HEALTH AND SOCIAL SERVICES DEPARTMENT

Radon and Public Health in Jersey

Introduction

The objective of this report is to assess the impact of radon on human heath in Jersey, to review the previous surveys that were undertaken and to make recommendations in relation to the impacts from radon on human health and further work that may be necessary.

Over the last few years, concern has been raised by States Deputies and several members of the public about radon risks and this report will address the concerns raised.

This work has been done in partnership with the UK Health Protection Agency (HPA) and the contribution of the Radiation Protection Division of the HPA is acknowledged, with particular thanks to Jane Bradley, who has supported several of the recent surveys in Jersey.

The 2012 survey was carried out across the Channel Islands as a joint initiative.

Historically there were radon surveys in Jersey in 1987, 1992 and 1997, and in Guernsey there was a survey in 1985. In 2012 tests were also carried out in Herm, Alderney and Sark.

Background

Radon is a natural radioactive gas that is emitted in varying quantities from all rocks and soils. If it escapes from the ground into the open air, it is diluted to low concentrations and poses little risk to the public. However it can reach high concentrations if it gets trapped in enclosed spaces like caves, mines and buildings, including homes. Radon in the home delivers the larger dose to the public than any other natural source of ionising radiation. It was recognised over twenty years ago that exposure to high concentrations of radon in homes leads to an increased risk of lung cancer.

This is of concern in Jersey because the geology of Jersey is made up of a number of different types of granite that contain natural uranium. Uranium is locked in the rock and radon gas is formed by the radioactive decay of the uranium. Being a gas, radon can travel out of the rock through fissures and faults and reach the surface where it becomes part of the atmosphere.

Radon gas itself is not harmful but shortly after being formed it undergoes radioactive decay forming “progeny” which are heavy particles roughly of the

density of lead and in the process of the radioactive decay series these progeny emit radiation. It is the radioactive products of decay that are harmful to human health.

For the purposes of this report the term ‘radon’ includes reference to all of the progeny and decay products of radon gas.

Health effects of Radon

A number of studies have been undertaken that have linked high levels of radon with an increased incidence of lung cancer. Early studies were initially undertaken in mines where there were very high levels of radon and the population exposed to the radon, i.e. miners, were easily identifiable. These studies established the causal link between exposure to radon and lung cancer and established that the risk of lung cancer was directly related to the concentration of the radon exposure.

Later studies, particularly a large study in Sweden, have established the same links between lung cancer and radon exposure in the general population, where there has been domestic or occupational exposure to radon. There is also international agreement, supported by the studies, that people who smoke have an added risk of developing lung cancer from radon exposure above the already high risk that smoking alone presents.

The mechanism for radon causing lung cancer is well understood. The radon gas is inhaled and usually exhaled with no ill effect. If the radon decays to progeny when in, or close to, the lung these, because of their density, will lodge in the lung and as they decay further emit alpha radiation. The radioactive particles can then damage the cells of the lung. Mostly they will kill the cells or damage them in a way that prevents multiplication. However, some damage may allow the cell to live and become cancerous. This process is confined to the lung because the alpha radiation whilst being able to penetrate the very thin membranes in the lung cannot penetrate other tissue such as the skin. Whilst there are some theoretical possibilities that other cancers might be caused by radon these have not been demonstrated and the pathways are unlikely to be of significant risk.

As can be seen even in a high radon concentration there needs to be a sequence of events occurring to cause the lung cancer. The risk of a single exposure causing lung cancer can be discounted and the risk levels for exposure are all calculated on a life time’s exposure to radon.
The risk from radon is not immediate, however, it can give rise to a serious condition – lung cancer – and reduction of the risk by reducing exposure to radon is advisable.

It has been estimated in the UK that exposure to 100Bq/m^3 over a thirty year period increases the lung cancer risk by 5-31% with a central risk estimate of 16%.

At long-term exposure, average concentrations of 0,100, 200,400,and 800 Bq/m^3 the cumulative 'absolute' risk of lung cancer at age 75 would be about 0.4, 0.5 0.5, 0.7 and 0.9% in life long non-smokers and 15,17,17,23 and 30% respectively, for cigarette smokers. For those who quit smoking, the risk reduces significantly.

