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Home Owner Knowledge of Radon in Areas where Full Radon Protection is Expected

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Home Owner Knowledge of Radon Areas where Full Radon Protection is Expected

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Abstract

New homes in areas of high radon risk should include radon protection, typically comprising a gas-tight barrier with provision for additional measures that can be activated if the need is indicated by a radon test made once the home is occupied. A survey of owner occupiers of relevant new properties sought to understand the extent to which the occupiers were aware of, and had taken action on, radon. A minority of householders reported that they had key information and advice on radon, suggesting there is scope for improvement.

Recommendations are made to improve householder awareness, focusing mainly on enhancements to existing information channels that form part of the process of buying a new home. Improvements are also suggested to online information sources along with a potential means to remind home owners about radon after they move into a new home that may have radon protection.

Executive Summary

In 2008, the Health Protection Agency (HPA)* advised that new homes with provision for 'full' radon protective measures should be subject to an appropriate radon test in the first year of occupation. This is achieved through the provision of information and advice to the buyer as part of the home buying process.

Presently, it is unknown how much information is provided to home owners about radon and radon protection when buying new homes. A project was set up using a targeted approach to seek home owner knowledge about radon through a questionnaire; in addition, it offered a free radon test to inform home owners about their radon level. If high radon levels were found, the home owners were advised and encouraged to activate the full protective measures. The project targeted homes built between mid-2010 and the end of 2011 in England where the radon potential exceeds 10%. The project aimed to deliver:

- a** Evidence and recommendations for ongoing improvements in communications about protection against radon in the form of:
 - evidence about occupier knowledge of radon after buying new homes in areas where the radon potential is high and where homes are expected to be built with provision for full measures
 - evidence of the need for changes to questions on conveyance documents and to encourage further communication to the householder/landlord
 - recommendations about implementing a rolling programme to improve householder knowledge of radon for future homes in relevant areas and encourage testing and remediation

- b** Health protection outcomes to home owners in the form of:
 - improved knowledge about the radon potential at their location
 - measurement of the radon level in their home
 - advice on reducing radon where levels are high

In total, around 500 home owners completed the questionnaire and around 220 were included in the final analysis. Half of the home owners that completed the survey were aware of radon. Less than 20% of home owners received information that they should carry out a radon test and around a third of the home owners were aware of radon protective measures. Builders and solicitors were the most informative of the stakeholders.

All home owners buying a property in a radon 'Affected Area' should be provided with information on radon. This report suggests how this information flow could be improved to home owners by raising awareness among housing professionals and encouraging improvements to radon information distributed through conveyance documentation and builder's information packs. Clearer communication of radon information will allow home buyers to make informed decisions about what to do about radon in their newly built homes.

A rolling annual programme to target newly built homes is recommended. The aim will be to raise public awareness about radon in general, radon testing and radon protective measures.

* On 1 April 2013 the Health Protection Agency was abolished and its functions transferred to Public Health England.

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1 Introduction

Radon gas originates from the radioactive decay of uranium in rocks and soil. If it escapes from the ground to the outdoor air it is quickly diluted to low concentrations: in the UK the outdoor concentration is around 4 Bq m^{-3} . The average radon level in UK homes is about 20 Bq m^{-3} . The distribution of radon concentrations in homes is approximately log normal over a wide range of concentrations, with individual homes varying from less than 10 Bq m^{-3} to $10,000 \text{ Bq m}^{-3}$ or more (Rees et al, 2010).

Inhalation of indoor radon is the largest contributor to the average UK radiation exposure (Watson et al, 2005). Higher radon levels have been clearly associated with an increased risk of lung cancer, with the excess risk appearing to be approximately proportional to the long-term average indoor radon concentration. A report by the Advisory Group on Ionising Radiation (AGIR) states that radon is the second largest cause of lung cancer after smoking, leading to just over 1000 deaths in the UK every year (AGIR, 2009). High concentrations of indoor radon are therefore a significant risk to health.

The potential for high radon levels is partly determined by local geology including the concentration of uranium and the porosity and/or degree of fracturing in the near-surface geological features. Radon maps provide an indication of the radon potential and identify areas where high levels are more likely (Miles et al, 2007, 2011; Daraktchieva et al, 2015). Definitive datasets are used to assess the likelihood that an individual property will have a high radon level. The UK has a radon action level of 200 Bq m^{-3} and areas where the risk of exceeding this is 1% or more are termed radon 'Affected Areas'. Public Health England (PHE) advises that all homes in radon Affected Areas should have their radon levels assessed (HPA, 2010)*.

1.1 Protecting new homes against high indoor radon levels

Requirement C1 (CLG, 2010) of the Building Regulations 2010 states that: 'Reasonable precautions shall be taken to avoid danger to health and safety caused by contaminants on or in the ground covered by the building, and any land associated with the building'. The Approved Document Part C (CLG, 2013) refers to guidance produced by the Building Research Establishment (Scivyer, 2007). Both identify areas where such protection is necessary and the latter gives guidance on construction.

For areas of England where the potential for homes to exceed the action level is 3% or above, the guidance recommends the inclusion of 'basic' radon protection in new buildings. Basic radon protection consists of a well-installed damp-proof membrane, modified and extended to form a gas-tight radon-proof barrier between the ground and the building.

It is recognised that basic protection is sometimes insufficient. In areas where the radon potential is higher, with 10% or more homes predicted to be above the action level, the guidance states that new buildings should include provision for 'full' radon protective measures (Scivyer, 2007; CLG, 2013). In England and Wales, full protection consists of basic measures plus either an inactive and capped 'standby' radon sump or a ventilated sub-floor void.

* On 1 April 2013 the Health Protection Agency was abolished and its functions transferred to Public Health England.

Even if building regulations and guidance are followed, it cannot be guaranteed that radon levels in new homes will be below the action level. The only way of knowing that a home has a low radon level is to measure it. A representative measurement cannot be made until a property is occupied because indoor radon levels are significantly affected by ventilation, heating, etc, of the property.

A post-occupation radon measurement is advised in the first year (HPA, 2010). This informs the decision about whether the full measures should be activated by adding a fan to the sump system or to the sub-floor void. In many cases, it is expected that radon levels will be low and activation of the full measures will not be required.

