUN BETWEEN 48-96 HOURS *****

Record the Test Kit Serial # for your own records.
It is required when contacting the lab for any reason.
Tip: Take a picture of this completed form!

Test Kit Serial #:

Test Start Time:

Hour Min AM PM Mark AM or PM with "X" Month Day Year

Test Stop Time:

Test Floor: Basement 1st Floor 2nd Floor 3rd Floor + Other

Structure Type: Slab (No Basement) Crawl Space Basement Multi-Story (No Basement)

Closed House Conditions? Yes No

Testing Reason: Real-Estate Transaction Post Mitigation Personal Knowledge

Room Location:

(Example: Living Room)

***** COMPLETE ONLY IF TEST ADDRESS IS DIFFERENT FROM THE ADDRESS ABOVE *****

Test Address:

City:

State: ZIP:

***** COMPLETE ONLY IF TESTING IN NEW JERSEY (NJ) OR PURCHASING LAB RUSH SERVICE *****

Checks payable to Alpha Energy Labs

CREDIT CARD # \$10.00 NJ STATE FEE

CC EXP: - CSC: BILLING ZIP: \$10.00 RUSH SERVICE (OPTIONAL)

(Expiration Month) (Expiration Year) (3 or 4 Digit Card Security Code)

SIGNATURE: _____

DATE: _____

VSN: 7.0



Step 1 - BEFORE TESTING:

- **Read through all instructions on this sheet to fully understand the test and to avoid mistakes.**
Your test kit should include a charcoal radon sampler, this information sheet, and a return mailer.
- Please make sure to observe Closed House Conditions:
 - Make sure all exterior doors & windows are closed for at least 12 hours before starting the test.
 - Keep all exterior doors & windows closed during the test. **Normal entry and exit of your home is permitted.**
 - Dehumidifiers, heating, and cooling systems should be run normally. Avoid using vent or exhaust fans during the test.
- Questions? Refer to our Frequently Asked Questions online at DrHomeAir.com/FAQ, or email us at radon@alphaenergylabs.com.
- Instead of filling out this sheet, you may register your test online at DrHomeAir.com/Register. This will speed up your test results.
- Record your name, address, Test Kit Serial #, and test location on the front of this sheet. Make sure to record the Test Kit Serial # for your own records as well. The Test Kit Serial # is located on the plastic side of the radon sampler.
- Record your phone number on the front of this sheet. We will send you a text message when your report is complete. Leave your phone number blank if you do not want to receive this text message. We will not use your phone number for marketing purposes.
- Choose how you would like to receive your results. If you choose email, we will email your report from radon@alphaenergylabs.com.

Step 2 - START THE TEST:

- **Remove the charcoal radon sampler from the plastic bag. This starts your radon test.**
- Record your start time and date on this information sheet.
- Place the charcoal radon sampler using these guidelines:
DO:
 - Place the radon sampler on the lowest level of your home suitable for occupancy, whether it is finished or unfinished.
 - Place the radon sampler on a flat surface with the **paper side facing up**.
 - Place the radon sampler 2-7 feet above the floor.
 - Place the radon sampler at least 3 feet from exterior doors and windows.
 - Place the radon sampler at least 6 inches from any wall or large object taller than 6 inches.
DO NOT:
 - Do not puncture, rip, tear, peel, or remove the paper side of your radon sampler.
 - Do not place the radon sampler near heating or air conditioning vents, or a place where it will be exposed to constantly moving air.
 - Do not place the radon sampler where it will get wet.
 - Do not place the radon sampler in areas of high humidity (i.e. bathroom, crawlspace, or sump). In humid areas, only test for 48 hours.
 - Do not place the radon sampler in closets, crawlspaces, or confined areas.
 - Do not place the radon sampler in direct sunlight or near heat sources.

