Environmental Radon Newsletter

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The latest on radon in Europe

Chris Scivyer, Building Research Establishment

During October last year the *European Radon Research and Industry Collaboration Concerted Action* (ERRICCA) group, funded by the European Commission, held its second European Radon Forum Meeting. It was held in Greece and hosted by the National Technical University of Athens. Forty-two delegates from 21 European countries attended the meeting. The UK was well represented by the Building Research Establishment (BRE) who are co-ordinating the programme, the National Radiological Protection Board and the Radon Council. The forum operates at both European and National levels, and aims to assist in:

- Disseminating existing research findings to industry and the public
- Clarifying industry needs for further research
- Undertaking collaborative work in common topic areas

ERRICCA's progress in the first year has been considerable, with the establishment of a network of National Radon Fora across Europe. Fourteen national meetings have so far taken place, mostly devoted to single countries. Some countries where radon work is still in its infancy, such as Romania and Hungary, combined their efforts to hold joint meetings. The meetings have proven to be a resounding success, with almost 80 people attending the UK national meeting in Matlock Bath, Derbyshire, last April, and more than 700 people attending national events across Europe.

The main issues discussed in Athens were:

- How to increase public awareness and confidence
- Whether there is a need to test radon barrier materials for radon permeability, or whether current moisture permeability and strength tests will suffice
- Progress in protecting new buildings and the establishment of a European database of technical solutions
- Experience gained in remedying existing buildings and the setting up of European databases of technical solutions and case studies
- Measurement and mapping protocols – in particular cross border mapping

What was most evident at the meeting was that the UK has a far more advanced and all-encompassing approach to dealing with radon than most other countries in Europe. The UK appears to be making greater advances in raising awareness of radon at a local level, principally through the Department for the Environment, Food and Rural Affairs programme of assisting local authorities to become the focal point for advice and guidance. It would seem that few other countries have yet linked radon into the house purchasing process, and the UK approach to providing newbuild protection remains unrivalled. As a consequence many countries are adopting UK techniques to resolve their problems, and are sourcing UK companies to provide services.

The UK is not only seen as a leader in Europe, but the World Health Organisation sent a representative to the Athens meeting and is keen to use the UK approach in developing guidance for use worldwide.

A website for ERRICCA is being set up at http://european.radon.ntua.gr. It is intended that this will provide links to each National Forum, and will in time hold databases of technical solutions, case studies and other information on radon.

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Combined geological and grid square mapping

Jon Miles (National Radiological Protection Board) and *Don Appleton* (British Geological Survey)

Maps of radon prone areas in the UK are based on the results of measurements of radon in houses, rather than indirect indicators such as concentrations of uranium in rocks and soils. Two ways of deriving maps from these data have been used: grouping house radon results either by grid square or by geological unit. Because average radon levels vary both between and within geological units, both of these methods have strengths and weaknesses. It was realised by the National Radiological Protection Board (NRPB) and the British Geological Survey (BGS) that combining the two methods could give more accurate mapping than either separately. NRPB and BGS have therefore decided to follow this route, and research on combined radon potential mapping is in progress. This article explains how it is intended that the combined mapping method will be applied.

Figure 1 shows a hypothetical map of four geological units. When the units were originally laid down, each was continuous, but parts of each unit have since been removed by weathering, and parts are now overlain by other units (see cross-section in Figure 2). We intend to map the varying radon potential of each unit separately, starting, for example, with unit C.

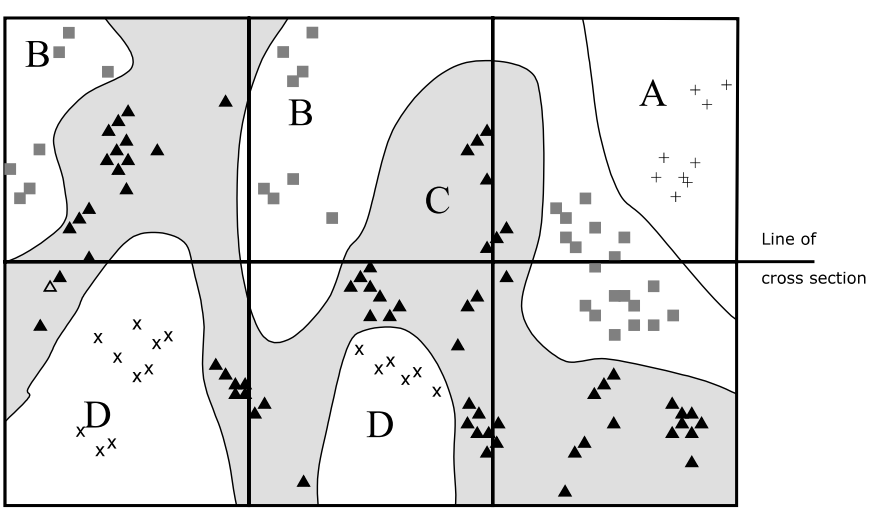

Figure 1. Map showing four geological units, A, B, C and D, with locations of radon measurements marked with different symbols for different geological units