A review of radon and public health risk in 2009 (AGIR, 2009) highlighted a concern that the investment in full radon protective measures in newly built homes is unlikely to be cost-effective unless the occupant of a new property is aware that the property should be tested and the additional protection activated if measurement shows that the radon levels are high.

1.2 Information needed by home owners

The type of radon information that is most appropriate for home owners at the time of purchase depends partly on where the home is located and may include some or all of the following:

- a** They are buying a home in a radon Affected Area
- b** Radon protective measures may be installed in their home
- c** The home may still have high radon levels even if it is installed with radon protective measures
- d** All homes in radon Affected Areas should have a radon test
- e** What to do if the radon test result is high
- f** Where to find more information about radon

All of this information is needed by people buying a new home in an area where full radon protective measures are installed.

Radon information is collected and provided in conveyance documentation during the new house purchasing process from solicitors, other conveyance professionals and builders. Information received by the home owner is dependent upon provision by these stakeholders and the home owner reading and understanding the implications.

Home owners who are made aware of radon can obtain further information from websites and by enquiries through Public Health England, the Building Research Establishment and their local authority.

1.3 Information potentially provided to buyers of new homes

1.3.1 Scope of information that conveyance professionals may provide

In the late 1990s the Royal Institution of Chartered Surveyors (RICS, 2014) advised its members that radon should be mentioned in valuation or pre-purchase reports for all homes in radon Affected Areas. Since then, conveyance documents have been developed to ask relevant questions about radon among other environmental issues related to the home.

During the house conveyance process, solicitors gather radon information about the property to share with and advise the buyer. Some of this information is collected and disseminated to home buyers using conveyance forms, which are described briefly below:

- a** Local authority environmental searches use the CON 29 form to ask questions about environmental issues, including whether the property is in a radon Affected Area
- b** Environmental searches are optional but currently widely used during the house conveyance process. Buyers' solicitors often use a commercial search agency to provide a radon Affected Area search which informs the need for testing
- c** TA6 property information form, introduced in 2009, is completed by the seller; it asks relevant questions about radon, particularly whether any radon tests have been carried out and whether there are any remedial measures in place
- d** TA8 new home information form does not have any questions about radon

Both the TA6 and TA8 forms are used in conveyance transactions for newly built homes. They are used to inform the purchaser and their use is considered good practice by the Law Society (2013a,b).

Table 1 summarises the questions asked on the forms. If the forms are used, they provide good information that is fit for purpose, delivering the information that the home owner needs.

Table 1: Radon-related questions and comments on conveyance documents

Questions/comments	Conveyance forms		
	Environmental search		Law Society information form
	CON 29 local authority	Commercial search agencies	Property information TA6
Is the property in a radon Affected Area?	Y	Y	
Has a radon test been carried out on the property?			Y
Please supply a copy of the test result			Y
Was the test result above the action level?			Y
Were any remedial measures undertaken on construction to reduce radon gas levels in the property?			Y
What level of radon protective measures for new dwellings or extensions to existing ones is required for the area within 25 m of the property?		Y	
Supported by explanatory notes		Y	Y
PHE (www.ukradon.org) contact information provided		Y	Y

1.3.2 Scope of information that builders may provide

1.3.2.1 Radon protection in homes

For this study period, builders were informed by planning and building regulations and associated guidance (Scivyer, 1999, 2007) that homes require radon protection in areas where at least 3% of homes are predicted to have a radon level above the action level of 200 Bq m^{-3} ; additional protection is required in areas with a 10% or greater probability.

Builders will therefore be aware of the need for and the particular radon protective measures installed; this information may be provided to home buyers.

1.3.2.2 Advice on testing for radon and activation of protective measures

Advice on monitoring of completed buildings and extensions is given in the guidance, although it is stated that this is not a requirement of the building regulations for new dwellings. Builders may be aware that the buyers should test to check that their radon levels are low. If radon levels are high, the well-informed home owner will be able to reduce radon levels by employing and activating the full radon protective measures where fitted. There is currently no advice for builders about the quantity and content of radon information they should provide.

1.3.3 Scope of information provided by other stakeholders

Local authorities are expected to provide standard information through the CON 29 environmental search form: dissemination of this information relies upon communications from the solicitor to the buyer during the conveyance process. Local authority environmental health departments may give additional advice about radon in their area in response to direct enquiries.

Warranty providers give structural guarantees for newly built homes. Sections within the policy can include cover for problems arising from the builder failing to comply with building regulations; for example, Part C – ‘Site preparation and resistance to contaminants and moisture’, which includes radon protection.

The British Geological Survey provides a GeoReport service (www.bgs.ac.uk). This is used by builders and local authorities to identify the Affected Area status of land to be built upon and advises on radon protective measures required for new buildings.

Home owners may also research and gather their own information about radon issues.

1.4 Aims of the study

The aims of the study were:

- a** To identify homes built recently in relevant areas where full radon protection is expected
- b** To gather home owner knowledge on radon
- c** To offer post-occupation radon tests to raise radon awareness and to provide advice and encouragement to home owners to remediate those homes that are found to have high radon levels
- d** To provide recommendations for improvements in the process of information flow from stakeholders to buyers of new homes that have radon protection

2 Methods

2.1 Survey design

The survey was designed to collect information on what home owners knew about radon when buying their newly built home. The information was gathered using a questionnaire. This will determine the radon knowledge base of the home owners and inform judgements about whether communications through stakeholders could be improved. Specifically, the aim is to use the information collected to answer the following questions:

- a** What proportion of home buyers received radon information at the point of purchase?
- b** Who provided the information?
- c** What information was provided?
- d** Did the home owner carry out a radon test?
- e** Are there geographical variations in the information delivered?
- f** Does the type of builder or the size of the housing development make a difference?
- g** What can be done to improve radon communications to home owners?

Home owners were offered a free radon measurement at the same time as the request was made to complete the questionnaire. As well as raising radon awareness, the free test provides a post-occupation measurement of radon to check that the levels in the homes are sufficiently low. After the test, advice was given on the result report by PHE when radon reduction was recommended; this was tailored to the radon protective measures that are expected in these new homes. This aspect of the study will be reported separately.

