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New radon map for England and Wales

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The Health Protection Agency (HPA) and the British Geological Survey (BGS) plan to issue a new radon map of England and Wales in July 2007. It is intended that this map will be used for:

- targeting surveys of radon in existing homes
- answering the 'CON29' question about whether a house to be purchased is in a radon Affected Area
- defining areas for radon preventive measures in new houses

HPA and BGS have worked together over a number of years to improve the accuracy of mapping radon potential, the estimated percentage of houses above the Action Level. The method used is described in issue 35 of the Environmental Radon Newsletter. The estimates are based on the results of measurements of radon in houses, which are grouped first by geological boundaries and then by 1 km grid squares. The method allows variations in radon potential both between and within geological units to be mapped.

This combined mapping procedure produces a more accurate but relatively complex picture, with some boundaries between areas of different radon potential being defined by the edges of grid squares, and some being defined by the boundaries of geological units.

In addition to the improved mapping method, there are two further reasons for updating the radon map of England and Wales: more houses have been measured since the last map was published, and the understanding of the effects of measurement uncertainties on calculating radon potential has improved (see page 3).

The new map is very detailed: so detailed, in fact, that it would take hundreds of map sheets to show the full detail. It would not be feasible to publish the data in this way. Instead, HPA and BGS decided to publish the data in two ways, to give both an overview of the data and to give detailed information for specific locations:

- A paper atlas will be produced, which will look broadly similar to the previous Radon Atlas of England and Wales, showing the same percentage bands above the Action Level. The percentage bands will now be shown for all 1-km grid squares in England and Wales. However, unlike the maps in the previous atlas, the new maps will be indicative rather than definitive: that is, they will show the highest radon potential within each 1-km grid square. Hence if a square is shown as being in the 0-1% band, that means that none of that square is a radon Affected Area. On the other hand, if a square is marked as being in the 3-10% band, that means that part or all of the square is in that band, but there could be parts that are in lower bands.
- A dataset giving the full detail of the map will be produced. This dataset will be available via a website (see page 2) or can be licensed in full or in part by local authorities and others.

The atlas will be issued free to all local authorities in England and Wales, and will be available to purchase as hardcopy from HPA and as a free download from the HPA website.

There will be a fee (not yet decided at the time of writing) for accessing the detailed data on the website or for licensing the dataset. This is to contribute to the costs of developing the map and delivering the data. More details of the website and dataset are given on page 2 of this newsletter.

This newsletter and previous editions can be seen at www.hpa.org.uk/radiation/radon

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Website and dataset for England and Wales radon data

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A new radon website, www.ukradon.org, will give access to the most detailed level of radon data. It will give an estimate, for any house or location in England and Wales, of the percentage of homes above the UK Action Level for radon. It will report this using the same percentage bands as the radon atlas.

The website will also make clear an important point: that the map can only give an estimate of the probability of a house being above the Action Level, and is not a substitute for a measurement of radon concentration in the house.

The steps for obtaining the information will be:

1. Type in a postcode
2. Select a house from a list of properties in that postcode
3. Confirm that the house has been correctly identified
4. Pay by credit card or as a registered user
5. View the report on screen or print it off

There will be a fee (not yet decided at the time of writing) for accessing the detailed data on the website, to contribute to the costs of developing the map and delivering the data.

The report will contain the following information:

- The address of the property
- The grid reference
- Whether the property is in a radon Affected Area
- The answer to the standard enquiry on house purchase known as CON29
- The estimated probability of the property being above the Action Level for radon

The website will also provide links to government departments and agencies concerned with radon, and a range of information about the effects of radon, dealing with radon in house purchase, radon in the workplace, how to measure radon, and how to reduce radon levels. A version of the website in Welsh will be available.

The same detailed information will be made available as an electronic dataset which can be licensed in full or in part by local authorities and others for use in their own Geographical Information Systems. Those local authorities that are set up to automatically generate answers to queries on house purchase will be able to incorporate the radon dataset into their systems.