Step 3 - PLAN TO STOP THE TEST:

- **Make sure to stop your test within the correct time period. Tests exposed for less than 48 hours or more than 96 hours are invalid and cannot be analyzed. We recommend a 48 hour exposure.**
- Make a note of the following for your own records:
 - Test Kit Serial # (Tip: take a picture with your cell phone!)
 - Date you will ship the package, tracking number, and shipping method (i.e. FedEx Ground 1/30/2018)
- On the outside of the mailer, print the Test Kit Serial # in the appropriate box.
- **New Jersey Regulatory Fee – Only necessary for tests conducted in New Jersey:**
If you are testing in the state of New Jersey (NJ) please enclose a required \$10.00 payment for the New Jersey Regulatory Fee. In addition, you must enter this information sheet online for the New Jersey DEP: DrHomeAir.com/NJ
- **Lab Rush Service (Optional) – Report sent via email/fax by end of next business day after receipt:**
For lab rush service, fill out the section at the bottom of the information sheet, including cash, check, or credit card. The cost is \$10.00 per radon sampler. Be sure to check the RUSH box on the outside of the mailer or write RUSH. Unmarked rush tests will encounter delays.
- Lab rush service does not expedite your shipment to the lab; it only affects our processing time. We recommend expedited shipping.
- **No fees are required unless you are testing in New Jersey or wish to purchase Lab Rush Service.**

There is no time guarantee for regular analysis. If you must meet a deadline we strongly recommend expedited shipping and lab rush service.

Step 4 - STOP TESTING AND MAIL YOUR PACKAGE:

- Record the stop time and date on this information sheet and complete any missing info. Times & dates are required for a test result.
- **Place this information sheet, radon sampler, and payment (if applicable) inside the mailer and seal it tightly. This stops your radon test.**
- If you have more than one test, you can ship them all in one box or package. Each test must be sealed individually.
- **Mail the package immediately to Alpha Energy Labs at 2501 Mayes Road Suite #100, Carrollton, TX 75006.**
- We must receive the radon sampler within 10 days of stopping the test. We recommend expedited shipping – Priority Mail, UPS, or FedEx. **USPS First Class Mail is not guaranteed. If you ship with First Class you do so at your own risk.**
The time sensitive part of analysis is always completed on the day the test arrives in the lab. A complete result may take a few more days.
- Your report will be completed and sent to you 3-5 business days after receipt in most cases (rush service will speed up lab analysis).
- You can track test status & download results online at DrHomeAir.com/Results. Please allow 1-2 business days after receipt for lab tracking.

REPORT



c/o Alpha Energy Labs
2501 Mayes Road, Ste 100
Carrollton, TX 75006
DrHomeAir.com
(800) 324-5928

Report & Sample Dates

DATE RECEIVED: 7/18/2018
REPORT DATE: 7/24/2018

Laboratory Certification Info

NRPP ID#: 101132 AL
STATE ID#: N/A
ELAP ID#: 11430 NY

RADON TEST REPORT

YOUR RADON TEST RESULTS:

RADON LEVEL: **5.6 pCi/L**
TEST KIT SERIAL#: AE678080
LAB ID#: 1845714

TEST ADDRESS:

TEST FLOOR: Basement
TEST LOCATION: Basement
CLOSED HOUSE: Yes

TEST TYPE: Activated Charcoal
SAMPLE TYPE: Short Term
TEST METHOD: EPA-402-R-92-004

TEST START: 08:34 AM 07/14/2018
TEST END: 08:45 AM 07/16/2018
EXPOSURE: 48.18 Hours

RADON HEALTH RISK INFORMATION:

Radon is the second leading cause of lung cancer, after smoking. The more elevated a home's radon level, the greater the health risk to you and your family. Smokers and former smokers are at especially high risk.

Radon concentration is measured in picocuries per liter of air (pCi/L). The US Environmental Protection Agency and the Surgeon General strongly recommend taking further action when the home's radon test results are 4 pCi/L or greater. Even homes with very high levels can be reduced below 4 pCi/L. The EPA recommends that you use a NRPP/NRSB or state-approved contractor to correct radon problems. Radon levels less than 4 pCi/L still pose some risk and in many cases may be reduced. If the radon level in your home is between 2 pCi/L and 4 pCi/L, The US Environmental Protection Agency and the Surgeon General recommend that you consider correcting the problem in your home.

QA/QC - Short Term Radon Tests have an estimated accuracy of $\pm 5\%$ when used according to directions.

DISCLAIMER: Test results are only indicative of the sample as received by the lab. Incorrect information or improper procedures will affect results. Alpha Energy Labs did not provide sampling services unless otherwise indicated. This measurement is not necessarily predictive or supportive of measurements conducted at different times or different locations. Alpha Energy Labs is not responsible for the consequences of any action you do or do not take based on the test results. One sampler can test up to 2,000 square feet.