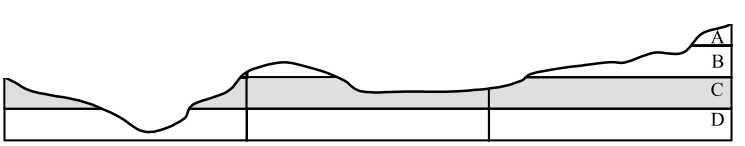

Figure 2. Cross section of map in Figure 1.

The first step is to identify the locations of all measurement results, and separate out those located where the geological unit at the surface is C (shown as triangles in Figure 1). The measurements on unit C are

distributed patchily across the area of the map, because in most places C is overlain by other units or has been removed by weathering. Nevertheless, the radon potential of C is mapped as if C was continuous across the whole map area (which it was when it was laid down).

The grid square mapping procedure estimates the radon potential for each grid square, using only results from unit C. This produces Figure 3, where the different shadings represent different radon potentials caused by geographical variations in the radon potential within unit C.

However, we know that unit C only comes to the surface in certain areas, so we need to cut out the map in Figure 3 using the outline of unit C from Figure 1. This produces Figure 4. Unshaded areas of this map are areas where geological units other than C are at the surface.

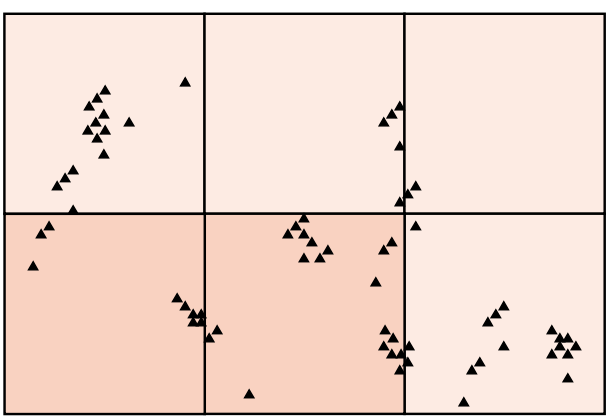

Figure 3. The results of mapping the whole area using only the measurement results in unit C, marked with triangles. Different shadings represent different radon potentials

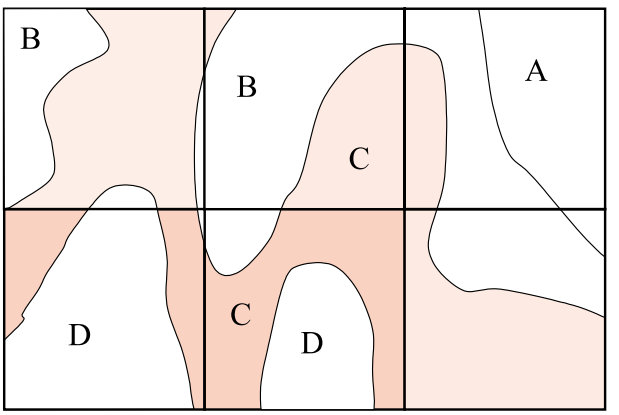

Figure 4. The grid square shading in Figure 3 is cut out using the outline of geological unit C, to show the variation of radon potential within unit C.

The procedure is then repeated for each of the other geological units, filling in the blanks in Figure 4. The final map takes into account both the variation of radon levels between geological units and the variation within each unit. Where insufficient radon measurements are available to interpolate variation within a geological unit, the average radon potential is applied to the whole of the unit.

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. The best means of presenting the results of this exercise in a useful form is still under discussion. Current users of radon potential maps will be consulted before a decision is taken.

Radon Atlas a success

The publication of the new radon atlas for England and Wales* in December last year has been a success. Over 4,000 copies of the atlas were downloaded from the NRPB website in December alone, and over 600 printed copies have been distributed. About half of the printed copies were distributed free of charge to Environmental Health and Building Control Departments of Local Authorities and the remainder sold to Building Societies, Surveyors, Estate Agents, Solicitors and other organisations with an interest in the building transaction market.

In addition, a significant number of organisations have ordered A1 size (about 3ft by 2ft) laminated wall maps of particular areas#. These maps show more detail than is possible in the atlas, including electoral-ward boundaries and many more settlements and roads.