Effects of uncertainties in radon measurements on radon mapping

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No measurement is perfect – there is always an associated uncertainty, and measurements of radon in houses are no exception to this. In particular for radon, there is an uncertainty in extrapolating from a three-month measurement to the long-term average level over years, which is the quantity of interest. The method of extrapolation takes into account the variation in indoor radon levels as the outdoor temperature varies with the seasons, to make a best estimate of the long-term average.

When we use the radon data in mapping, we base the map on large numbers of results, and that helps with the accuracy of the mapping. Some individual results are overestimates and some are underestimates, so that the average, used for the map, will be more accurate than the individual results.

It is necessary to explain at this point the way in which house radon measurement results are distributed: there are a lot of results at low levels, and a long tail going out to high radon levels (see Figure 1). This asymmetric distribution is called a lognormal distribution. However, if the numbers of houses are plotted against the logarithm of the radon concentration (instead of against the radon concentration), then the distribution becomes a symmetrical bell-shaped curve, like the curves in Figure 2.

The uncertainty on individual radon results means that the distribution of the measured results is not the same as the distribution of the true long-term average concentrations in the houses. The uncertainties cause a spread on the results, giving a wider, flatter curve for the distribution of measured results than the distribution of true radon concentrations (see Figure 2). Note that in this figure the differences between the two distributions are exaggerated for clarity.

As can be seen from Figure 2, the percentage of homes above the radon Action Level is higher if the measured distribution is used than if the distribution of true long-term radon levels is used. In effect, using the measured results