In total, there were just over 4000 newly built residential homes in England identified for inclusion in this programme. The study was limited to England because legislation covering newly built homes is different in other parts of the UK. Royal Mail Just Built™ files were used to provide the addresses of properties capable of receiving mail that were newly constructed in the period from July 2010 to the end of 2011, the most recent years for which appropriate radon-related building regulations apply. These were compared with the radon Affected Area dataset to identify properties with a greater than 10% chance of having a radon level above the action level. New homes in these areas are expected to have full radon protective measures installed. The occupants of these homes were sent a survey pack.

2.2 Survey pack

The letter (see the appendix) gave information about radon and its risks and described the aim of the research. The householder was asked to complete a questionnaire outlined in Table 2, either by post or online and offered a free radon test.

The letters and questionnaires were dispatched in March 2013. A summary of the questionnaires sent and received for analysis is given in Table 3. Around 12% of home owners completed a questionnaire. Of those that responded, 75% accepted a free radon test.

Table 2: Outline of information collected on the questionnaire

Section	Questions asked
Radon measurement offer	Name, address, signature
Section 1 – about the home	Year of build, tenure, type of build (new build or conversion), ground floor type, builder and development type, first time occupier?
Section 2 – radon awareness	Type of radon information received, information provider, presence and type of protective features
Section 3 – radon testing	Has a 3-month test been completed, is the result above the action level, actions taken to reduce the level, has a retest been undertaken to check the level has been reduced adequately?
Comments	Open text format for any comments

Table 3: Responses to home owner questionnaire

	Responses	Completed questionnaires			
		Paper	Online	Homes already tested (503 responses)	Homes accepting test (503 responses)
Number	503	460	43	50*	377
%	100	91	9	10	75

* Of those that had already completed a test, 24 accepted another free measurement; 3 had tests in progress.

2.3 Selection of data: questionnaires to be included for analysis

The timescales between planning consent and building completion can be several years. To ensure that all of the homes included in the analysis were expected to have full radon protection, the following refinements were made:

- a** The property is in a radon Affected Area that required full radon protection as shown in Annexe A of the 2007 version and also in the 1999 version of BR211 (Scivyer, 1999, 2007). It was assumed that planning permission was given after 1999 for these properties because they were allocated an address during 2010 or 2011
- b** The occupant is the first owner of the property; the study aimed to establish what people knew about radon when they bought a new property. Tenants were excluded as they were not involved in the property purchase
- c** The property is newly built; conversions and extensions were excluded because the complete footprint of the building may not have full protective measures installed to the specifications of a newly built property stated in the guidance document BR211

Figure 1 shows a flow chart describing the selection criteria and the number of responses discarded at each stage. Of the 503 completed questionnaires, the number was refined to a total of 220 questionnaires that were included in the analysis. Questionnaires were collected until October 2013 and the data collated in a Microsoft Access database.

