

# Environmental **Radon** Newsletter

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## Radon Around the World

### New Publications

#### Workplace Radon Guide

A new guide, *Radon in the Workplace*, has been published by the Building Research Establishment in conjunction with the Health and Safety Executive. It is principally aimed at employers and others responsible for workplaces. It offers practical cost-effective advice on measures for reducing radon levels in workplaces. The majority of building types are covered, and twelve case studies are included illustrating typical situations and how they have been tackled. The case studies include schools, a surgery, a hostel, offices and shops.

The guide (ISBN 1 86081 040 3) costs £9.95 and may be obtained from Construction Research Communications, 33/39 Bowling Green Lane, London EC1R 0DA, telephone 0171 837 1212. The Building Research Establishment has produced a free leaflet to publicise the guide and to set out some of its key messages.

#### HSE Leaflet

HSE has revised and reprinted its free leaflet, also called *Radon in the Workplace*. This may be obtained from the HSE Information Centre, Broad Lane, Sheffield S3 7HQ, Tel: 0114 289 2345.



Attitudes of governments to radon in homes vary enormously: some countries have no guidance, some have advisory levels, and two (Sweden and Switzerland) have both an advisory level and a compulsory upper limit. The table shows reference (or advisory or action or guidance) levels for radon in existing houses. The Netherlands has generally very low radon concentrations in houses, and has set 20 Bq m<sup>-3</sup> as a target for the average level in homes, to provide a level of risk comparable with other environmental and everyday risks. In most countries it would not be practicable to set such a low target, as many houses cannot be reduced so low.

Country, organisation	Radon reference level (Bq m <sup>-3</sup> )
Netherlands	20
Luxembourg	150
United States of America	150
Australia	200
Ireland	200
Norway	200
Sweden	200
United Kingdom	200
Germany	250
Austria	400
Belgium	400
Finland	400
Switzerland	400
Canada	800
European Community	400
Basic Safety Standards for Radiation (International Atomic Energy Agency, World Health Organisation and others)	200-600
International Commission on Radiological Protection	200-600

The data for this table was taken from *National approaches to controlling exposure to radon* by PA Colgan and J Gutierrez, presented at the 6th Symposium on the Natural Radiation Environment, Montreal 1995.

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# Evidence on the Risks of Radon Exposure

*Gerry Kendall and Colin Muirhead, National Radiological Protection Board*

There is a great deal of evidence that exposure to radon, or rather its decay products, leads to lung cancer in miners. The twelve main studies are summarised in the table, showing the number of lung cancer deaths expected on the basis of the number of miners and their ages. There is a statistically significant excess of observed lung cancer deaths over the expected total. The size of the excess is found to depend on the radon level and the length of time men were exposed. These findings and extensive animal experiments provide compelling evidence for a causal association between radon exposure and lung cancer.

radon exposure and the risk estimates were consistent with those from the miner studies.

The quantification of risk in studies of domestic exposure is, however, hampered by the lack of statistical power. For example, a recent

Canadian study with about half the number of cases included in the Swedish study gave a wide band of risk estimates, consistent with both the miner risk estimate and with no effect of radon. Researchers are therefore discussing plans for pooling the data from the various indoor studies to give more accurate estimates.

There is clear epidemiological and biological evidence for the role of radon in

inducing lung cancer. Against this background the International Agency for Research on Cancer has concluded that there is sufficient evidence to classify radon as a carcinogen in human beings.

Although there are some uncertainties in quantifying the risk, particularly at low radon exposures, the information available has allowed the International Commission on Radiological Protection and other authoritative bodies to estimate risk factors. These are then used as the basis of programmes to prevent excessive human exposure by adopting remedial and preventative measures.