CONFIDENTIALITY: This report is confidential. If you receive the report in error, please inform the lab and destroy all copies.

Measurement Specialist / Laboratory Director

Date 7/24/2018

IF YOU HAVE QUESTIONS ABOUT WHAT YOUR RESULTS MEAN:

EPA National Hotline: (800) 557-2366, epa.gov/radon, or, call your State Radon Contact: (573) 751-6102

IF YOU HAVE QUESTIONS ABOUT HOW TO FIX A RADON PROBLEM:

Radon Fix-it Hotline: (800) 644-6999, epa.gov/radon, or, call your State Radon Contact: (573) 751-6102

WHAT DO MY TEST RESULTS MEAN?

If your test result is **below 2 pCi/L** you do not need to take further action at this time. The EPA recommends you retest every few years, and whenever you renovate the home.

If your test result is **between 2 pCi/L and 4 pCi/L** you should monitor your home. Your home is above the indoor average of 1.3 pCi/L. You can consider retesting now, or you can wait. However, The EPA recommends testing every 2 years to confirm your radon levels are not rising.

If your radon level is **4 pCi/L or greater** you should take further action. If this is your first test, The EPA recommends you conduct another test to confirm your initial reading. If you have tested multiple times and the average of those tests is above 4 pCi/L, you should fix your home.

HOW DANGEROUS IS MY RADON LEVEL?

RADON RISK IF YOU SMOKE

Radon Level	If 1,000 people were exposed to this level over a lifetime	The risk of radon induced lung cancer compares to	What To Do Next?
100 pCi/L	About 770 people could get lung cancer	110 times the risk of dying in a car crash	Fix your home
40 pCi/L	About 380 people could get lung cancer	95 times the risk of dying from poison	Fix your home
20 pCi/L	About 260 people could get lung cancer	250 times the risk of drowning	Fix your home
10 pCi/L	About 150 people could get lung cancer	200 times the risk of dying in a fire	Fix your home
4 pCi/L	About 62 people could get lung cancer	5 times the risk of dying in a car crash	Fix your home
2 pCi/L	About 32 people could get lung cancer	6 times the risk of dying from poison	Consider fixing between 2 & 4 pCi/L
1.3 pCi/L	About 20 people could get lung cancer	(Average indoor radon level)	(Reducing below 1 pCi/L is difficult)
0.4 pCi/L	About 3 people could get lung cancer	(Average outdoor radon level)	(Reducing below 1 pCi/L is difficult)

Note: If you are a former smoker your risk may be lower
Estimates are lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003)

RADON RISK IF YOU HAVE NEVER SMOKED

Radon Level	If 1,000 people were exposed to this level over a lifetime	The risk of radon induced lung cancer compares to	What To Do Next?
100 pCi/L	About 440 people could get lung cancer	63 times the risk of dying in a car crash	Fix your home
40 pCi/L	About 120 people could get lung cancer	30 times the risk of dying from poison	Fix your home
20 pCi/L	About 36 people could get lung cancer	35 times the risk of drowning	Fix your home
10 pCi/L	About 18 people could get lung cancer	20 times the risk of dying in a fire	Fix your home
4 pCi/L	About 7 people could get lung cancer	The risk of dying in a car crash	Fix your home
2 pCi/L	About 4 people could get lung cancer	The risk of dying from poison	Consider fixing between 2 & 4 pCi/L
1.3 pCi/L	About 2 people could get lung cancer	(Average indoor radon level)	(Reducing below 1 pCi/L is difficult)
0.4 pCi/L		(Average outdoor radon level)	(Reducing below 1 pCi/L is difficult)

Note: If you are a former smoker your risk may be higher
Estimates are lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003)

WHAT DO I DO NEXT?

Type of Test	# of Times		What do I do next?	What test do I use? (If retesting)
	Tested	Test Result		
Short Term (2-4 days)	1	<2 pCi/L	Retest every 2-3 years	Short Term
	1	2-4 pCi/L	Consider Retesting Now	Long Term or Short Term
	1	4-8 pCi/L	Retest Now	Long Term or Short Term
	1	>8 pCi/L	Retest Now	Short Term
Short Term (2-4 days)	2 or More	<2 pCi/L	Test every 2-3 years	Short Term
		2-4 pCi/L	Consider Fixing the Home	
		>4 pCi/L	Fix the Home	
Long Term (90-365 days)	1 or More	<2 pCi/L	Test every 2-3 years	Short Term
		2-4 pCi/L	Consider Fixing the Home	
		>4 pCi/L	Fix the Home	

HOW CAN I FIX A RADON PROBLEM?