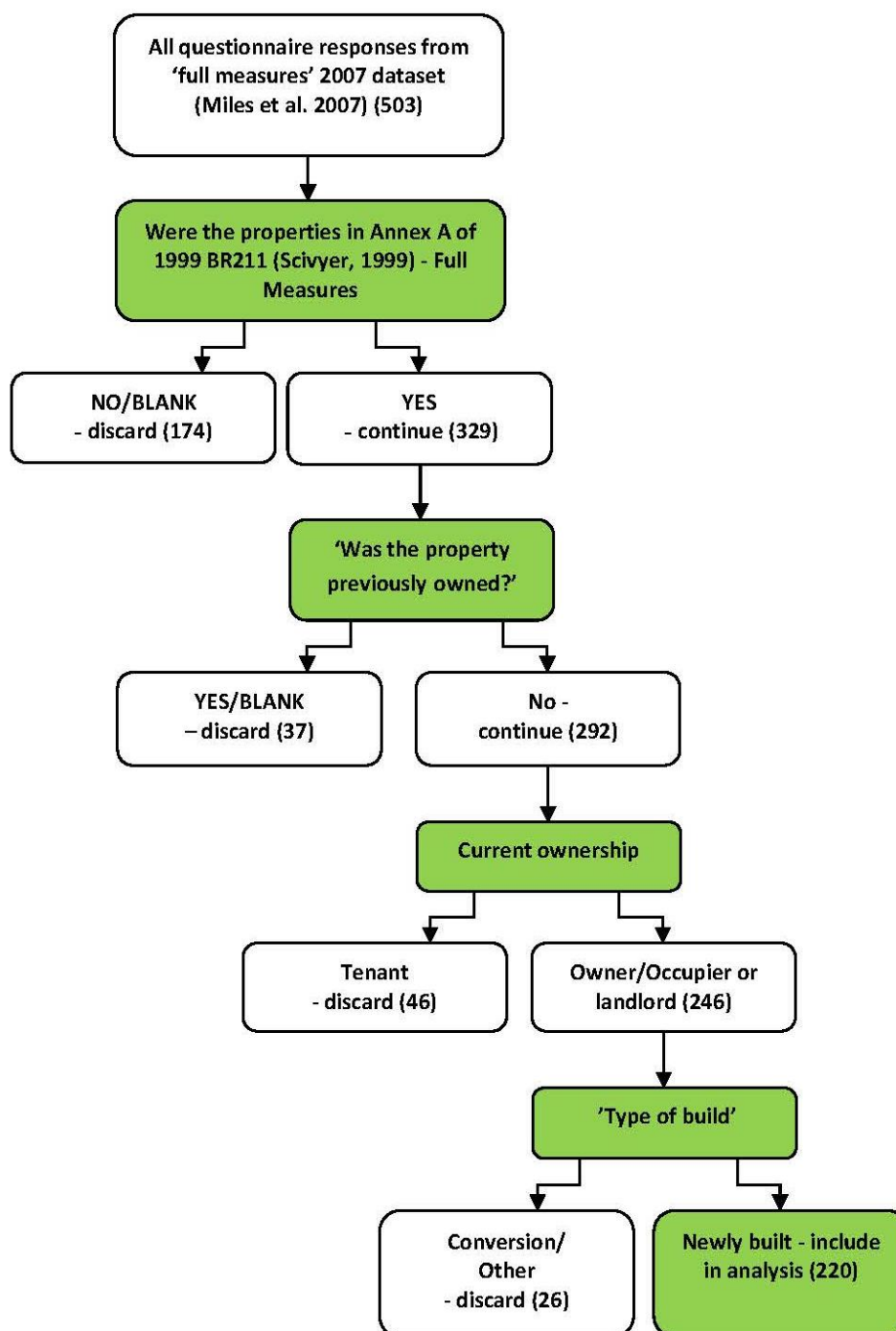


Figure 1: Flow chart showing how questionnaires were selected for analysis

2.3.1 Geographical distribution of homes in the survey

The geographical distribution of invitations and questionnaires returned are detailed in Table 4. It should be noted that the majority (61%) of the homes built in relevant areas in the period 2010 to 2011 were in the Plymouth, Truro and Northampton postcode areas, hence a large proportion of questionnaires were sent to and received from these areas.

Table 4: Geographical distribution of households in the survey

Postcode	Post town	Number sent to post town	Number received from post town	Number selected for analysis	% of all responses selected for analysis
BA	Bath	104	12	8	4
BB	Blackburn	4	1	0	0
BD	Bradford	13	1	0	0
BS	Bristol	75	3	0	0
CA	Carlisle	37	11	0	0
CV	Coventry	3	2	0	0
DE	Derby	105	9	1	<1
DL	Darlington	49	4	0	0
DN	Doncaster	8	1	0	0
DT	Dorchester	7	1	0	0
EX	Exeter	197	18	10	5
GL	Gloucester	194	27	0	0
HG	Harrogate	21	0	0	0
HR	Hereford	5	1	0	0
LA	Lancaster	85	14	0	0
LE	Leicester	59	9	5	2
LN	Lincoln	43	4	0	0
NE	Newcastle Upon Tyne	6	1	0	0
NG	Nottingham	74	15	10	5
NN	Northampton	538	63	24	11
OX	Oxford	81	12	3	1
PE	Peterborough	89	12	0	0
PR	Preston	1	0	0	0
PL	Plymouth	1045	114	74	34
S	Sheffield	13	3	0	0
SK	Stockport	68	10	9	4
SN	Swindon	1	0	0	0
SP	Salisbury	12	3	2	1
SY	Shrewsbury	16	5	0	0
TA	Taunton	85	12	3	1
TF	Telford	3	1	0	0
TQ	Torquay	153	18	2	1
TR	Truro	991	114	69	31
TS	Cleveland (Teesside)	1	1	0	0
WR	Worcester	2	1	0	0
Total		4188	503	220	100

2.3.2 Data limitations

The questionnaire response data is dependent on the understanding and memory of the home owner. In some cases, it may be that home owners' recollections may be inaccurate or incomplete. Some responses indicated that homes were built in 2008, around 5 years prior to the survey. It was assumed that the application for planning permission for the properties was made after the 1999 edition of the BR211 guidance document (Scivyer, 1999) was published and that the local councils used the latest map data at the time of the planning application to determine if full protection was needed.

3 Results

3.1 General overview

3.1.1 House details

The selection of properties from Royal Mail Just Built™ files from 2010 and 2011 was to ensure that the majority of homes were actually completed during this period when relevant building regulations and guidance applied to newly built homes. To check this method of selecting homes, the 'time of build' information from all returned questionnaires was assessed. This data confirmed that the majority of the properties were built in 2010 or later (Figure 2). A significant number of properties were listed as built before 2008. Approximately half of these were conversions that may have been originally built before 2008: these were excluded from further analysis as part of the selection process described in Section 2.3.

This suggests that the use of the Royal Mail Just Built™ files selection criteria in combination with the home owner question about the date of build was appropriate and would be suitable for similar future work.

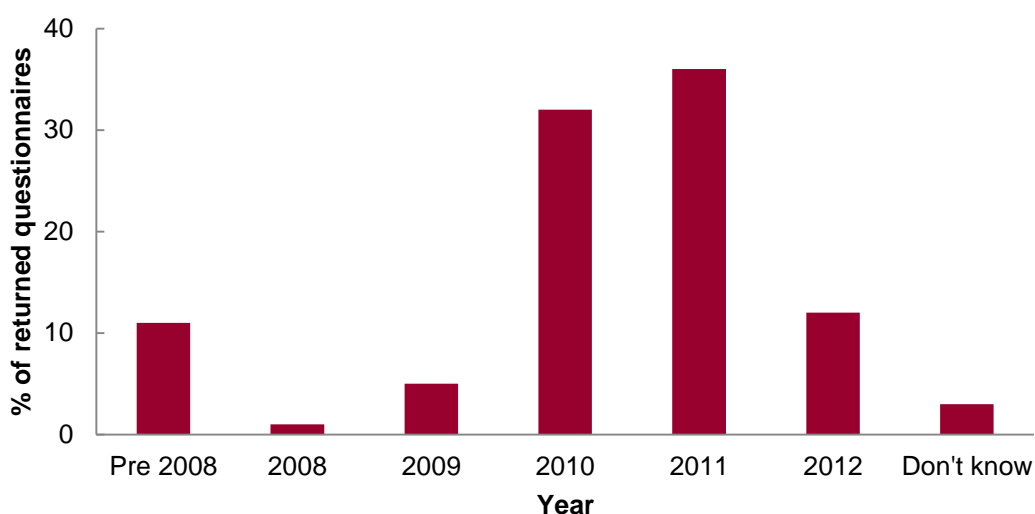


Figure 2: Year of build total response

3.1.2 Results from the questionnaires

There were 220 questionnaires selected for analysis after refinement. The responses are summarised in the example questionnaire in Figure 3.

Free Radon Measurement Offer
 Please tick here if you would like to accept the offer of a free measurement pack 187 «Unique_No»

If you agree to take up the offer of a free measurement, we will use the measurement data gathered for research purposes.
 Title: Mr Mrs Miss Other
 Initial(s) Surname
 Signature Tel:
 Please do not detach this section.