Table: Mortality from lung cancer among miners exposed to radon

Mines	Number of lung cancer deaths	
	Expected (without radon)	Observed
Colorado Plateau, USA	59	256
Ontario, Canada	68	152
Beaverlodge, Canada	34	65
Port Radium, Canada	25	57
West Bohemia, Czech Republic	138	702
Malmberget, Sweden	15	51
New Mexico, USA	17	68
Newfoundland, Canada	22	113
Yunnan Province, China	267	981
Cornwall, UK	67	105
Radium Hill, Australia	23	32
France	21	45
<b>Total</b>	<b>756</b>	<b>2627</b>

Although the evidence from miners is clear, it is less easy to detect the effects of radon in houses because of the small number of people exposed at high radon levels in their homes, and the difficulty of measuring past exposures. Nevertheless, researchers are undertaking such studies. The most reliable are those that use individual data on radon exposures and smoking histories. Results from the largest domestic case-control study to date were recently published by researchers in Sweden. This study was based on 1360 lung cancer cases and roughly twice as many controls. The lung cancer risk was shown to increase to a statistically significant degree with increasing

# Surveying Radon in Commercial Workplaces

Mike Arnold and Bob Stevens, Daventry DC Environmental Health Department.

Once the problem of radon in Daventry homes had been well established, it became apparent that some commercial and industrial premises were also situated on radon-emitting geology. It was not clear if this potential would be translated into high levels in the buildings. The only references available related to large space factory and warehouse premises, whereas many of the commercial premises in our area were similar in size and construction to the homes in which we knew there were high levels.

There is a clear duty on employers to assess the risk to the health of their employees. However, as the evidence that high radon levels would occur in these premises was unclear, no-one was prepared to put their name on a Notice requiring an assessment to be carried out. So began a publicity campaign to inform employers of the risks involved. Articles were published in the press and local radio programmes went on the air. In addition every letter that went out to businesses in the district carried information about radon, and a letter drop was made to an area of the town centre where a particular potential problem was identified.

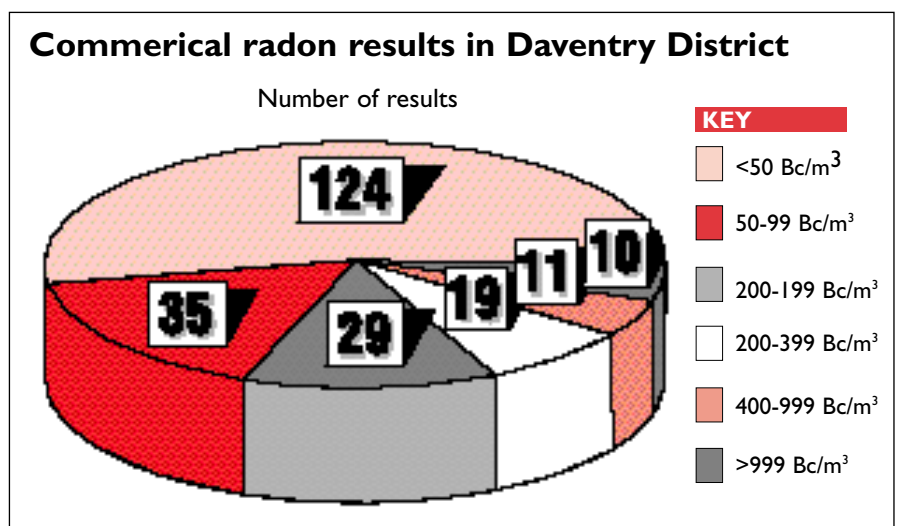
It was also decided that the Council should offer a radon testing service for businesses in the area. There were three reasons for this: to facilitate tests being made; to build up a database on the problem for enforcement; and because of concern over some of the recommendations which had been made by "consultants". We had previously given the names of radon measurement laboratories to employers, but few had ordered tests.

We therefore offered a service of ordering, placing and collecting monitors, giving further advice for those premises with elevated levels. Now the level of testing has increased, with just under 50% of town centre properties tested or with monitors in place.

The results that we have so far (Figure 1) clearly indicate that there is a potential problem in Daventry, sufficient to use as evidence to support an

Improvement Notice requiring a risk assessment. However, some caution needs to be exercised in interpreting the results of detectors; it is the dose received by individuals that matters, not the levels measured in a room.