It is estimated that 3.3% of lung cancer deaths in the UK are attributed to residential radon exposure. Of this only about 0.5% is due to radon acting alone, the rest being due to radon exposure and smoking in combination.

The calculations of the rate of lung cancer cases in the UK cannot be directly transposed to Jersey because of the differences in exposure due to the radon emitting geologies being different and variations in smoking prevalence.
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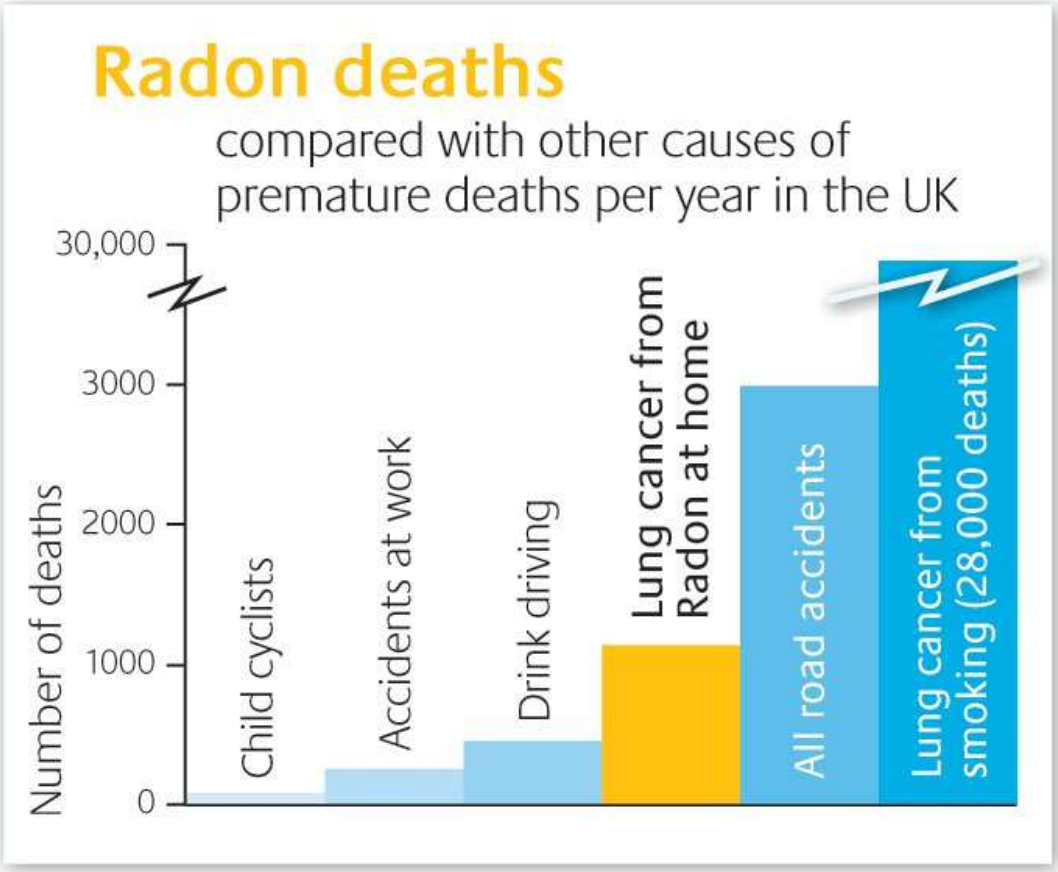
The cases of radon induced lung cancers in Jersey are likely to be very low.



recommended the remediation of homes with high concentrations of radon and the installation of preventative measures in new homes in risk areas.
In 1990 the UK National Radiological Protection Board (NRPB), provided advice on the risks associated with radon in homes and recommended an 'action level' of 200 Becquerels per cubic metre (Bq/m^3).