Please attempt to answer all the questions and please answer them as accurately as possible.

Section 1: About your home

<p>When was the property built? a) before 2008 <input type="checkbox"/> 5 2008 <input type="checkbox"/> 4 2009 <input type="checkbox"/> 10 2010 <input type="checkbox"/> 83 2011 <input type="checkbox"/> 92 2012 <input type="checkbox"/> 25 don't know <input type="checkbox"/> 1</p>	<p>Are you... b) an owner occupier (including if you have a mortgage) <input type="checkbox"/> 219 a landlord <input type="checkbox"/> 1 a tenant (rent from the council/housing association) <input type="checkbox"/> 0 a tenant (rent privately) <input type="checkbox"/> 0</p>	
	<p>Has anyone lived in the property before you? c) yes <input type="checkbox"/> 0 no <input type="checkbox"/> 220 not applicable (for example, you are a landlord) <input type="checkbox"/> 0</p>	
<p>If you were the first owner or occupier was it... d) newly built <input type="checkbox"/> 220 a conversion (example, barn conversion) <input type="checkbox"/> 0 other (specify in comments overleaf) <input type="checkbox"/> 0</p>	<p>Is your ground floor type... e) solid <input type="checkbox"/> 128 suspended <input type="checkbox"/> 24 part solid/suspended <input type="checkbox"/> 18 not sure <input type="checkbox"/> 48</p>	<p>Who was your property built by? f) local house builder <input type="checkbox"/> 66 national house builder <input type="checkbox"/> 89 regional house builder <input type="checkbox"/> 41 self build <input type="checkbox"/> 11 Not sure <input type="checkbox"/> 10</p>
<p>Was your property built: g) as a single unit on a plot <input type="checkbox"/> 42 on a small development (fewer than 20 properties) <input type="checkbox"/> 44 on a larger development (20 or more properties) <input type="checkbox"/> 124</p>	<p>If you know the name of the builder please add here h) <input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/></p>	

Section 2: Radon awareness

When you purchased your property did you receive... (please tick all that apply)

a)
 General information about radon 81 Advice that you should test for radon 38
 Information about radon protection in your property 12 Advice on what to do if the radon level is high 5

Radon in new build properties

Figure 3: Questionnaire and responses

Who provided the information about radon? (please tick all that apply)

b)

builder	<input type="checkbox"/> 50	own investigation	<input type="checkbox"/> 20
warranty provider (for example, NHBC)	<input type="checkbox"/> 9	estate agent	<input type="checkbox"/> 1
local authority	<input type="checkbox"/> 18	solicitor	<input type="checkbox"/> 43
landlord	<input type="checkbox"/> 0	surveyor	<input type="checkbox"/> 14
Health Protection Agency	<input type="checkbox"/> 6		

Was your property built with radon protective features?

c)

yes 74 no 4 don't know 135

If yes, do these include:

d)

a radon membrane or barrier	<input type="checkbox"/> 36	a radon sump	<input type="checkbox"/> 22
under-floor ventilation (for example, airbricks)	<input type="checkbox"/> 44	not sure	<input type="checkbox"/> 31

Section 3: Radon testing

Have you already completed a 3 month radon test?	If yes, was the result above the Action Level (200Bq m⁻³)?
a)	b)
yes <input type="checkbox"/> 23 no <input type="checkbox"/> 186 in progress <input type="checkbox"/> 0	yes <input type="checkbox"/> 3 no <input type="checkbox"/> 23
If you have you taken any action to reduce the radon level, what have you done? (please tick all that apply)	
c)	
activated the sump with a fan	<input type="checkbox"/> 0
added a passive stack to the sump	<input type="checkbox"/> 0
increased the under-floor ventilation (for example, cleaning, replacing or adding airbricks)	<input type="checkbox"/> 1
added a fan to the under-floor space	<input type="checkbox"/> 0
added a positive ventilation system	<input type="checkbox"/> 0
other (please specify below)	<input type="checkbox"/> 0
Did you retest to check that your radon level has reduced?	
d)	
yes	<input type="checkbox"/> 0
no	<input type="checkbox"/> 28

Comments:

Please return your completed questionnaire to us in the pre-paid envelope enclosed; otherwise return to:

Radon Group, Health Protection Agency, Chilton, Didcot, Oxon, OX11 0RQ

Thank you for taking the time to complete this survey

Radon in new build properties

Figure 3: Questionnaire and responses (continued)

3.2 Radon information received by the home owner

3.2.1 Who provided information about radon?

In total, 121 home owners (65%) responded to this question (Figure 4). Seven (13%) of the home owners received information from more than one source; hence the percentages do not sum to 100. Most of the information was provided by builders and solicitors.

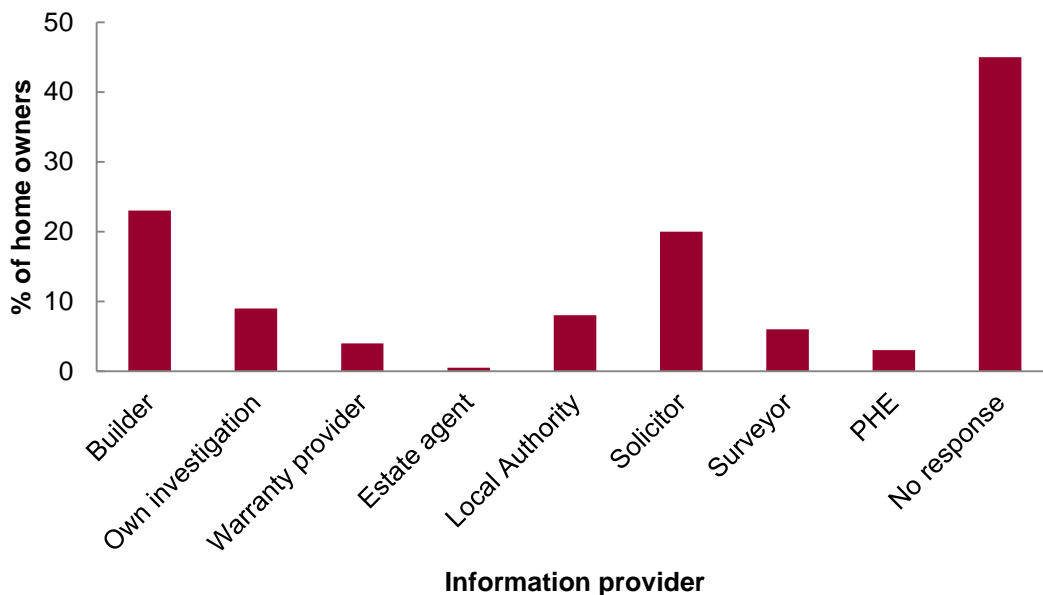


Figure 4: Source of radon information provided to home owners (121 respondents)

