

Environmental **Radon** Newsletter

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Health Risks from Radon

This short document outlines the main facts about radon with emphasis on the health risks of domestic exposures. It was produced by the National Radiological Protection Board in conjunction with the Chartered Institute of Environmental Health and the Faculty of Public Health Medicine.

Executive summary

The natural radioactive gas radon occurs in varying concentrations in all homes and workplaces. Inhaling radon causes the sensitive cells of the lungs to be irradiated. Under most circumstances the risk is small but nevertheless, living for a lifetime in a house where radon is at the Action Level of 200 Bq m⁻³ carries a 3%-5% risk of fatal lung cancer (a quarter to a half of all such deaths are in non-smokers). It is estimated to be the second leading cause of lung cancer after cigarette smoking.

The excess of lung cancer caused by inhalation of radon can be detected in epidemiological studies. It has been suggested that radon may also cause other types of cancer, for example, leukaemia. On theoretical grounds, some such radon induced cancers would be expected, but these would be far fewer than the lung cancers and have not been detected in well-designed epidemiological studies.

Radon originates from natural uranium in the ground, though the processes by which it concentrates in one house rather than another

are complex. Nevertheless, radon maps have been developed to show where houses are particularly at risk.

A number of techniques are available to measure radon concentrations. However, radon levels fluctuate greatly with time, and an extended measurement period is required to obtain an accurate estimate of the true annual average. Short-term measurements (typically over one week) can provide rough and ready screening.

Since the 1980s, government policy has been to control radon levels in houses with the highest concentrations. This has been taken forward by identifying and remediating existing houses and also by installing preventative measures as new houses are built in the areas most at risk. Measures to prevent radon from entering new buildings can easily be incorporated as they are being constructed. Remedial measures to reduce levels in existing dwellings are typically no more difficult or expensive than other minor building works.

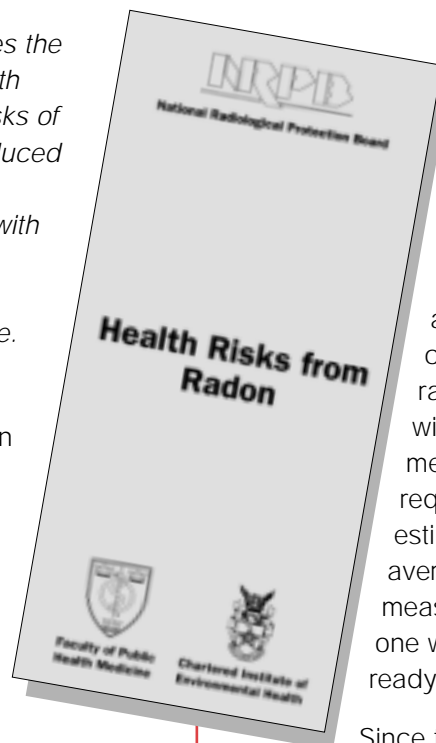
Single copies of the booklet can be obtained from NRPB Information Office, Chilton.

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For multiple copies, a charge of £2.00 per copy will be made.



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Radon Protection Is For Life - Not Just Handover

Chris Scivyer, Kim Noonan, Building Research Establishment Limited

Since 1991, installation of radon protective measures has been required within new dwellings in areas affected by radon. The areas of the country for which these requirements apply were revised last year with the publication of the 1999 edition of BRE Report BR211 *Radon: Guidance on protective measures for new dwellings*.

Practical cost effective technical solutions were developed by BRE working with house-builders during the mid to late 1980s. Their effectiveness was confirmed when some 300-400 new homes were monitored between 1989 and 1991. The measures have been installed routinely in new houses ever since.

There has however always been a nagging question as to whether the measures would perform adequately in the long term – firstly in preventing radon entry but secondly in not causing any long term adverse effects. There had been concerns that providing a radon barrier across the whole footprint of a building could result in possible damp penetration where the barrier passed through cavity walls. To prevent moisture ingress it was recommended that a cavity tray be installed to drain any moisture in the cavity to the outside of the building. Although cavity trays are not a new idea, their past use had resulted in some construction problems, hence the concern.

In order to answer these questions BRE recently undertook a study for the Department of the Environment Transport and the Regions looking at long term durability. A sample of 73 homes monitored between 1989

and 1991 were re-visited to see whether radon levels remain low and check for signs of any construction defects.

Householders were asked whether any significant changes had been made to their homes since the earlier study eg, replacement windows, extensions, which might have affected radon levels. They were also asked whether they were aware of any damp or structural problems with their homes. Twelve homeowners reported problems with their homes, but after talking with them it was possible to eliminate the inclusion of radon protective measures as a possible cause in all cases.

As with the earlier studies, radon measurements were made in each house for a three month period. In all cases the results were found to remain well below the 200 Bq m⁻³ Action Level recommended by NRPB. The measures continued to provide a fairly constant level of radon protection over time.

Although this study only looked at ten year old properties, the materials used to provide the radon protection in these buildings are all derivatives of materials with a long pedigree of use within the construction industry, so there is no reason to expect that they will not continue to perform adequately in the future.

The good news is that the results of this study confirm that the radon protective measures that are routinely installed in the UK do provide long term protection against radon and do not result in any long term building defects.

Assessing Workplace Risks

Daryl Dixon, National Radiological Protection Board

An important element of the Ionising Radiations (IR) Regulations 1999 is the formal requirement for an assessment of risks. While this has always been an obligation on employers, it was previously required by the Management of Health and Safety at Work (MHSW) Regulations which address the whole range of hazards, amongst which radon is often not perceived as an obvious and important issue by employers. Inclusion of risk assessment in the IR Regulations brings a sharper and more explicit focus to the issue of radon, which will affect all employers with premises in which there might be significant exposures.