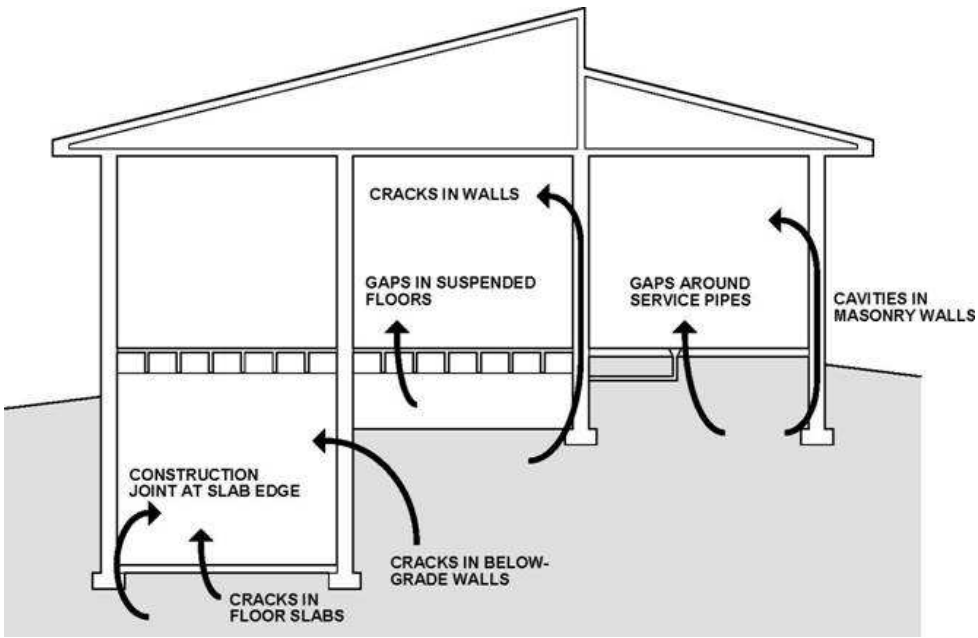
Further research has been carried out and the international consensus on action levels for radon concentrations in domestic premises is at or around 200 Bq/m^3 for existing premises and 100 Bq/m^3 for new builds.

There is no safe level for radon exposure but internationally it is accepted that the risks below these levels are too small to warrant action. The level is lower for new builds because reducing levels is more easily achieved in the design and build of new premises.

Measurements are easily undertaken by placing two track etch detectors contained in small pots of about 5cm diameter, one on the ground floor and one on the first floor. These are then returned to the HPA laboratory for analysis and for seasonal corrections to be applied.

Radon enters buildings though the floor and at the sides of wall foundations. Concrete floors are not sufficiently gas proof to stop the gas passing through. The concentration in buildings depends on a number of factors which will include; the integrity of the floor, the ventilation of the building, whether there are appliances that draw gas in from the ground e.g. boilers, ventilation fans, cooker hoods etc. and the weather. How the house is occupied has an impact on the levels that can be detected.

It is usual for levels to be higher in basements and cellars than ground floors and levels in first floors and above to be lower. When risk calculations are being made they take into account the time spent in first floor bedrooms if appropriate. Tests usually take place over 3 months and seasonal adjustments are also made to take account of the known effects of weather. For workplaces, an exposure of 8 hours i.e. a working day is assumed. Concern has been raised about buildings constructed of granite but evidence from the work done in Cornwall has shown that construction granite makes only a small contribution to overall levels.



There are well documented instances of apparently identically constructed rows of house having large differences in their radon levels. The only means of finding the radon level of a building is to have a test undertaken.