If your radon level is at or above 4 pCi/L, you should fix your home. If your radon level is between 2 pCi/L and 4 pCi/L, you may wish to fix your home. For most homes, radon levels can be lowered to 2 pCi/L or lower.

We recommend only hiring contractors who are certified and trained in radon mitigation. To find a certified contractor you can:

Call your State Radon Contact at (800) 644-6999 or go to DrHomeAir.com/States

Go to DrHomeAir.com/Mitigation for a list of NRPP/NRSB certified contractors

Thank you for using our product. If you have future radon or mold testing needs, below is a coupon to purchase at discounted prices. You can fill out the coupon and return it to us, or order online using the coupon code: RADONREPORT

Mail in form or order online: DrHomeAir.com/Buy
Checkout coupon code: RADONREPORT

Product	Qty.	Special Price	Subtotal
Short Term Kit (2 - 4 Days)		\$10.76	
Real Estate Twin Pack (Two Short Term Kits + FedEx Return Postage)		\$26.96	
Long Term Kit (91 - 365 Days)		\$25.16	
Radon in Water Kit		\$25.16	
Mold Detection Kit		\$8.96	

Please Write Legibly

Checks can be made to
Alpha Energy Labs

Subtotal: _____

Shipping: **\$ 3.50**

Total: _____



**ALPHA ENERGY
LABORATORIES**

2501 Mayes Rd. Suite #100
Carrollton, TX 75006

Phone: (800) 324-5928
Fax: (972) 242-8860

Name _____

Address _____

City _____ State _____ ZIP Code _____

Phone _____

Email _____

Credit Card or Check No. _____ Exp. Date _____

Signature _____

Chain of Custody (Form 1-A)

Project Form 1-A (Rev.1 6/27/17)



ALPHA ENERGY
LABORATORIES

2501 Mayes Road
Suite 100
Carrollton, TX 75006
972-242-2479

PROJECT INFORMATION FORM

Project/School Name: _____

Mailing Address: _____

Testing Address: _____

Email/Fax: _____

Structure Type: Slab (No Basement) Crawl Space Basement Multi-Story (No Basement)

Testing Reason: Real-Estate Transaction Post Mitigation Personal Knowledge

Total Number of Test Kits: _____

Analysis Requested: Alpha Track (Long Term)

Total Number of Pages of Device Placement Log 1-C: _____

Activated Charcoal (Short Term)

Total Number of Pages for all forms: _____

****PLEASE NOTE ****

You must complete the Personnel Log Form 1-B and Device Placement Log Form 1-C and send in with the tests. Forms can be downloaded online at DrHomeAir.com/instructions

Test start and stop dates, start and stop times, as well as the test address zip code are required for test results.

Any information you would like to have on the reports must be included on these forms.

Chain of Custody (Form 1-B)

Project Form 1-B (Rev.2 7/6/17)



**ALPHA ENERGY
LABORATORIES**

2501 Mayes Road
Suite 100
Carrollton, TX 75006
972-242-2479

PERSONNEL LOG

Project Name: _____ *Please list any individuals who deployed or retrieved test kits.*

Printed Name	Signature	Initials	Date

****PLEASE NOTE ****

You must also complete the Project Information Form 1-A and Device Placement Log Form 1-C send in with the tests. Forms can be downloaded at DrHomeAir.com/instructions

Test start & stop dates, start & stop times, as well as the test address zip code are required for test results.

Any information you would like to have on the reports must be included on these forms.

Chain of Custody (Form 1-C)

Project Form 1-C (Rev.3 7/6/17)

DEVICE PLACEMENT LOG



Project Name: _____

Please list times in 15-minute intervals or less. Indicate AM/PM, or use 24-hour format. If kit goes missing, please note in Retrieval Time/Date section.

	Test Kit Serial #	Test Location	Deployment			Retrieval			Closed Y/N	Comments
			Time	Date	Initials	Time	Date	Initials		
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

****PLEASE NOTE ****

You must complete Project Information Form 1-A and Personnel Log Form 1-B and send in with the tests. Forms can be downloaded online at DrHomeAir.com/instructions

Note: Test start & stop dates and time as well as the test address zip code are required for test results.

