



**Radiological Protection Institute of Ireland**

An Institiúid Éireannach um Chosaint Raideolaíoch

**Guidance notes to assist with the planning  
of radon surveys in workplaces**



# **Guidance Notes**

To assist with the planning of radon surveys in workplaces

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## **Introduction and Legislative Framework**

This is a guide to carrying out surveys in work places to determine if the radon gas concentration exceeds the national workplace Reference Level of 400 becquerels per cubic metre (Bq/m<sup>3</sup>). Employers who wish to demonstrate that radon concentrations in workplaces comply with national legislation can use this guidance to ensure that they do so.

It should be noted that there is a Reference Levels that applies to radon in homes of 200 Bq/m<sup>3</sup>. Some workplaces, such as prisons, nursing homes, psychiatric hospitals and live-in training units, also have residential areas. For those areas that are clearly residential the Reference Level for homes is applicable, while for those areas that are clearly workplaces the statutory value of 400 Bq/m<sup>3</sup> applies. For areas where there is a doubt as to whether they are residential or workplaces, for example a communal area in a prison or nursing home may be so regarded, the 200 Bq/m<sup>3</sup> Reference Level is recommended. For further guidance on this see the RPII's guidance at:

<http://www.rpii.ie/radon/longstay.htm>

Radon gas measurements in workplaces must be carried out in accordance with criteria specified by the Radiological Protection Institute of Ireland (RPII). These criteria, which are set out in this document, cover measurement techniques, the period of measurement, the number of detectors required and the selection of measurement locations within the workplace.

Regulations<sup>1</sup> governing radon in the workplace set a national Reference Level for radon gas concentrations in workplaces of 400 Bq/m<sup>3</sup> measured over a minimum period of 3 months. The RPII is the national organisation with regulatory and advisory responsibilities in matters relating to ionising radiation and has been assigned particular responsibilities under S.I. No. 125 of 2000. In accordance with S.I. No. 125 of 2000 an employer, or self-employed person responsible for a workplace, must undertake a radon survey on being directed to do so by the RPII. The purpose of such a survey is to determine if the radon gas concentration in the workplace exceeds the Reference Level. Workplaces to which S.I. No. 125 of 2000 applies are:

- (a) All underground workplaces, including mines and show caves
- (b) Above ground workplaces in High Radon Areas
- (c) Other workplaces which may be identified by the RPII as being liable to have radon concentrations in excess of 400 Bq/m<sup>3</sup>, averaged over a minimum period of 3 months

S.I. No. 125 of 2000 defines a High Radon Area as any area where it is predicted that 10% of dwellings will have radon concentrations greater than 200 Bq/m<sup>3</sup>. Maps which show these areas have been published by the RPII and can be viewed on its website [www.rpii.ie](http://www.rpii.ie).

Radon in the workplace also falls within the scope of the Safety, Health and Welfare at Work Act, 2005, regulated by the Health and Safety Authority (HSA). This Act requires employers to identify the hazards at the workplace, assess the risk to health and safety from these hazards and put in place measures to eliminate or reduce the risk. The HSA has stated that where radon gas is identified as a hazard in the workplace the employer has a duty, as with any other hazard, to assess the risk and eliminate or reduce that risk.

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<sup>1</sup> 1. Radiological Protection Act, 1991 (Ionising Radiation) Order, 2000 (Statutory Instrument No. 125 of 2000)

Radon is regarded as a potential hazard in the workplace and consequently all employers are required to carry out a risk assessment. A risk assessment may or may not involve a measurement and it may or may not be limited to a measurement. The following principles apply:

1. Outdoor workplaces would not be expected to have elevated radon concentrations and therefore no radon measurements would be required. This would apply to workers in the agricultural, fishing, construction and transport industries.
2. S.I. No. 125 of 2000 includes a general duty on employers in High Radon Areas to include radon in their risk assessment. This means that radon measurements should be carried out in indoor workplaces in these areas.
3. Workplaces in areas not designated as High Radon Areas do not need to carry out radon measurements unless there are specific reasons as to why high radon concentrations might be expected. For example, underground mines and showcaves as radon concentrations can be significantly higher in these workplaces. However, it is important to note that workplaces above the Reference Level can be found in any area of the country. While mines and showcaves are at particular risk other employers in areas not designated as a High Radon Area are urged to take a proactive approach and consider having radon measurements made.
4. All employers in High Radon Areas should refer to radon in their Safety Statement, the HSA publication “Guidelines on Risk Assessments and Safety Statements”, (2006) ([www.hsa.ie/eng/](http://www.hsa.ie/eng/)) provides guidance in relation to this.

## **Radon Measurement Techniques**

To determine if the radon gas concentration in a workplace exceeds the Reference Level the Regulations require that the radon concentration is measured over a minimum period of three months. Measurement over this time period is necessary as radon can vary considerably from day to day depending on factors such as building usage, ventilation rates and the prevailing weather. For such measurements, the use of passive detectors is generally the most cost effective and the most straightforward approach. These detectors are small, unobtrusive and harmless. The detectors are supplied by the measurement service, to which they are returned for processing after the measurement period. Normally, the survey can be done entirely by post. Purchase and placement of detectors can be carried out in-house.