3.2.2 Who was the property built by?

Of the 217 people that answered this question, just over half bought properties from national or regional house builders (60%) (Figure 5).

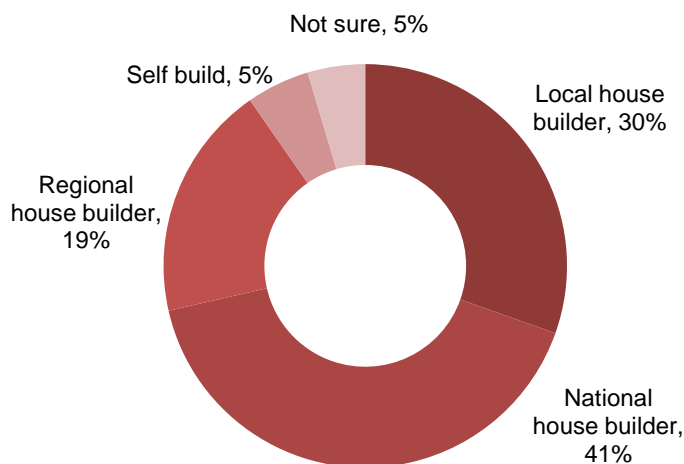


Figure 5: Type of builder (217 respondents)

Using the information on the type of builder together with data on radon information received, it appears that a similar proportion of each builder type provides radon information. Home owners buying from local builders and self-builders were slightly better informed (Table 5).

Table 5: Information received from different types of builder

Builder type	Number	Radon information received	%
Self-build	11	2	18
Local house builder	66	18	27
Regional house builder	41	8	19
National house builder	89	21	23
Not sure of type	10	1	10
Total	217	50	23

3.2.3 How large is the building development?

Over half (56%) of the homes were in developments of 20 properties or more. The remainder were from single unit developments (19%) or developments with fewer than 20 homes (20%). Around 5% did not answer the question.

Comparing development size and whether information was received, it appears that more home owners in properties that were built as single unit developments were better informed about radon compared to those buying properties built in developments of either fewer or more than 20 homes; 64%, 32% and 52%, respectively (Figure 6).

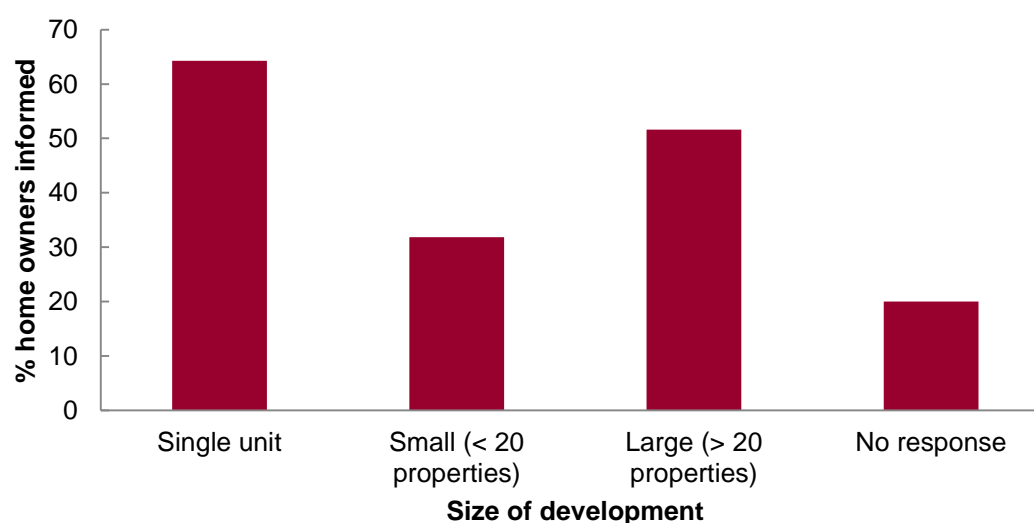


Figure 6: Proportion of home owners receiving radon information depending on development size (210 respondents)

3.2.4 What information do home owners recall receiving?

Around half (49%) of the home owners stated that they had received some form of radon information when they purchased the property. Of 107 home owners that answered this question (Figure 7), 75% received general information and 35% were advised to test for radon. Information about radon protective measures was given to 24 (11%) of the home owners; 11 (5%) of the home owners were given information about what to do if radon test levels were high.