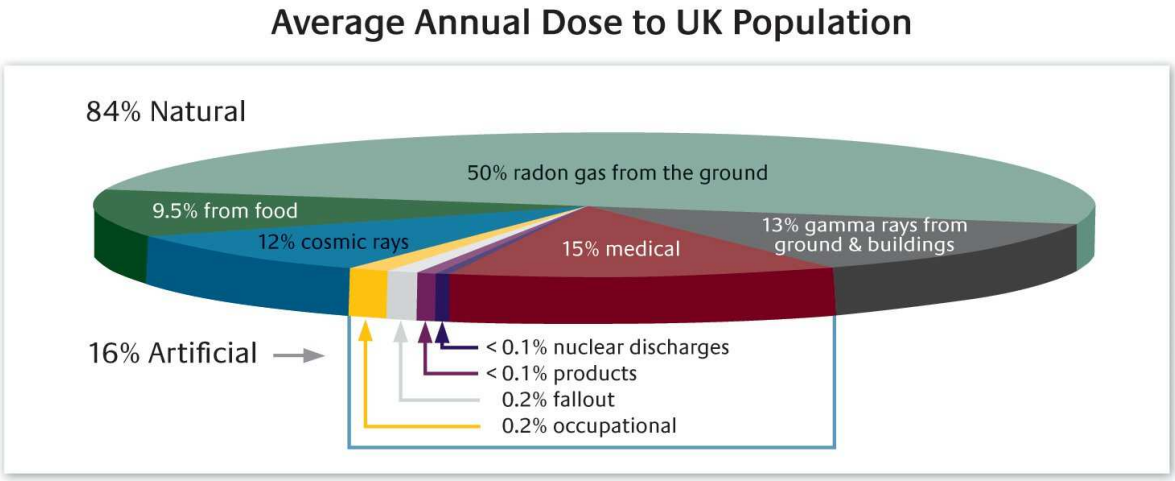
The situation in Jersey is that all buildings are sited on potentially radon emitting geology and occupiers of accommodation that includes ground floors need to undertake testing.

Radon in Water

Radon is soluble in water and so high concentrations may occur if water comes into contact with uranium bearing rocks.
This can pose two risks to human health. Firstly, radon can 'de-gas' from water posing a risk of inhalation and secondly, if the water is drunk before degassing it can pose a risk to the gastrointestinal tract and other body organs. The likelihood of inhaled radon from water is very small.

Standards for radon in water in the UK are set at 100bq/l for public water supplies and 1000bq/l for private water supplies.
In Devon a study of private water supplies indicated that about 8% of those tested exceeded the level of 1000Bq/l. Wells that have been drilled into rock are at greatest risk.

There has been no recent testing of radon in private water supplies by the States of Jersey. Private householders currently undertake their own monitoring although it is not known whether they include radon testing.



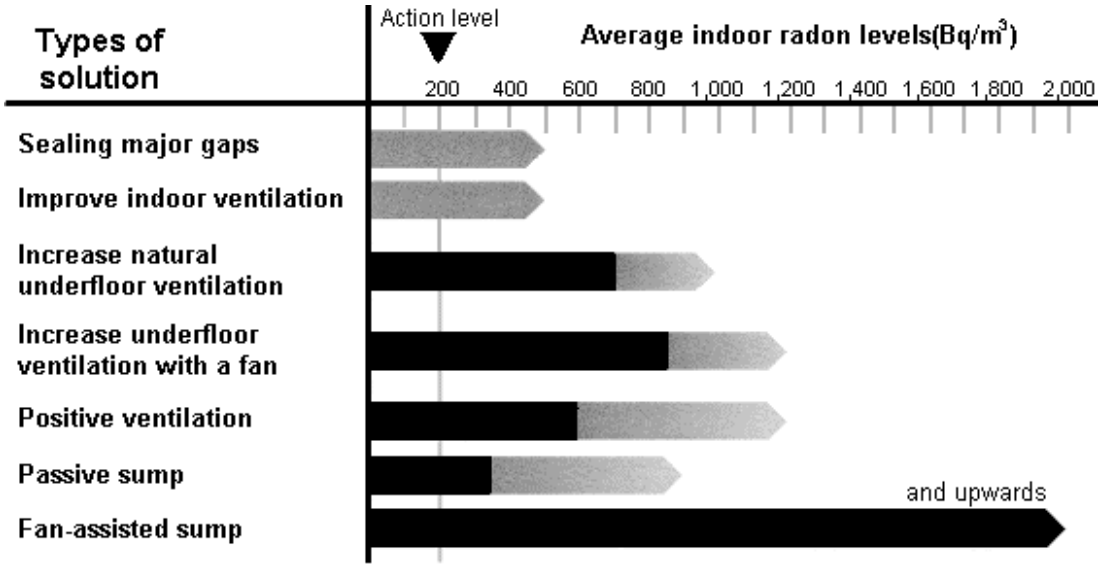
Reducing radon levels in buildings can be done in a number of ways. Different methods are appropriate at different levels of radon. They include sealing the

floor of a building, providing positive ventilation to pressurise the building to stop the gas entering and interrupting the flow of radon from the soil into the house by providing a ventilated sump under the floor or under floor space.

