Office of Radiological Protection

EPA PROTOCOL FOR THE MEASUREMENT OF RADON IN HOMES

August 2016

1. Scope

To ensure the results of radon gas measurements for a home can be compared with the national Reference Level (200 Bq/m^3) and to ensure the measurements are carried out in a consistent manner across the country, the radon gas concentration must be determined in accordance with the Environmental Protection Agency's measurement protocol as set out here. This protocol also includes detector handling and measurement procedures, the application of seasonal correction factors and required report contents. Separate guidelines are available covering radon measurements in workplaces and long-stay institutions[1,2].

2. Detector handling procedures

To ensure that the radon measurement is as accurate as possible it is important that:

- Detectors are ordered as needed so they are not stored for long periods of time before use. Due to the effects of aging and fading, detectors should not be stored for more than one year.
- Detectors should be stored in a freezer below -15˚C until dispatch to customers
- A unique identifier should be applied to each detector to ensure traceability
- Detectors returned by the customer should retain their unique identifiers and include details of the start and end exposure dates

3. Measurement procedures

The radon gas concentration shall be measured using a detector capable of integrating the radon exposure continuously over a period of not less than 3 months. Suitable devices include, but are not limited to CR-39[3] alpha track diffusion radon gas detectors. The annual average radon gas concentration for a home shall be determined using two radon gas measurements, one for the main living area and one for the main bedroom.

The average radon gas concentration for a home shall be calculated as the arithmetic mean of the measured values for the main living area and the main bedroom. Equal occupancy between the two locations shall be assumed. Where the measurement period is less than 12 months, the seasonal correction factors set out in Appendix 1 shall be applied in order to determine the seasonally adjusted annual average. A worked example of the use of seasonal correction factors is given in Appendix 1. It is this seasonally corrected average radon concentration that is compared to the Reference Level of 200 Bq/m^3.

It is important to ensure that customers place the detectors as follows:

- One detector should be placed in a bedroom that is in regular use. The second detector should be placed in a living room.

[1] Advice on setting a reference level for radon concentrations in long-stay institutions. www.epa.ie.
[2] Guidance notes to assist with the planning of radon surveys in workplaces. www.epa.ie.
[3] Register Trademark of Columbia Resins

- Avoid placing the detector beside window sills, radiators, fireplaces, television sets or inside any object.
- Detectors should be placed at least one metre above the floor for example, on top of a dressing table, coffee table or bedside locker.
- Detectors should be left in place for no less than 3 months and no greater than 12 months.
- The date on which the detectors are placed and removed and the placement location for each detector should be recorded.

4. Communicating radon test results

Where a laboratory is issuing test results to a supplier, ideally, these results should be issued in the form of a pdf. This will facilitate traceability of results.

The test report issued to the customer[4] shall include the following:

- The name of the testing service and the person responsible for issuing the report, including their signature.
- The name of the customer, or contact as appropriate
- The full address of the building tested
- The report date
- The unique identifier for each detector which is traceable to the original results
- A report reference
- The measurement period (start and end date)
- The actual measured radon gas concentration at the two measurement locations (bedroom and living room) in becquerels per cubic metre (Bq/m^3).
- Where the measurement period is less than 12 months, the seasonally corrected annual average radon gas concentration for the home in becquerels per cubic metre (Bq/m^3) should be included.
- The results should be compared with the national Reference Level for homes of 200 Bq/m^3.
- A suggested template for the above is given in Appendix 2.

Where the results of the test exceed the national Reference Level:

(a) For results between 200 and 800 Bq/m^3 the following additional information shall be included with the test report:
   - A link to or copy of the EPA booklet Understanding Radon Remediation.
   - A link to or list of radon remediation services as provided on www.radon.ie
   - A link to or copy of the leaflet radon and your health.
   - Advice to follow up remediation work with an independent test provided by a registered measurement service.

[4] Note that a pdf of results may be emailed to the customer

(b) For results between 800 and 2,000 Bq/m^3 in addition to (a), the customer should be called by phone to discuss the findings and ensure that the risks associated with their results are understood, specifically:

- Ensure placement of detectors within the home was correct. For example, placement of detectors in a cupboard can result in elevated results that are not present in the living areas.
- Outline health risks associated with exposure to radon including the increased risks to smokers.
- Outline options for reducing the radon levels in the home.
- Outline grant assistance that may be available from the Housing Section of the Local Authority and the Home Renovation Incentive Scheme.

Alternatively the customer should be referred to the Radon Section of the EPA for further advice.

(c) **For results exceeding 2,000 Bq/m^3, in addition to (a) and (b) the Radon Section of the EPA should be notified immediately of the anonymised results. This should include the individual results, the measurement date and the townland/ village/ town.**

Appendix 1
Seasonal Correction Factors Suitable for Use in Irish Homes

January	1.16
February	1.16
March	1.12
April	1.05
May	0.96
June	0.89
July	0.85
August	0.84
September	0.88
October	0.96
November	1.04
December	1.11

The seasonal correction factor to be applied to the measurement is obtained by averaging the monthly correction factors given above for the measurement period. The average of the two measured concentrations should be divided by the average seasonal correction factor to determine the seasonally corrected annual average.

For example, a measurement with the following results:

Bedroom: 150 Bq/m^3
Living Area: 210 Bq/m^3

Results in an average radon concentration of:

$$\frac{150+210}{2} = 180 \text{ Bq/m}^3$$

Where the measurement period covers the months of April, May and June, the seasonal correction factor is calculated as follows:

$$\frac{1.05 + 0.96 + 0.89}{3} = 0.97$$

The final, seasonally adjusted, average radon concentration is:

$$\frac{180}{0.97} = 186 \text{ Bq/m}^3$$

Note:

1. Only the results of radon measurements made in accordance with this protocol can be compared to the National Reference Level of 200 Bq/m^3.
2. Where measurements are carried out for periods greater than three months, the seasonal correction factors for each of the measurement months should be used to calculate the average correction factor.
3. Where the measurement includes 15 or more days of a month, the seasonal correction factor for that month should be included in calculating the average, otherwise it should not be included.
4. Some home owners request that more than two rooms be measured, for example, homes where the bedrooms may be on more than one storey or homes of more than two stories. Calculation of the average radon concentration for these homes should include all of the measurements carried out.
5. Seasonal correction factors are not applied to radon measurements in workplaces or long-stay institutions.
6. The above seasonal correction factors are derived from: Burke, O., Long, S., Murphy, P., Organo, C., Fenton, D. and Colgan, P.A. Estimation of seasonal correction factors through Fourier decomposition analysis – a new model for indoor radon levels in Irish homes. Journal of Radiological Protection. J. Radiol. Prot. 30 (2010) 433-443.

Appendix 2
Suggested Template for Radon Measurement Report

Name of Radon Measurement Service

Radon Measurement Report

Name and address of customer		*Measurement address*
Report date	*Report Reference*	*Measurement period*
Detector Number	Location	Radon Concentration (Bq/m^3)
	Living area	X
	Bedroom	Y
Seasonally adjusted annual average in building		Z

Since the seasonally adjusted average radon concentration in air in this home is below the national reference level of 200 Bq/m^3, the ***Radon Measurement Service*** advises that no further action is necessary.

Report issued by: *Signature of person responsible for issuing report*

Name of person responsible for issuing report