Appendix C

QAM Forms A-G

QA MANUAL LOG: HISTORY OF REVISIONS

EFFECTIVE DATE	REV #	COMMENTS	INITIALS	DATE

Date: _____

Signature Card

Name	Signature	Initials
Electronic Signature (If applicable)		
Signature Stamp (if applicable)		

Quality Assurance Record Sheet

QAM Revision Number: _____

Date: _____

Employee Signatures to Confirm Training and Acknowledgement of New Manual:

#	Employee Name	Employee Signature
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

By signing this record sheet the employee confirms that he/she has received understands that he/she has access to the most current version of the QA Manual, and has released any and all copies of previous versions to the QA Manager.

QA Manager Signature: _____

Alpha Energy Laboratories Ethics and Data Integrity Commitment

I _____ (print name), state that I have read and understand the high ethical standards that I must uphold as an employee of Alpha Energy Laboratories. I am committed to performing my duties to the best of my ability while at the same time maintaining the level of integrity and quality of data for which our company is known. I further consent to hold all information pertaining to our clients' data completely confidential.

I agree that in the performance of my duties for Alpha Energy Laboratories and its clients, I shall strive to always conform to the following ethical standards and will report immediately to the Quality Assurance Office or an appropriate supervisor any information regarding the misrepresentation of data, or other inappropriate lab behavior that includes, but is not limited to:

1. Altering an instrument, computer, or clock for an inappropriate purpose.
2. Altering the contents of logbooks and/or datasheets to misrepresent data.
3. Forging or misrepresenting a technician's identity.
4. Changing raw data or reporting false or fake data.
5. Altering calibration procedures or standards to produce a certain result.
6. Failure to comply with standard operating procedures without proper documentation and approval.
7. Disposing of or deleting electronic data files or hard copies of raw data.
8. Engaging in any practice that ultimately misrepresents data or narratives in any way.
9. Failure to report any observed violation of the above standards by fellow employees.
10. Failure to maintain client confidentiality.

I will not knowingly participate in any of the above activities and will not tolerate such unethical practices by others. I also understand that confidentiality will be strictly enforced by Alpha Energy Laboratories in such matters. I am responsible for seeking approval to report data that may deviate from standard operating procedures or methods.

If I am unsure of how to handle data generated by me, I am responsible for seeking the advice and approval of the Quality Assurance Officer or supervisor. I agree to seek such information within 24 hours of the discovery.

I understand that if I knowingly participate in any unethical or prohibited activity that I am subject to disciplinary action that may include termination of my employment with Alpha Energy Laboratories, and that I may face individual prosecution from the appropriate authorities and possibly imprisonment.

My signature affirms my understanding of the consequences of violating this agreement as well as my commitment to its intent.

Signature

Date

Supervisor Signature

Date



2501 Mayes Rd. STE. 100
 Carrollton, TX 75234
 (800) 324-5928

Demonstration of Capability Statement

Date: _____

Analyst Certified under this statement: _____

Type of analysis: Analysis of short term activated charcoal test kits

Method Number, SOP Number: EPA 402-R-92-004 and ELAP 7036

We, the undersigned, certify that:

- 1) The technicians identified above, using the cited test method (s), which is in use at this facility for the analysis of samples under NELAP, have met the requirements for Demonstration of Capability.
- 2) The test method (s) was performed by the technicians identified on this certification.
- 3) A copy of the laboratory-specific test method (s) and SOPs are available for all personnel.
- 4) The data associated with the demonstration capability are true, accurate, complete, and self-explanatory (1).
- 5) All raw data (including this form) necessary to reconstruct and validate these analysis, and have been retained, and the associated information is well organized and available for review by authorized parties.

Laboratory Director's Name: Carla Earley **Signature & Date:** _____

This certification form must be completed each time a demonstration of capability study is completed.

- | | |
|-------------------|--|
| (1) True: | Consistent with supporting data. |
| Accurate: | Based on good laboratory practices consistent with sound scientific principles/practices |
| Complete: | Includes the results of all performance testing |
| Self-Explanatory: | Date properly labeled and stored so that the results are clear and require no additional explanation |