In new builds the usual approach is to install a gas proof membrane in the floor and walls and to build in a passive sump and pipe work that can be connected to a fan once the building is occupied and has been tested for radon.

This further precaution is required as work in the UK has established that there is a measurable failure rate in membranes usually due to poor installation. All new domestic premises built in Jersey are required by the Building Regulations to install a membrane and a passive sump.

Further discussion about the Energy Policy and the objective to conserve energy through 'tight houses' as this is contrary to health advice on ventilation to protect health from radon exposure.



Black areas indicate high likelihood of success.
Grey areas show where some success has been acheived.

In the early 1980's in the UK, the NRPB (now HPA) worked with local authorities in setting up surveys to obtain evidence of levels of radon in houses. The surveys began in Cornwall and parts of Devon and later included Derbyshire, Northamptonshire and some smaller areas of the country. These surveys started to be undertaken in the mid 1980's and new areas are still being identified and surveyed. A great deal of data is now available.

In Jersey, the Health Protection Service (HPS) of the Health and Social Services Department was concerned because the initial surveys in Cornwall had shown that there were high levels of radon associated with granite geology. Jersey also has granite geology and so a survey was undertaken

here. The first Jersey survey was undertaken in 1987 at the same time as a UK national study was co coordinated by the Chartered Institute of Environmental Health (CIEH).

As in the UK, the first surveys were undertaken by the States paying for detectors from the HPA to be placed in houses and for the otherwise confidential results to be given to the States. This first survey confirmed that houses in Jersey were affected by radon and that some had elevated levels. Following this survey a press release was issued advising the public to test their homes and there was also a display at the Howard Davies Farm Exhibition.

Other surveys have since been undertaken and in all HPS had results from 135 tests on domestic premises and 3 results from commercial premises.

Individual households received advice on remediation from HPS and from the UK HPA who processed all of the samples.

Advice to the public from the HPS has been consistent recommending that all areas of the island are affected by radon gas and that the only way to check whether a house is affected is by undertaking testing.

This advice is on the web site and will be updated to take account of the new round of testing. Advice has also been consistent for smokers highlighting that the risks of smoking are substantially higher than those of radon exposure.

Householders with levels above the action level are advised to undertake remediation and those between the 'action level' 0f 200 Bq/m^3 and the 'target level' of 100 Bq/m^3 are advised to take action if anyone in the house smokes.

Results of Radon tests in Jersey

HPS has 135 domestic and 3 commercial test results taken over a series of surveys since 1987. 63 of these results relate to the survey carried out in 2012.

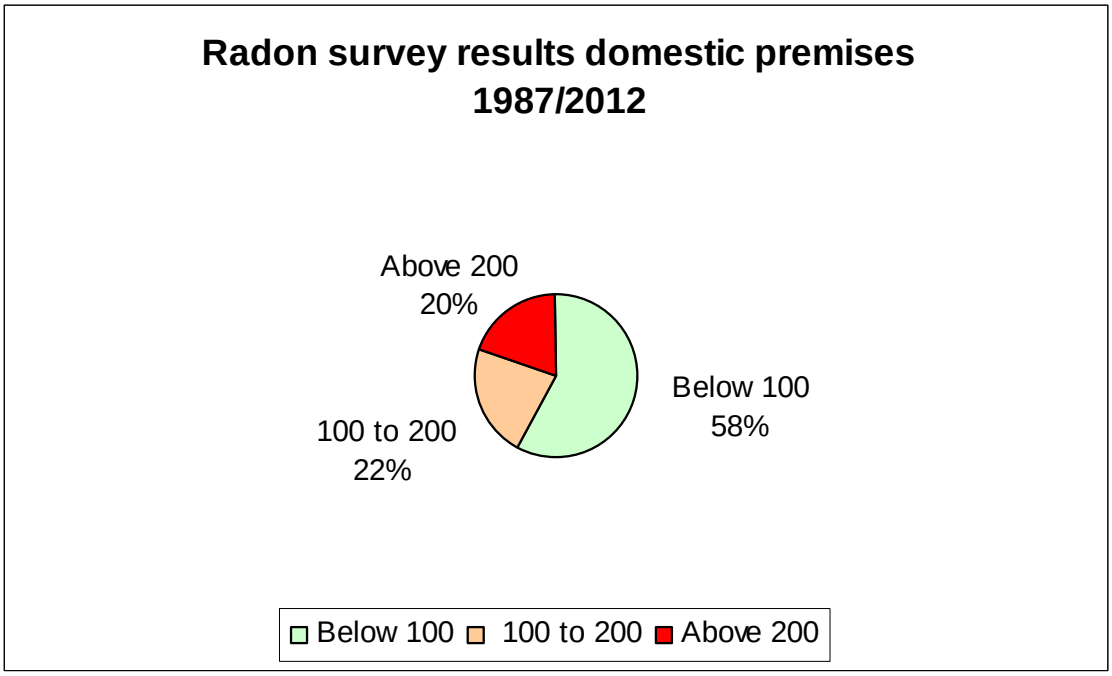
None of these surveys were entirely random with premises being selected, at least in part, to cover different geological conditions or population areas. The results do cover all of the parishes and all of the main geological conditions in the island. The latest test contributes nearly half of all of the results that we have. The commercial tests were in part targeted at likely high risk premises and none of the commercial results are representative of an average commercial property in Jersey.