The RPII holds a list of suppliers of radon measurement services. However, the RPII cannot warrant or endorse services provided by or available from these measurement services. The list is provided for information purposes only.

## **Carrying Out Measurements**

Before commencing radon measurements, it is first necessary to give careful consideration to the measurement locations and the number of detectors to be used. The following considerations should be taken into account

1. The primary purpose of the survey is to assess the concentration of radon to which workers are realistically liable to be exposed. Measurements, therefore, should be made at locations which are representative of actual or reasonably foreseeable worker occupancy. For this reason it will not be necessary to carry out measurements in areas such as corridors, washrooms, toilets, etc. which are unoccupied or occupied infrequently. As a general rule,

an infrequently occupied area is one where an individual is unlikely to spend more than 100 hours per year of their working time.

2. The main entry route for radon into buildings is through cracks and gaps in the floor. In general within a given building, basement and ground floor rooms are likely to have the highest radon concentrations. Normally, therefore, a workplace survey should be made in workspaces located on the ground floor and in sub-ground or basement levels, where these are frequently occupied.
3. At least two measurements should always be made in any workplace.
4. The recommended number of detectors per workplace is based on the number of offices or on the floor area to be surveyed and on the workplace type. Recommended measurement densities are set out in Table 1 for different workplace types.
5. Where a workplace consists of a number of different work area types, each type should be considered separately for the purpose of determining the number of detectors. For example, in a factory the number of detectors to be placed in the offices should be determined by the number of offices in the ground floor or basement areas, while the number of detectors to be placed in warehouses or workshops should be determined independently on the basis of the area of these workspaces.
6. Radon concentrations can vary significantly between adjacent buildings. Radon concentrations in an adjacent or adjoining building should not, therefore, be taken as indicative of the concentrations in a particular workspace. Therefore, where a workplace is divided over a number of adjacent buildings it is necessary that each building be surveyed.
7. 7. In the case of multi-storey buildings occupied by more than one employer, measurements made on the ground and basement levels would normally be sufficient for assessing compliance with the Reference Level for all workplaces in the building.

8. Where different employers are responsible for different floors of a multi-storey building, employers whose staff are located on upper floors should have radon measurements carried out unless they can confirm that the radon concentrations in the ground floor and basement workplaces do not exceed the Reference Level.
9. Where a large number of buildings are being surveyed, it is recommended that quality assurance be incorporated in the survey, to ensure the quality of the final results.

**Table 1      Survey Strategies for Above Ground Workplaces**

Workplace type	Number of detectors	Examples
Office-type accommodation	One detector per individual office	Banks, schools, Government premises, professional practices
Open plan office, and retail or workshop up to about 1000 m <sup>2</sup> , also public access areas	One per 200 m <sup>2</sup>	Administrative and call centres, light industry, hotel foyers
Areas from 1,000 to 5000 m <sup>2</sup>	One per 400 m <sup>2</sup>	Warehouses, small supermarkets
Very large areas of several thousand m <sup>2</sup>	One for each distinct area with obviously different environmental conditions. Not less than 1 per 500 m <sup>2</sup>	Large manufacturing or process plants, large warehouses
Basements	One in each separate room, section or area irrespective of size, even if infrequently used (but greater than 100 hours/year occupancy).	Bank vaults, mechanical and/or electrical control centres

## **Detector Placement**

Detailed instructions on placement of detectors should be provided by the measurement service. The following general principles should, however, be kept in mind:

1. Detector locations should be selected to provide a reasonable degree of security, as it is important that detectors are not moved or interfered with during the measurement period. It is recommended that detectors be clearly labeled and that the purpose of the survey should be explained to all workers (including cleaning staff).
2. Care should be taken to select locations where detectors are exposed to air that is representative of that in the workplace. Detectors should not be placed in enclosed spaces such as cupboards, or in direct proximity to a source of fresh air such as an air intake fan, permanent background ventilation or a frequently opened window. It is preferable to avoid placing detectors beside heaters or radiators. Where practicable detectors should be placed one to two metres above floor level.

## Glossary

### **Passive Detector:**

A detector used to measure radon gas consisting of a radiation sensitive element located inside a small plastic chamber. The alpha radiation released by the radon gas and its decay products strikes the element and damages it on a microscopic level. After chemical processing, the radiation damage on the element is analysed and the average radon concentration to which the detector was exposed during the measurement period is determined.

**Radon** means radon-222 gas in air.

**Radon Concentration:** This means the activity concentration of radon gas in terms of activity per unit volume of air. The unit of radioactivity is called the becquerel (Bq), with the activity concentration is measured in becquerels per cubic metre (Bq/m<sup>3</sup>). A becquerel is equal to one nuclear disintegration per second.

**Reference Level** This is a concentration of radon above which action to reduce the radon levels may be needed. In Ireland the Reference Level for radon in workplaces as specified in legislation is 400 Bq/m<sup>3</sup> averaged over any three month period.





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## **Mission Statement**

“In the three year period from 2008 to 2010 the RPII will grow the level of awareness and implementation of the measures needed to protect people in Ireland from the harmful effects of ionising (and non-ionising) radiation through scientifically based regulation, monitoring and advice.”

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