

Radon Mitigation and Measurement Safety Plan

For

Certified Environmental Contractors, LLC

255 Squankum Road

Farmingdale, NJ 07727

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Revision # in parentheses

## **Business Organization**

### **Owner**

Peter Lordy

### **Mitigation Specialist**

Angelo Spalluto MIS12289

### **Measurement Specialist**

Jason Elliott MES13784

Person responsible for health and safety:

Angelo Spalluto MIS12289

# Radiological Training

## Radiation Health Risks

- Radon-222 has been classified by the International Agency for Research on Cancer as being carcinogenic to humans. Elevated lung cancer rates have been reported from a number of case-control studies of underground miners exposed to radon and its decay products. There is sufficient evidence for the carcinogenicity of radon and its decay products in humans for such exposures
- Two studies show definitive evidence of an association between residential radon exposure and lung cancer. North American study and a European study, both combined data from several previous residential studies. They confirm the radon health risks predicted by occupational studies of underground miners who breathed radon for a period of years
- Radon Risk If You Have Never Smoked

Radon Level	If 1,000 people who never smoked were exposed to this level over a lifetime*...	The risk of cancer from radon exposure compares to**...	WHAT TO DO:
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 home fire	Fix your home
8 pCi/L	About 15 people could get lung cancer	4 times the risk of dying in a fall	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 person could get lung cancer	The risk of dying from poison	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 2 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult.)
0.4 pCi/L		(Average outdoor radon level)	

## Radiation Safety Practices

### ALARA Practices (As Low As Reasonably Achievable)

The ALARA radiation safety principle is based on the minimization of radiation doses and limiting the release of radioactive materials into the environment by employing all reasonable methods. ALARA is not only a sound radiation safety principle, but it is a regulatory requirement for all radiation protection programs. The ALARA concept is an integral part of all activities that involve the use of radiation or radioactive materials and can help prevent unnecessary exposure as well as overexposure. The three major principles to assist with maintaining doses As Low As Reasonably Achievable are time, distance and shielding.

#### Reducing external exposure

1. Time: Reducing the time of exposure can directly reduce radiation dose. Dose rate is the total amount of radiation absorbed relative to its biological effect. Dose rate is the rate at which the radiation is absorbed. Limiting the time of radiation exposure will reduce your radiation dose.
2. Distance: Increasing the distance between you and the radiation source you will reduce exposure by the square of the distance. Doubling the distance between your body and the radiation source will divide the radiation exposure by a factor of 4.

#### Reducing internal exposure

##### 1. Use Proper PPE

Using the proper personal protective equipment (PPE) such as respirators, safety glasses, etc. will help reduce the possibility of ingestion or absorption of radioactive materials.

- All new employees involved in radon mitigation who will be entering structures with unknown or elevated radon levels will be instructed in proper safety practices before entering
- Every reasonable effort will be made to maintain radon exposure as far below the dose limits as is possible
- Refresher radon safety training will be conducted annually

### Radon Testing

- Time in unknown or high level radon areas will be limited as much as possible
- Discussions with clients will be conducted in lower level radon areas, such as upper levels or outside the structure
- Samples are to be analyzed in low radon areas
- Calibration and set up of testing equipment shall be done prior to entering an unknown or elevated radon area

### Radon Mitigation

- Pre-mitigation test results will be made known to all mitigation workers prior to beginning work
- Area where work is to be performed shall be ventilated as much as possible
- Time spent in high radon areas shall be limited to the time required to complete the work
- Breaks and lunch shall not be taken in high radon areas
- Gasses from sub-slab suction systems shall be vented to the exterior, one foot above the roof

- Only those workers required to complete the mitigation shall be present in the structure being mitigated
- Smoking by employees shall not be permitted in the structure being mitigated
- Hands on training will be provided in the use of all tools and equipment
- Safety gear, including eye protection, ear plugs and respirators shall be worn in all situations where applicable
- Asbestos is to be avoided when possible. When not possible an expert shall be consulted

## **Record Keeping**

- Records of worker radiation safety training and annual refresher course shall be maintained during and up to one year after employees termination and shall include, the date of training, the instructor, length of session, and topics covered
- Records of employees performance on the safety test shall be maintained along with a copy of the test taken
- Safety records shall be available for inspection during normal business hours

## Radiation Safety Test

1. Most of the Radon in homes comes from:
  - A. Building Materials
  - B. Burning liquid propane in a fireplace
  - C. The underlying soil
  - D. Water while taking a 10 minute shower
  
2. According to EPA what is the rate of homes with elevated radon?
  - A. One in 15
  - B. One in 20
  - C. One in 30
  - D. One in 40
  