The latest survey was funded by the HSS Department at a cost of about £3,000, and was undertaken in partnership with the UK HPA. The survey was carried out across the Channel Islands at the same time.

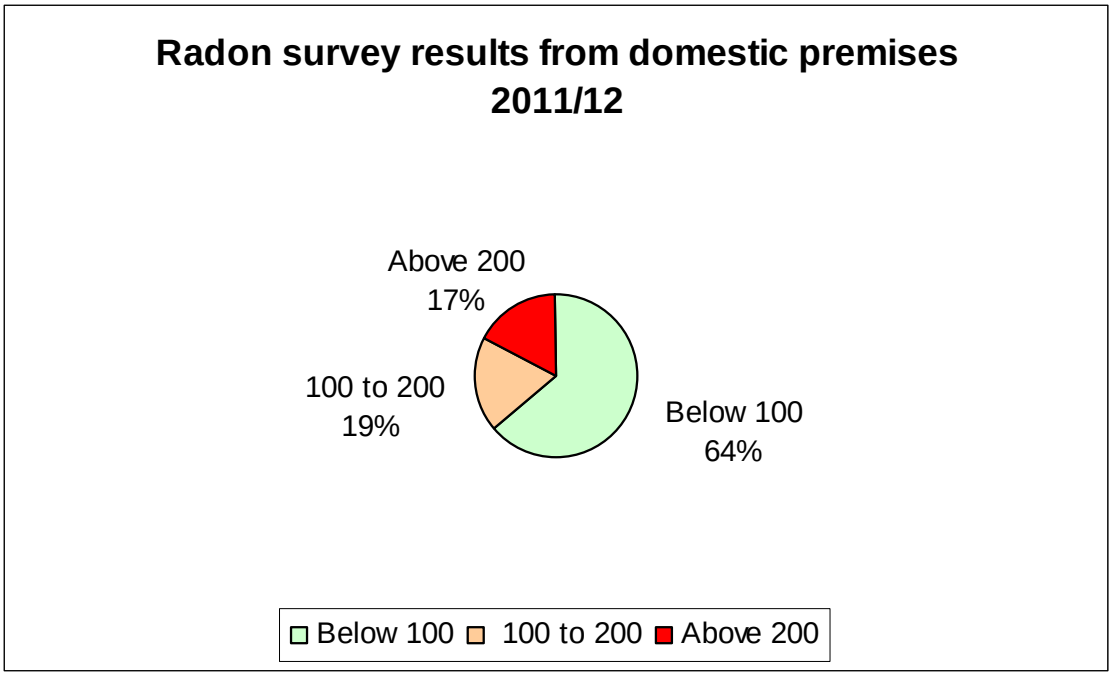
Houses were selected at random by the staff in HPS. The island was divided into 1Km grid squares and a property was selected in each square. Extra properties were selected in the more populated areas e.g. St Helier, St Brelade etc. An information leaflet was produced by the local staff to ensure the local perspective, photographs etc. This was then forwarded to the HPA for use in the survey packs.

