Environmental Radon Newsletter

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UK Radon Forum 2009

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The seventh UK National Radon Forum was hosted by the Health Protection Agency (HPA) in Oxfordshire on the 23rd February 2009. The meeting was fully subscribed with delegates coming from all over the UK and abroad. There was plenty of time over the day for networking and discussion between delegates. A pre-meeting introductory overview of the UK's radon problem for delegates new to the subject, or those who just wanted a refresher, was given by Jane Bradley of the HPA.

The meeting was opened by Neil McColl, who has recently taken overall responsibility for the HPA radon work. The first talk was by Dr John Cooper, one of the HPA Deputy Directors, who outlined the HPA's recommendations to UK government on radon protection measures for new buildings (see Environmental Radon Newsletter 56). Martyn Green (HPA) provided an initial analysis of the effectiveness of basic radon preventive measures (a radon membrane across the footprint of the building). He reported a significant reduction in radon exposure in new buildings in those areas where Building Regulations require basic radon preventive measures.

Chris Scivyer is a member of the independent Building Regulations Advisory Committee, charged with providing advice to the UK government on revision of the Building Regulations in England and Wales in 2010. Mr Scivyer, from the Building Research Establishment, presented some suggested revisions to the regulations, to increase their effectiveness in preventing radon entry into buildings. He welcomes comments from interested parties on proposed changes to the regulations (see Points of Contact).

The new UK radon map dataset, based on joint work by the HPA and the British Geological Survey (BGS), had been launched at the previous forum in 2007 (see Environmental Radon Newsletters 51, 53 and 54). At the 2009 meeting, Daryl Dixon (HPA) reported on how large clients (for example local authorities, district councils, solicitors and environmental search providers) and smaller clients (individual householders, new buyers, small businesses) are using the radon dataset. Both types of customers use www.UKradon.org to identify whether a property is in a radon Affected Area. Some larger businesses with multiple properties prefer a more tailor-made service. Jane Smithard (HPA) outlined some new services being offered to meet the needs of clients with large property portfolios, or with very large buildings.

Anthea Brown from the BGS gave a useful presentation outlining the options for the largest users of the radon dataset, local authorities. Licensed digital data is available from BGS enabling local authority staff to answer the 'CON29' radon question, which is a standard question during house purchases in England and Wales, and other queries. Local authorities are responsible for stating whether a property is in a radon Affected Area or not. This information is available from the full digital dataset only. The printed indicative map only indicates the worst-case scenario for each 1-km grid square and can only be used to answer the CON29 radon question for the lowest band 0-1%. Thus a local authority may answer the CON29 radon question incorrectly if it relies on the indicative map.

The full digital dataset is available for purchase by local authorities under licence direct from BGS. It is also available for use in geographical information systems that local authorities are already likely to be using to answer other parts of the CON29 legal document. All enquiries on obtaining and using the digital radon data can be sent to enquiries@bgs.ac.uk. For new property developments, where a postcode may not be available, all users can verify if a location is in a radon Affected Area or not by contacting http://shop.bgs.ac.uk/georeports/.

The last session of the day was about radon work by local Authorities, and was chaired by Robert Larmour of the Environment Agency of Northern Ireland. Gareth Thomas, from the Health and Safety Executive presented advice on how local authorities can ensure workplaces in their enforcement areas are complying with legal requirements. Mr Thomas outlined various successful strategies in use by authorities for addressing workplace radon issues, including

- provision of information and advice to employers
- working with stakeholders, such as Chambers of Commerce and local trade bodies
- working directly with employers

The final presentation of the day was from David Gell of Broxtowe Borough Council, who gave an enlightening talk on how his council found public funds to remediate high homes in an area newly identified as having radon problems in the latest HPA England and Wales radon map.

If you would like to be notified about the next UK radon forum, please email radon@hpa.org.uk or telephone 01235 822622.

POINTS OF CONTACT

www.UKradon.org provides general information on radon, and also an estimate of the probability that an individual property in England and Wales is above the Action Level for radon.