We are now coming to the end of the publicity programme and together with HSE will be looking at enforcement for those premises potentially at risk. When we offer to undertake the testing the contract documents make it clear that the results of an individual premises will be confidential except that, in the case of high levels, we will reserve the right to use



the results in support of enforcement action. This has not so far caused us any difficulty. Nor have we encountered any need to take formal action in the case of high levels, as all employers so far have been willing to respond to our advice in reducing risks.

Two cases gave us concern over advice being given to business. The first was a hotel that was advised to test every room, which would have resulted in 100 detectors being placed. Fortunately they contacted us first and we did the testing with 5 detectors. The other was a shop that spent over  $\text{€}5000$  to reduce radon from 600 to 350 becquerels per cubic metre in a basement in which no one worked!

Our experience is that promoting testing in commercial premises is worthwhile and that facilitating testing by offering a complete service increases the percentage of employers willing to test. It also gives useful information that can be used to make the less willing undertake testing.

# Radon Testing in Schools and Other Council Buildings

Trevor Gregory, Radiation Protection Supervisor, Cornwall County Council

Cornwall County Council has been testing its stock of over 800 buildings for radon since 1986. More than 5,500 etch-track detector results have been assessed so far and the results are now held on a computer database designed in-house for the purpose.

All tests last three months, and are carried out between September and Easter. Although seasonal correction factors are available for any period of testing throughout the year, Cornwall County Council prefers to use winter tests only. Most test rounds follow school terms, because the largest single group within the building stock is schools.

The choice of spaces to be tested is based on two criteria. On the one hand spaces which are occupied by large numbers of people for long periods, or to which the general public have access, require monitoring. On the other hand, spaces of inherently high potential such as basement workshops and boiler rooms are tested despite the small number of users and low occupation times. The comparatively small number of houses for which the County Council is responsible are tested according to the NRPB protocol giving a single average based on 55% of the bedroom value added to 45% of the lounge value.

All buildings, however small, are fitted with a minimum of two detectors to avoid reliance on a single measurement. Larger buildings are fitted with additional detectors using a rule of thumb that no detector should monitor a floor area greater than 250 m<sup>2</sup>. This figure is taken to be the maximum area capable of mitigation by a single sub-slab depressurisation system. Testing is restricted to the lowest floor of the building, generally the ground floor or basement.

Detectors are delivered by carrier to County Hall, Truro, and are passed to Building Surveyors based in District Council offices for placement in premises with which they are very familiar. Retrieval procedure is the same operation in reverse. Variation in exposure times

can be up to 2 weeks, equivalent of 15% of exposure time, so individual dates are recorded on standard forms. Placement and retrieval are carried out by the same person where possible. Finding a 50 mm diameter yellow disc in an infants' classroom is not an easy task!

Especially in larger buildings, the exact location of the detector can be difficult to describe. A primary school classroom could be 'The Red Classroom', 'Junior Class 2' or 'Mrs Smith's Room'. Looking over the records 5 years later, changes of paint, class or personnel can leave the reader baffled. In order to avoid this, up-to-date plans are supplied with the standard forms and the detectors. These plans are marked with the detector number and a cross for exact location. The individual rooms also carry a unique reference number that is entered on the standard form.

The duplication of placement information on plans and forms has resulted in less than 1% of detectors being misplaced or wrongly identified. This compares favourably with the loss/tampering rate of around 7%. Experience has shown that it is better to inform responsible adults as fully as possible where detectors are placed to avoid their being inadvertently thrown away. However, in the case of buildings occupied by those less than responsible, detectors are often placed inconspicuously out of hours, although protocols prevent their being actually concealed.

Of course, anything that can go wrong will:

*"We have a result of 2,000 Bq m<sup>-3</sup> but are unable to establish the location of the detector."*

*"Our police dog has eaten the detector from the lounge."*

*"I threw the air-freshener away. Those little yellow ones never seem to smell of anything."*

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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.