Properties selected for the survey were sent a pack from the HPA containing 2 radon detectors, the information leaflet that had been produced by HPS, and a prepaid return envelope. The detectors were placed in the bedroom and living room of each property for 3 months. At the end of the survey the detectors were returned to the HPA laboratory for analysis. The HPA then forwarded the results to the house holder and to the department.

Jersey Test Results



Lowest household measurement 6 Bq/m^3
Highest household measurement 1300 Bq/m^3



Lowest household measurement 18 Bq/m^3
Highest household measurement 1100 Bq/m^3

The results from all of the surveys have been reasonably consistent given that some surveys were targeted on specific areas and the smallest survey was of only 14 premises. The range of results above the action level across the surveys was from 10% to 36%.

All occupiers of premises above the 200 Bq/m^3 action limit have received a letter from the HPS offering advice.

All of the surveys have shown that there is potential for domestic premises in any area of Jersey to be affected by radon.

In the latest tests, results for a pair of semi detached houses have shown a level of 160 Bq/m^3 in one house and 60 Bq/m^3 in its neighbour. This helps to illustrate the need for householders to test their individual premises for radon and not to rely upon the results for houses close by.

Commercial Test Results

Two of the tests were targeted at premises with likely high levels and the third test was of a premises that is not typical of commercial premises in general. Two premises exceeded the commercial radon action level of 400 Bq/m^3 in work rooms. This result cannot be extrapolated to other commercial premises and, using the data from the UK, it is to be expected that overall a lower percentage of commercial than domestic premises will be above the commercial action level. The situation regarding testing will be the same as for domestic premises, in that employers need to test for radon in individual premises to ascertain the levels. There is mention in historic documentation

that some schools in Jersey may have been tested but HPS has no record of the results for these.

Advice for Householders and Businesses

There are well tested means of reducing radon levels in domestic premises and the cost of remediation is low in relation to the value of housing and the impacts on health. Whilst costs will vary, they can be expected to be between £400 and £1900 although in the case of houses in the 100-200 Bq/m^3 with a resident smoker there would be no cost to giving up smoking and reducing the radon levels might be as simple as increasing ventilation.

Builders and architects can obtain advice on methods of remediation from the Building Research Establishment in the UK.

Businesses should be recommended to include radon in their risk assessments for health and safety the first step of which would be undertaking testing. This work needs to be coordinated with the HSI staff.

Occupiers of newer houses should be encouraged to test their houses to check that the radon membrane is effective.

Potential house buyers should ask the vendors as part of the search process if radon levels have been tested and whether remedial action was required and taken

Recommendations

1. That the States of Jersey continues to recommend to householders and employers that they test their premises for the levels of radon exposure.

2. That consideration should be given to further work with the HPA to undertake grid square mapping and geology based mapping. This may require additional testing and further funding.

3. That the current contract with the HPA be continued to allow local residents to purchase test packs at a reduced rate through the department (£35 through the States cf £48 to individual householders).

4. That advice is given to householders with high levels of radon and levels that might affect smokers, on how to reduce levels of radon in their homes.

5. In households that have levels affecting smokers, advice and support to quit should also be given.

6. A new report from the EU - European Atomic Energy Community (Euratom) has advised that EU member States should introduce a new standard of 100Bq/l for water supplies and also member States should

consider the development of a ‘Radiological Action Plan’ that includes radon in air and water supplies.
HPS has already started to develop a plan for Jersey and has raised the risk of radon in drinking water with the Environment Department.

7. Environment Scrutiny Panel (ESP)
   Radon was on the ‘legacy list’ for the current ESP. The Head of HPS was invited to give a short presentation to the ESP subgroup about radon.
   The outcome was that the ESP subgroup recommended that a joint meeting with the Minister for Environment and staff from Planning and Building Control should be organised with the Head of HPS to discuss the issue further to ensure a joined up approach to policy and implementation.
   This is particularly important as the current Energy Policy requires residents to conserve energy consumption by ‘tight house’ initiatives. This is in conflict with the health recommendation to improve ventilation to reduce radon exposure.

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07.08.2012