Building Research Establishment (BRE)
Garston, Watford, WD2 7JR
www.bre.co.uk/radon

Radon Survey
Radiation Protection Division,
Health Protection Agency
Chilton, Didcot, OX11 0RQ
Tel 01235 822622
email: radon@hpa.org.uk
www.hpa.org.uk/radon

Welsh Assembly Government
Housing Division
Cathays Park, Cardiff, CF1 3NQ
Tel: 01222 825219
Fax: 01222 825391

Northern Ireland Environment Agency
Klondyke Building, Cromac Avenue
Gasworks Business Park
Lower Ormeau Road
Belfast BT7 2JA
Tel 02890 569305
Fax 02890 569263

Scottish Executive Development Department
Housing Division 1
First Floor East, Victoria Quay
Edinburgh, EH6 6QQ
Tel: 0131 244 5575
Fax: 0131 244 5596

Health and Safety Executive
Health Directorate B6
Rose Court, 2 Southwark Bridge
London, SE1 9HF
Tel: 020 7717 6854
Fax: 020 7717 6717
www.hse.gov.uk/radiation/ionising/radon.htm

Radon South West Committee
Secretary: Gerald Hudd
46 Parkfield Drive, Taunton
Somerset TA1 5BU
Tel: 01823 355194
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Derbyshire Radon Steering Group
c/o Environmental Health Department
Derbyshire Dales District Council
Town Hall, Matlock
Derbyshire, DE4 3NN

The Radon Council Limited
PO Box 39, Shepperton
Middlesex, TW17 8AD
Tel: 01932 221212
Fax: 0870 0518551
email: info@radoncouncil.org
www.radoncouncil.org

Laboratories validated by the HPA for making measurements of radon concentrations in homes are listed at:
www.hpa.org.uk/radonvalidation

To obtain a report on the requirement for radon protective measures for building sites, go to http://shop.bgs.ac.uk/Georeports

Radon Validation Scheme – 2008 Revision

Chris Howarth, Health Protection Agency, chris.howarth@hpa.org.uk

The Health Protection Agency (HPA) has operated a radon Validation Scheme* for laboratories measuring radon in UK This has been in operation since 1991 and has recently been updated and revised. The Scheme ensures a common methodology for determining and reporting radon measurements in homes. It is based on existing accreditation systems for measurement laboratories.

Technical accreditation schemes assess the ability of a laboratory to carry out measurements in an accurate and consistent manner. The HPA's radon Validation Scheme achieves this by evaluating a supplier's performance both when it first applies to become a Validated Supplier and at regular intervals to remain Validated. These assessments are carried out in the HPA radon chamber, which is regularly calibrated with primary sources from the National Physical Laboratory, Teddington, Middlesex, or from the German equivalent organisation, Physikalisch-Technische Bundesanstalt.

For the initial full performance test, detectors are exposed over a wide range of radon exposures that can be expected in UK homes. The supplier provides 35 detectors; five of these are used to assess transit exposure, and the remainder are split into three groups of ten and given three different radon exposures. All of the detectors are then returned for processing and reporting of exposures. The supplier is not told what the exposures are or which detectors are grouped together until it has reported the individual detector results to the HPA.

The supplier's results are assessed by the HPA. To pass the performance test, the results for each group must meet criteria laid down in the Scheme for accuracy and precision of results. Later performance assessments are simpler with only the transit and a single exposure group assessed. A supplier which fails an on-going performance test must pass a full test in order to remain Validated.

The HPA radon Validation Scheme is different to most accreditation programs (which normally deal exclusively with technical matters) by requiring the organisation to have in place procedures for dealing with issues such as minimum exposure periods for radon measurements, how results are reported to householders, data protection and how customer complaints are dealt with. This is achieved by assessment of a supplier's Validation Manual (a document submitted by a supplier applying for validation status) demonstrating stage by stage how the supplier complies with the Scheme, with additional supporting documentation such as standard written procedures and staff structure.

The latest revisions* simplify and clarify how a laboratory can comply with the Scheme and there are two major changes:

- estimated annual average radon concentration in a home may now be calculated using corrections based on the average outdoor temperature in the local region of the home during the exposure. The original method of using seasonal correction factors also remains valid.
- the performance test now includes an assessment of the mean transit exposure of radon detectors. This must be below the equivalent of a three-month exposure at 20 Bq m^{-3}, which is the average radon concentration in UK homes. This change reduces the possibility of 'false positives', ie a householder being informed their home is above the UK radon Action Level when it is not.

Government departments with responsibility for radon in homes have requested local authorities give favourable consideration to grant applications for radon remediation only when supported by measurements carried out by a Validated Supplier.

A full up-to-date list of Validated Suppliers can be found at:
www.hpa.org.uk/radonvalidation

**Validation Scheme for Organisations Making Measurements of Radon in Dwellings: 2008 Revision.* CB Howarth and JCH Miles. HPA-RPD-047. Available for free download from the HPA website, www.hpa.org.uk.