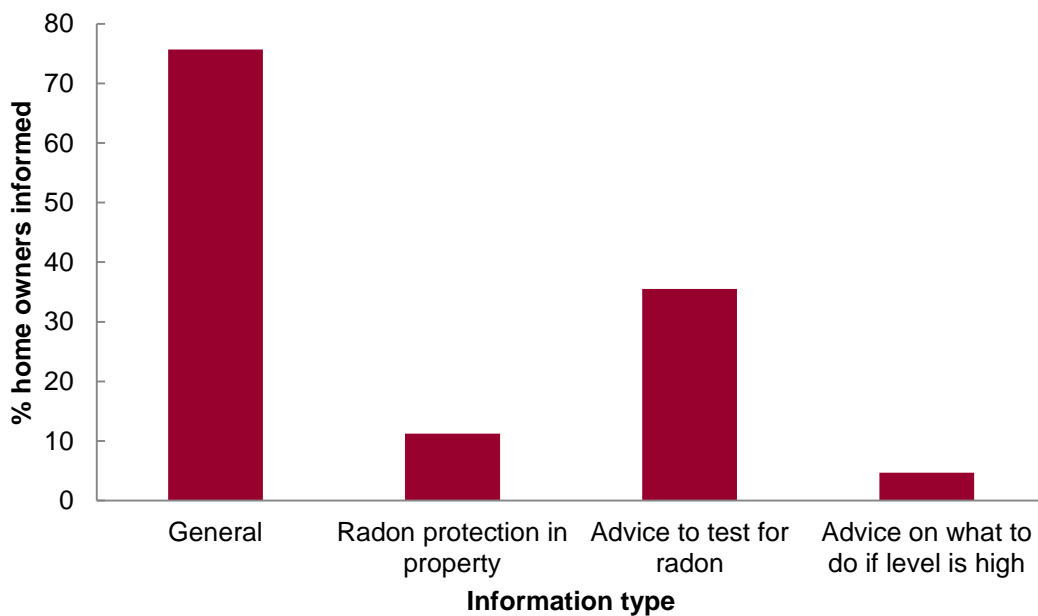


Figure 7: Type of radon information received (107 responses)

3.2.5 Who provided what information?

Figure 8 describes the combined responses from the 93 home owners that responded to both questions on the type of information provided and who provided it (Figures 4 and 7, Sections 2a and b, respectively, on the questionnaire). Builders and solicitors not only provided information most often, but they also provided the fullest range of radon information. Builders and local authorities appear more likely than others to give information about testing for radon. Builders and solicitors were the main source of information about radon protective measures installed in the property. Home owners carrying out their own investigations were the most informed about what should be done if radon levels were high. Home owners did not state the source of information when carrying out their own investigations, but it is likely that they would have used a range of sources including internet searches.

3.2.6 Was your property built with radon protective features?

In total, 213 home owners answered this question (Section 2c). Of these, 35% identified that their home has radon protective features installed but 63% did not know.

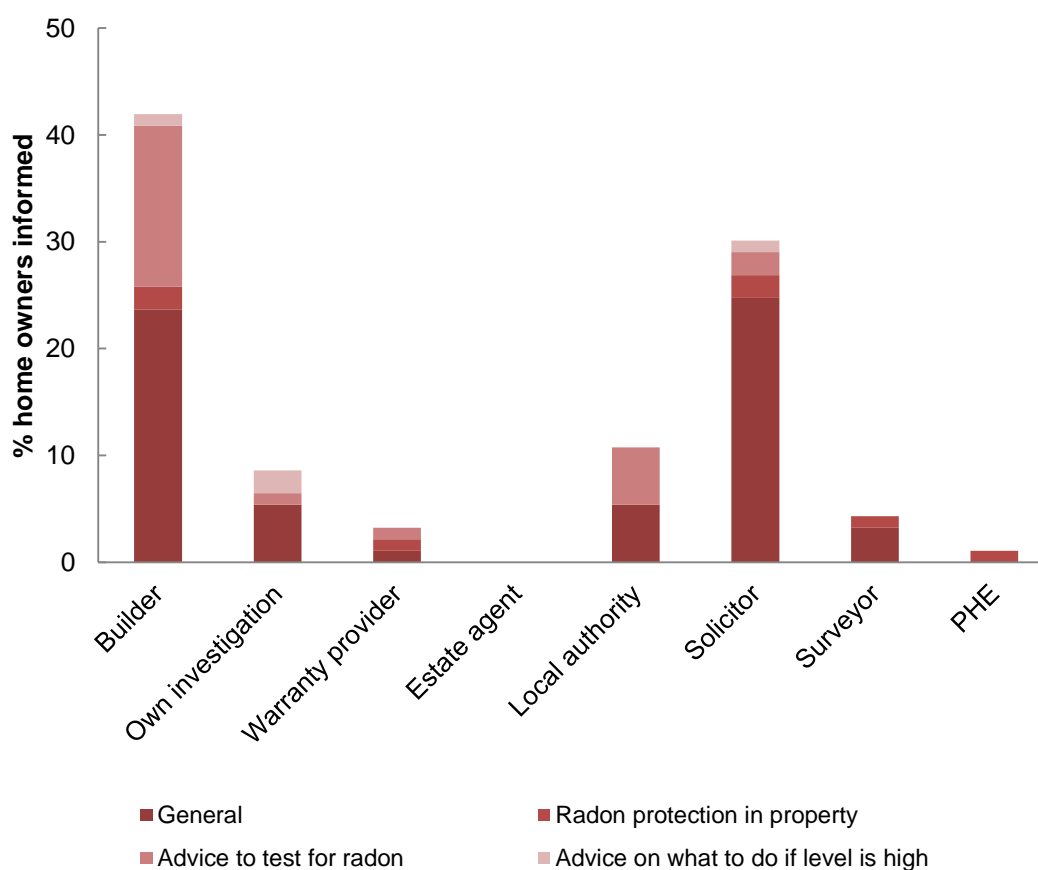


Figure 8: Range of radon information provided from a single source (93 responses)

3.2.7 What were the protective features?

Table 6 shows the type of radon protective features that home owners identified as being installed in their home. This table comprises data from 101 home owners that responded to Section 2d, even though only 74 stated that they had protective measures in Section 2c. Single protective features were identified by 40% of this group, with 9% suggesting that only basic protection (a membrane) was fitted. Around 40% identified multiple features, suggesting that they were aware of full radon protection being fitted. Two of these home owners identified all three protective measures: this combination (membrane, sump and under-floor ventilation) is only used in suspended floor properties where the membrane is incorporated in the oversite concrete with a standby sump below. Around 31% of the home owners knew that they had protective measures but were unsure of the type.

The home owners that stated their builder type and knew that they had radon protective measures are summarised in Table 7. Owners of self-built properties and those built by local builders were more aware that they had radon protective features: 82% and 47%, respectively.

Table 8 shows similar data based on the development type. Home owners with properties built as single units most frequently reported that protective measures had been installed (64%) compared to those that purchased properties in developments with multiple homes.