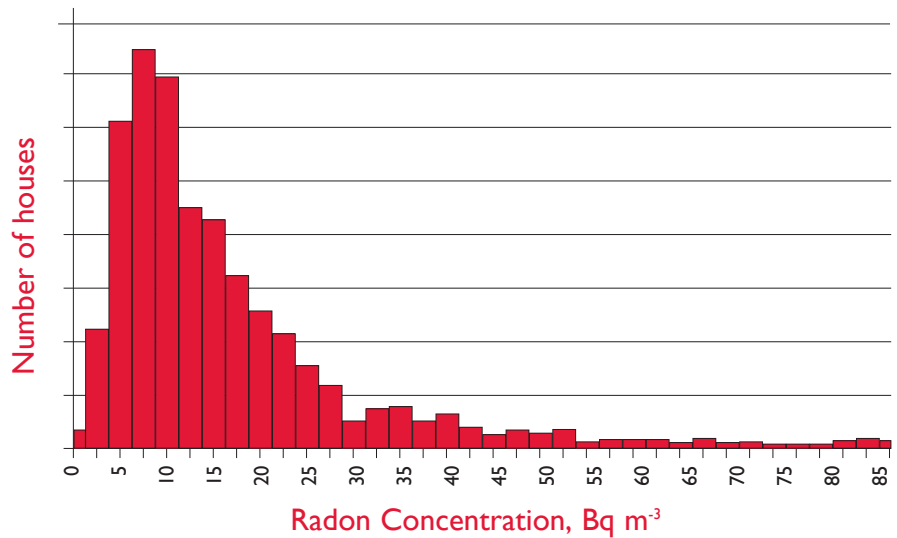


Figure 1. Distribution of UK radon levels on a linear scale

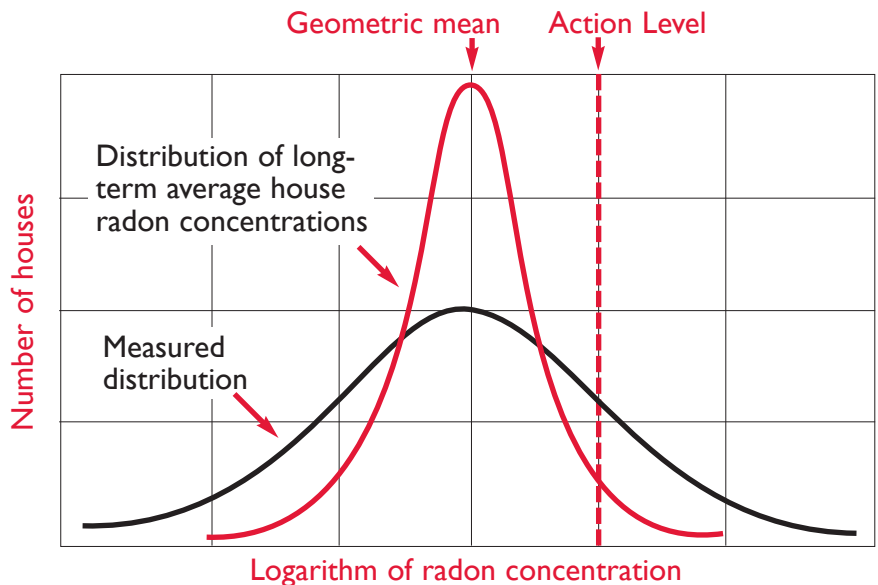


Figure 2. Measured and true distributions of house radon levels on a logarithmic scale

to calculate the percentage of homes above the Action Level results in an overestimate of the percentage of homes that would be found to be above the Action Level, if each was measured over several years.

It is possible to correct for this effect, and we have done so in the most recent mapping of England and Wales. The result of this correction is a reduction in the numbers of houses in the percentage bands above 1%. Earlier mapping exercises, in the UK and elsewhere, did not take account of this factor.

Progress on the WHO International Radon Project

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As reported in issue 48 of this newsletter, the World Health Organisation (WHO) has set up an International Radon Project. Over 50 scientists from around the world met in Munich in March 2007 for the third meeting of work on developing international guidance on radon.

The outcome of this project is intended to be two reports:

- A report on the global burden of disease from radon
- A WHO Radon Handbook

The report on the global burden of disease from radon is essential to put radon into context among other sources of disease. This is the province of the epidemiologists, who are applying the results from many studies of the risk of radon exposure in the home to calculate how many deaths around the world are caused by radon.

The WHO Radon Handbook will include chapters on exposure guidelines, measurement, mitigation, cost-effectiveness and radon risk communication, as well as a background chapter. National and local authorities and perhaps legislators will be the main target group for this report. Both reports will be available via the internet.

Because of the enormous diversity of radon problems, experience and legislation in different countries, preparing guidance that is widely applicable is a difficult task. At the Munich meeting, the scientists worked in separate groups to develop different chapters of the reports.

Exposure guidelines

Almost all countries that have radon guideline values have set them in the range 100-400 Bq m⁻³. Canada, which had been an outlier with a guideline value of 800 Bq m⁻³, is reducing its guideline to 200 Bq m⁻³. Many countries have yet to set a guideline for radon, and the WHO report will assist them in setting and implementing a guideline.

Some countries, such as Switzerland and the Czech Republic, set both a guideline value and a compulsory upper limit to radon levels in homes, to avoid the significant risks associated with high radon exposures.

Measurement

Most countries recommend long-term radon measurements, usually 3-6 months, to take account of the variations in radon levels. The USA is an exception to this, where most measurements are carried out commercially, and last only a few days. However, this is not generally regarded as best practice, and longer measurements are recognised as giving better estimates of the long-term exposure of the residents of a home.

Mitigation

Mitigation of radon is taken to mean both preventing high radon concentrations in new homes and reducing high concentrations in existing homes. This is a complex subject, because of the diversity of radon sources and of building methods around the world. In most areas, radon from the ground is by far the most important source of indoor radon problems. However, there are countries where certain building materials, or radon in

the water supply, can also cause high indoor radon concentrations. There is, however, general agreement on one finding: where the major source of radon is the ground, extracting air from under the building is the most effective mitigation method.

Cost-effectiveness

This refers to the cost-effectiveness of radon reduction programmes, in comparison with other disease reduction measures. This is a subject that has not been studied in great detail before, and should produce very interesting results that can be used to guide radon policies.

Radon risk communication

Radon scientists are not experts in risk communication, and so must learn from others. The experts in this subject emphasise the importance of concentrating on core messages. For instance, the United States Environmental Protection Agency finds that the message: "You can protect your family from radon" is one of the most effective in persuading people to take action to reduce exposures to radon.