Effectiveness of radon preventive measures in new homes

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An early study showed that installing radon preventive measures in new homes can be effective in reducing radon concentrations. An examination of recent data collected by the Health Protection Agency (HPA) confirms a substantial lowering of radon concentrations in homes built with basic radon preventative measures.

In 1992, the Building Research Establishment (BRE) published research showing that basic radon preventive measures (a barrier across the whole footprint of the building) could reduce the concentration of radon in new homes by about half*. The builders of the homes tested were aware that the effectiveness of the barriers was being monitored, so they may have been more careful than builders not monitored. It is helpful to assess the effectiveness of the measures in practice, as applied on many building sites, since that initial research was done.

The results of measurements carried out by HPA in four local authority council areas after 2004 provide an opportunity to quantify the effect of the changes in the Building Regulations in England and Wales in reducing the exposure of the public to radiation from radon. The surveys of radon concentrations in homes were carried out by the HPA in areas with a greater risk of high radon concentrations where basic radon protection are now required under the Building Regulations (see chronology below). The analysis presented here is preliminary, and does not take account of individual house characteristics.

Radon concentrations were measured in over 21,000 homes in the higher radon risk areas of four council areas. As would be expected, the majority of these homes, about 18,000, were built prior to 1993, when the requirements under the Building Regulations came fully into force – once allowance is made for the planning processes. The remaining homes, around 17%, were built after 1993. Some of these homes will have had just basic radon protective measures, and some will have had both basic and full protective measures. For this reason, the results are not directly comparable to those in the original BRE study. The results (see table) show significant reductions in both mean radon concentrations and in the proportion of homes above the radon Action Level. The reduction in radon concentration, 42%, is not quite as great as in the original BRE study, but is still substantial.

The results show that the average radon concentration in the homes built after the 1993 changes is 77 Bq m^{-3} lower than in homes built before that date. This equates to a radiation dose reduction to each occupant of around 40% (or over 3 mSv y^{-1}). To put this into context, the average radiation dose to a typical member of the population from all sources of ionising radiation is 2.7 mSv y^{-1}. The changes to the Building Regulations in these areas have therefore resulted in significant reductions in radiation exposures.

**The principles of radon remediation and protection in UK dwellings*. M. Woolliscroft, Radiation Protection Dosimetry, 42, 211-216, 1992.

	Number of homes measured	Proportion above Action Level	Mean radon concentration, Bq m^{-3}
Built before 1993	18,000	26%	184
Built after 1993	3,730	12%	107

Brief chronology of changes relating to radon in building regulations and formal advice from the HPA.

1987. NRPB publishes advice to limit exposure to radon decay products in dwellings including a recommendation to implement changes to building procedures in areas of the country where high levels of radon are likely. National Radiological Protection Board, *Exposure to radon decay products in dwellings.* Chilton, NRPB, ASP10 (1987), (London HMSO).

1988. Building Regulations Division, Department of the Environment. *Interim guidance on construction of new dwellings.* London, DOE, June 1988.

1990. NRPB publishes revised advice on radon in homes including the provision of precautions in new homes. *Board statement on Radon in Homes*, Documents of the NRPB, vol 1, no 1, 1990, ISBN 0-85951-322-X.

1991. *Radon: guidance on protective measures for new dwellings.* Building Research Establishment Report, BR 211. ISBN 0 85126 5116.

1993. BR 211 reprinted with 1992 revisions. Identified by "1992 revision" on cover.

1999. *Radon: guidance on protective measures for new dwellings in Scotland.* Building Research Establishment Report, BR 376. ISBN 1 86081 3348

1999. New edition of BR 211 published, came into force 14 February 2000. Identified by "1999 edition" on cover.

2000. Revision of annex B map for parts of Suffolk notified by circular letter from BGS, dated 10 October 2000.

2000. *Building Regulations (Northern Ireland)* 2000. ISBN 0-337-01096-X. Came into operation 1st April 2001.

2001. *Radon: guidance on protective measures for new dwellings in Northern Ireland.* Building Research Establishment Report, BR 413. ISBN 1 86081 4697

2002. Revision of the annex B map for Wiltshire notified by circular letter from BGS, dated 29 April 2002.

2007. *Radon: guidance on protective measures for new buildings.* Building Research Establishment Report, BR 211. ISBN 978-1-84806-013-5. Identified by "2007 edition" inside cover.