The requirement for a risk assessment takes effect at a radon concentration of 400 Bq m⁻³, which may occur in a wide range of workplaces such as offices and other premises in radon-prone areas, but also in many types of underground work area including for example, basement stores, mines, caves, as well as water, telecommunications and military installations.

Although appraisal of risks in the workplace is a common feature of work planning, the formality associated with a written assessment under the Regulations will be less familiar to many employers. The scope of an assessment will vary greatly depending on the potential for exposure, but should not consume a disproportionate amount of effort. An assessment of risks will usually be based on measurements, normally with passive monitors over a period of three months. This will provide a reliable indication of long term exposure and therefore risk.

In the simplest case, when all results are below 400 Bq m⁻³, the Regulations do not apply and no further action is required. When the result of any measurement exceeds the threshold, the preferred action will be to reduce radon levels to below it to minimise exposures. The requirements of the MHSW Regulations continue to apply: it is important to ensure that the remedial work has been effective, and remains so. This will require measurements immediately after remedial work and at annual intervals.

If levels are not reduced, for example where occupancy of a high radon area is extremely low or

remediation very difficult, a risk assessment will need to include a more thorough analysis of exposure conditions. This analysis will consider the radon levels in different areas of a site (and perhaps at different times within an area), and the time that occupants spend in each location, so that the cumulative exposure can be estimated. Where estimated doses are less than 1 mSv, generally because of very low occupancy, the employer may choose to set up a scheme of surveillance with periodic measurements and reviews, as an alternative to remediation.

Increasingly, employers with large building stocks and a diverse range of work activities wish to demonstrate unequivocally that risks have been properly addressed and where appropriate, reduced, over the whole range of their operations. This requires a more comprehensive risk assessment, often involving radon measurements in all workplaces whether or not they are in radon-prone areas.

While this is rarely necessary for small employers, larger organisations can find such an exercise a valuable means of reassuring employees that they are all properly and equally protected from radon exposure. There are indications that for the relatively low costs involved and the peace of mind that it provides, reassurance monitoring is the preferred choice of the more safety conscious employers.

Stages in assessing and reducing radon risk

Stage	PROCEDURE
1	Identify radon prone working areas
2	Measure radon concentrations
3	Estimate exposure conditions and assess doses
4	Implement remedial measures if required

Radon and Land Use Planning

Don Appleton (British Geological Survey), *Jon Miles* (National Radiological Protection Board), *Chris Scivyer* (Building Research Establishment Ltd) and *Philip Smith* (Land Use Consultants)

Limitations in the administrative and policy responses to radon problems in new development have been addressed by a Department of the Environment, Transport and the Regions (DETR) research programme*. This aims to identify the circumstances where new development may be adversely affected by radon and to develop appropriate responses. This will help to ensure that occupiers of new domestic and non-domestic developments will be adequately protected against the harmful effects of radon.

The report on this programme:

- describes administrative responsibilities and policy responses
- summarises how radon in new development is dealt with through the building control system
- describes a potential planning response that may deal with some of the perceived limitations in the current response through building control
- provides a recommended framework for guidance for building control, planning and environmental health.

There are four main categories of new development or changes of use which may result in people being exposed to radon emissions:

1. new dwellings or extensions; material alteration to dwellings or conversion to domestic use
2. new workplaces or residential institutions or material changes to workplace use
3. change from workplace to domestic use, not involving material alteration or conversion
4. change from domestic to workplace or non-domestic residential use, not involving material alteration or conversion.

The report recommends that the role of the planning system should be confined to the provision of information about the radon problem and how it can be overcome. This information (about the application of relevant Building Regulations, Health and Safety Legislation, etc) should be contained in development plans and in decision letters about individual planning applications. The radon issue should be addressed as part of the current revision of PPG 23 on Planning and

Pollution Control (Contaminated Land) and the Technical Advice Note on Planning, Pollution Control and Waste Management in Wales. A system based on planning 'informatives' may be the most practical option for ensuring that radon protection is adequately dealt with in cases of material change of use (such as barn conversions) or non-domestic development, including workplaces and certain residential institutions.

Detailed guidance on areas where radon protection is necessary, and construction details of radon protective measures, are provided in Building Research Establishment report BR211, 1999 edition (see newsletters 22 and 23). The maps in BR211 identify the areas where radon protective measures are required in new dwellings and extensions (Category 1 above). These maps could also be used to indicate where it may be advisable to install protective measures in Category 2 developments and where it may be advisable to monitor for radon in Category 3 and 4 developments, in order to verify whether remedial measures are required.

Regulations and guidance designed to protect the health and safety of employees and others who have access to workplaces are enforced by the HSE and Local Authority Environmental Health Departments. Employers occupying Category 2 and 4 developments in radon-prone areas for the first time would be responsible for carrying out a suitable and sufficient radon risk assessment.

Although the framework for guidance is directed towards dealing with radon emissions in new development in England and Wales, many aspects of the framework would also be applicable, in principle, to new development in Scotland and Northern Ireland.

* Dealing with radon emissions in respect of new development: Summary report and recommended framework for planning guidance. J D Appleton, J C H Miles, C R Scivyer and P H Smith, British Geological Survey Research Report RR/00/07, Price Code GG (£10) ISBN 0-85272-365-2. Available from the BGS Sales Desk: British Geological Survey, Keyworth, Nottingham NG12 5GG. Tel: +44 (0)115-936-3241; Fax: +44 (0)115-936-3488; e-mail: sales@bgs.ac.uk. The report may be downloaded from www.bgs.ac.uk/free/radon/radon.html