** Radon atlas of England and Wales. NRPB-W26, 2002. £16.50 (ISBN 0-85951-497-8).*

Available from the NRPB Information Office, Tel. 01235 822742, e-mail information@nrpb.org.

 # Laminated large format maps. £73 + VAT

Available from NRPB Radon Studies Group, Tel. 01235 822622, e-mail radon@nrpb.org

The above prices include post and packing and are for pre-payment with order, otherwise an additional 'small order invoice' charge of £10 applies.

Dealing with high radon levels in workplaces

Tracy Gooding, National Radiological Protection Board

When the Ionising Radiations Regulations 1999 (IRR99) replaced the 1985 regulations, they marked a change in the way that radon was perceived and in the way that high radon levels are managed. Through a more sophisticated system, the IRR99 allow employers to take a practical approach to areas with high radon levels but low occupancy. However, greater support is required from those who provide radon measurement services and those who enforce the regulations.

First the bad news...

Once a valid result of more than 400 becquerels per cubic metre (Bq m^{-3}) has been obtained from any area within a workplace, the IRR99 apply, and term *radiation employer* is used. The employer must inform their local health and safety inspector of the radon results, and conduct a risk assessment to see what further action is required.

Then the good news...

The National Radiological Protection Board (NRPB) has developed a self-assessment form for radiation employers, as part of a package to make the risk assessments as quick and painless as possible. The form takes them through the calculation of annual radiation doses to employees in units of millisieverts (mSv), based on radon concentrations and work patterns. The action required depends on the annual doses calculated:

Below 1 mSv

Officially, this is *work with radiation*, the lowest level of control recognised by the IRR99. The doses are self-limiting if the areas with high radon levels are rooms with low occupancies such as stores or basements. In consultation with a *radiation protection adviser* (RPA), radiation warning signs or key control might be advised. If usage of the areas changes, the risk assessment should be repeated to make sure that no additional controls are required.

From 1 mSv to 6 mSv

The IRR99 describe this as a *supervised area*, and impose certain additional requirements to those above. The employer will need to appoint an RPA and a *radiation protection supervisor* (RPS), make sure that employees are informed and trained appropriately, and conduct regular radon measurements. Alternatively, if radon levels are reduced, the need for formal controls will be reduced or eliminated.

Over 6 mSv

The highest designation is a *controlled area*, which requires formal administrative and physical controls. Employees receiving doses over 6 mSv a year are among the most exposed radiation workers in the UK, and may need to be designated *classified workers* and have continuous dose monitoring and annual health checks. Reducing radon levels may be cheaper and easier than applying these stringent measures.

Hobson's choice?

Although formally restricting exposure times is a perfectly reasonable response to areas with high radon levels and low occupancies, the administrative and measurement burden may prove excessive. Not only that, but if high radon levels remain unchanged it may cause problems if the management changes or the building is sold or leased. For many employers, remedial work to reduce the radon levels will be the only long-term solution.

A moot point

There is an apparent discrepancy between the threshold for controlling radon exposure in the workplace, 400 Bq m^{-3}, and the threshold of 1 mSv a year for supervised areas. At 400 Bq m^{-3}, the 2000-hour working year assumed in regulations would give a dose of approximately 3 mSv a year – half way to a controlled area! However, we know that radon levels during the normal working day are lower than the 24-hour average, and that the working year is now typically 1600 hours. This reduces the annual dose at a radon level of 400 Bq m^{-3} to closer to 1 mSv.

What needs to be done?

The first step is the hardest: getting employers to monitor radon in the first place. Raising awareness is easier if there is local support, as the Radon Roll-out Programme for homes has shown. The enforcement agencies obviously have a part to play here, and should be able to help employers who are dealing with radiation for the first time. We must also persuade householders to think about radon at work and employees to think about radon at home - it's the same radon and can be tackled in similar ways.

Many employers with high radon levels need to undertake remedial work to reduce the levels. Although large companies may have regular building contractors to hand, smaller employers will need to find builders competent in this type of work. Local councils can help by providing lists of builders, as some already do.

Radon-exposed employees are some of the highest dosed and least controlled of any radiation workers in the UK. With a pragmatic approach to risk assessment and remedial work, this can be changed.

This newsletter is prepared for the Chartered Institute of Environmental Health by the National Radiological Protection Board. It is published quarterly as an insert in Environmental Health and distributed by the Royal Environmental Health Institute for Scotland. Any suggestions for topics for future issues should be sent to Jon Miles at NRPB (see address on page 2). The views expressed in the contributions here are not necessarily those of the Chartered Institute of Environmental Health, the Royal Environmental Health Institute for Scotland or the National Radiological Protection Board.