2008. HPA gives advice on radon measures for new homes (press release of 21st May 2008).

Factors affecting seasonal variation in radon

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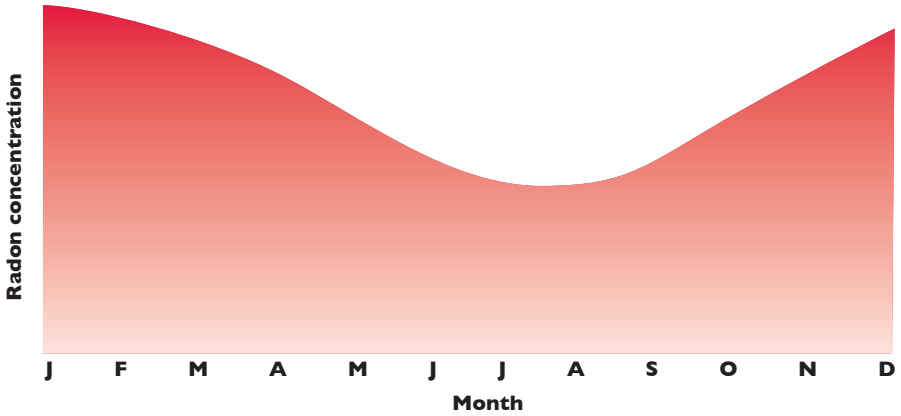
Radon measurements in homes conducted nationwide some 30 years ago revealed a strong seasonal variation in radon concentrations, peaking in the winter and at their lowest in the summer, as shown in the figure.



Typical seasonal variation in UK homes

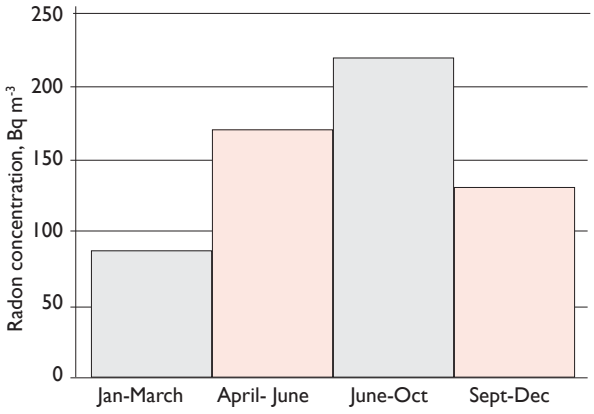
The primary mechanism causing this variation is an increased draw on soil gases due to an under-pressure in buildings created by rising indoor air when there is a large difference in temperature between indoors and out. This is generally compounded by reduced ventilation during the colder months. The laboratories validated for measurements in UK homes (see the article on page 2) apply standard seasonal corrections to all readings to allow for this. For the majority of homes, the corrected results provide a more representative annual average to compare to the Action Level of 200 Bq m^{-3}.

Changes in outdoor temperature and indoor heating and ventilation are the main, but not the only causes of varying radon levels within a building. Some environmental factors can cause a few homes to deviate from the normal pattern. Waterlogged ground can reduce the movement of soil air carrying radon. Wind strength and direction are known to alter the movement of air through buildings, which affects the ingress of soil gases. Unusual weather conditions during a radon measurement will add uncertainty to short-term tests of one to two weeks but are less likely to be a problem for the recommended longer measurements over periods of three months.

There is evidence that another factor, underlying karst geology, can sometimes affect seasonal patterns of radon level. 'Karst' is the description given to limestone regions where dissolution of the rock along internal weaknesses has created a network of voids through which water and air can flow. The White Peak of Derbyshire is the largest area of karst in the UK. It is a hilly terrain containing underground caves and passages which have been added to by mining activity. Intrusions of igneous rock in this area provide a source of mineral wealth but also of radon, which is readily transported through the natural and man made passages.

Research into radon levels in homes on karst terrain have shown that seasonal variations of radon levels in buildings can deviate from the normal pattern. The figure below shows a pattern of seasonal variation in one home which is the reverse of the normal 'winter high, summer low' pattern. This phenomenon is attributed to pressure-driven air movement down through the hill to the base during summer months. It is, however, quite difficult to categorise properties on such terrain in a useful quantitative way, and this limits the extent to which individual adjustments can be applied to results.

The few karstic limestone areas in the UK tend to have a low population density, so there are comparatively few homes on this type of geology. Surveys conducted in these areas suggest that the proportion of homes exhibiting large differences from the normal pattern of seasonal variation is small. There are, of course, many factors that can affect the interpretation of radon measurements, and HPA is considering the significance of the effect of karstic geology in relation to uncertainties caused by other environmental influences. The greatest potential for uncertain results in general remains that associated with very short testing periods.



Unusual seasonal variation in radon concentration in one house on karstic terrain

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