3. The radiation exposure tracking of NJ radon measurement technicians and specialists requires:
  - A. Continuous monitoring if exposure is 1 WLM/Y
  - B. Stop working if 4 WLM/y is approached
  - C. Annual exposure cannot exceed 4 WLM/Y
  - D. All of the above

4. The average indoor radon concentration in US homes is:

- A. 0.4 pCi/L
- B. 0.8 pCi/L
- C. 1.3 pCi/L
- D. 4.0 pCi/L

5. The Radon Action Level recommended in the US is:

- A. 2.7 pCi/L
- B. 4.0 pCi/L
- C. 5.4 pCi/L
- D. 8.0 pCi/L

6. The Equilibrium Ratio between the Radon Decay Products and Radon used by CERTIFIED to convert radon to Working Level is:

- A. 1.0
- B. 0.4
- C. 0.5
- D. 0.7

7. The minimum time of exposure for charcoal canisters and electret ion chambers is:

- A. 24 hours
- B. 36 hours
- C. 48 hours
- D. 4 days

8. Inhaled radon gas is more dangerous than inhaled radon decay products:

- A. True
- B. False

9. Radon decay products that plate out on surfaces present a health hazard:

- A. True
- B. False

10. The concentration of radon decay products is expressed as:

- A. pCi/L
- B. Bq/m<sup>3</sup>
- C. WLM
- D. WL

11. How many hours of continuous education are required for a NJ measurement technician to maintain his/her certification?

- A. 3 hours/year
- B. 4 hours/year
- C. 8 hours/year
- D. 16 hours/year

12. Which of the following radon measuring instruments is considered a short term passive measuring device?

- A. A continuous WL measuring device
- B. An alpha track detector
- C. A charcoal canister
- D. A continuous radon monitor using a pump to pull test air through its detector assembly

13. School testing in NJ requires:

- A. Test all rooms in contact with the ground or over crawl spaces
- B. Maintain a list of all test locations
- C. Record all information on chain of custody form
- D. Mark and sketch all test locations on a school floor plan
- E. All of the above

Measurement technician's or specialist's Name: \_\_\_\_\_

Certification ID # \_\_\_\_\_

Measurement Firm \_\_\_\_\_

Telephone # \_\_\_\_\_ e-mail \_\_\_\_\_

Passing score: 70%

Important: Every certified radon measurement technician or specialist must review the QA plan, pass the test and return the examination to CERTIFIED for evaluation in order to engage in radon testing in New Jersey.

## **Corrective Measures**

Should an employee fail the radiation safety test, they will be personally instructed in all areas of safety practices by the mitigation Specialist before being allowed to take the test again.

## **Exposure Tracking and Reporting**

- The certified specialist shall be responsible for tracking exposure of workers if there is a potential for exceeding 1 WLM/year
- The certified specialist shall review exposures on a quarterly basis
- Employees with exposure exceeding 2 WLM/year shall not be assigned mitigation work in higher radon structures
- The certified specialist shall notify workers in writing of estimated quarterly exposures
- Whenever the estimated exposure of a worker could exceed 4 WLM/year, and investigation shall be conducted and actions shall be taken to reduce radon exposure
- No employee shall be permitted to exceed 4 WLM/year from radon inhalation
- Exposure records shall be maintained for each employee exposed to elevated radon on a continuing basis
- Exposure will be calculated by using equations on page 14

## Working Level Month Exposure Form

Employee Name (Last, first and middle) \_\_\_\_\_

Cert. # \_\_\_\_\_

Business Name \_\_\_\_\_

Cert. # \_\_\_\_\_

### WLM Exposure

Period of Exposure (From - To) \_\_\_\_\_

Dose for the Period (WLM) \_\_\_\_\_

Total for Calendar Year (WLM) \_\_\_\_\_

Estimated Yearly Dose (WLM) \_\_\_\_\_

Corrective actions will be implemented if estimated exposures approaches or exceeds 2 WLM/year

## Formula for Tracking Exposure

Assumed ER (Equilibrium Ratio) 1.0

WL (Working Level) = (ER x pCi/L) / 100

WLM (Working Level Month) = ( Avg WL x hours) / 170

### Sample Equation

ER: 1

Highest radon level: 50 pCi/l

50 pCi/l = 0.5 WL

100

(0.5WL X 400 hrs/year) = **1.176 WLM/YR**

170 hrs/month

## **Corrective Actions for Exposure**

Quarterly reviews of radon exposure will help ensure no employee exceeds 2 WLM/year. Should Exposure exceed or approach 2 WLM/year corrective actions will be taken, Including:

- Limiting the employee to entering only lower level radon environments
- Not sending the employee into unknown radon environments
- Limiting mitigation work to only lower level areas such as the exterior of the building being worked on

Employees approaching 4 WLM/year will NOT be sent into ANY elevated radon environment for any reason and will instead be limited to office/shop work