Table 6: Home owner awareness of radon protection in homes by type of measure (101 responses)

Protective features	Full/basic radon protection	% of home owners answering the question
Membrane	Basic	9
Membrane and sump	Full	8
Membrane, sump and under-floor ventilation	Full	2
Membrane and under-floor ventilation	Full	17
Radon sump*	Full	9
Radon sump and under-floor ventilation*	Full	3
Under-floor ventilation*	Full	22
Not sure	N/A	31
Total		100
* Assumes membrane was also fitted.		

Table 7: Home owner awareness of radon protection in homes by type of builder

Builder type	Number of home owners	% aware of protective features
Self-build	11	82
Local house builder	66	47
Regional house builder	41	27
National house builder	89	25
Not sure	13	8

Table 8: Home owner awareness of radon protection in homes by size of development

Builder type	Number of home owners	% aware of protective features
Single unit	42	64
Small development (< 20 properties)	44	32
Large development (> 20 properties)	124	26
No response	10	10

3.2.8 Home owner knowledge in relation to geographical area

Table 9 summarises radon awareness in respondents according to their location using the major post town as the identifier. The areas of Plymouth, Truro and Northampton represented 62% of the questionnaires issued. Around 40% to 60% of home owners received some radon information.

Knowledge about radon protective measures was better in the South West and the 'rest' compared with Northamptonshire, although the small number of responses from Northamptonshire means that this observation is inconclusive.

While there are regional differences in the proportion of home owners who had completed a radon test, the overall position is the same in each area: a low proportion of home owners test their homes to decide whether full measures should be activated.

Table 9: Home owner awareness of radon protection in homes in England

Postcode	Post town	Number of completed questionnaires	% of positive responses in each area		
			Was radon information received?	Was the property built with radon protective features?	Has a 3-month test been completed?
PL	Plymouth	74	50	34	11
TR	Truro	69	39	35	20
NN	Northampton	24	50	17	0
Rest, excluding PL, TR and NN		53	58	40	2
Total		220	49	34	10

4 Discussion

4.1 Home owner knowledge base

4.1.1 General radon knowledge base of home owners

Half (107) of the home owners stated that they had received radon information (Figure 7). Of these, most (75%) indicated that they had received general information and 35% were advised to test for radon (Figure 7). A minority of home owners recalled receiving information about radon protective measures in the property and what they should do if the radon level was high (11% and 5%, respectively). Most of the information was provided by solicitors or builders.

An important point to note is the home owners may have ignored or forgotten the information provided by any of the information sources, although it is not possible to determine this from the questionnaire responses.

The following sections describe improvements in communication that could be made by stakeholders within the property purchase process.

4.1.2 Radon protective measures

The proportion of home buyers who stated that they have radon protective measures in their home was 35%. This is a larger proportion of home owners than those who stated that they had received information about radon protection when they purchased their home (10%). It might be that some obtained information afterwards (maybe in response to receiving the questionnaire). It may also be that some home owners knew about their home's radon protection but could not remember how they found out.

As around 65% of home owners were unaware that radon protective features had been installed in their property, this suggests that communication of information about radon protective measures could be improved significantly. This could be achieved by improving information provided to builders installing radon protection as part of the guidance and from the builders to the home owners at the point of sale by inclusion in information packs.

4.1.3 Advice on radon testing and activation of radon protective measures

Home owners may be aware of protective measures but may not be fully aware that they could potentially still have high radon levels and to be sure about this they need to test for radon. Only 17% of home owners reported that they had been given the information that they should test for radon: a large proportion of this advice came from builders compared with other stakeholders. Around 10% of home owners had taken the initiative to do a radon test. A small number of home owners (2%) obtained information on what to do if the radon level was high after testing; builders provided half of this.

It may be that information about the need to test is not clear or not provided. Some home owners may not feel it is necessary to test as they believe they already have radon protection built in. It may also be that many home owners forget this matter as they are settling into their new home.

Information on the need to test newly built homes in radon Affected Areas could be included in conveyance documentation, builder's information packs or websites such as the dedicated PHE website, www.ukradon.org.

4.1.4 Potential improvements to information flow from conveyance professionals to buyers

The conveyance forms (TA6 and TA8) provide a standardised and common means of ensuring that key information is obtained for, and provided to, new home buyers and those advising them. Radon is already addressed in the general conveyance form (TA6). However, there is scope for questions asked on the TA conveyance forms to be improved and clarified with respect to radon:

- a** On the TA6 property information form, one question asks about '... remedial measures that were undertaken on construction': this is ambiguous. It relates to

post-construction remedial measures that may be used to reduce radon levels, not to protective measures that are installed at construction. This question should be clarified to distinguish protective measures for newly built homes from remedial measures in existing homes

- b** On the TA8 form, which relates directly to newly built properties, an extra question could be included to ask what radon protective measures, if any, were installed on construction. A statement such as 'Home owners in radon Affected Areas should carry out a radon test once the property is occupied' could be included to communicate the need to test for radon. Buyers of new properties should be directed to appropriate websites for information

Solicitors collect and rely upon information provided by the sellers of properties, current owners and builders using the TA6 and TA8 forms. It is considered best practice to convey information from these forms to the buyers (Law Society, 2013a,b). It is difficult to estimate how much information is passed on by solicitors and to what extent buyers observe and act on the information they receive.

It may be useful if solicitors could be encouraged to remind relevant clients to retain and act on the information and advice about radon. To increase awareness among solicitors of the importance of the radon questions, articles about radon during house conveyance processes could be circulated in Law Society newsletters or bulletins.

4.1.5 Potential improvements to information flow from builders to buyers

Builders provide a good range of information about radon. However, information was limited on the radon protective measures installed, the need to test once the property is occupied, and how to activate the additional full radon protection if the test result is high.

Builders should be aware of the protective measures installed but may not know the steps to be taken to activate them.

Builders are likely to have well-established methods of providing information to buyers of newly built home. However, these may not include information about the radon protective measures installed. This survey did not identify the way in which information was delivered by stakeholders; for example, by leaflets, verbal communications or information packs.

Improvements to information flow could be facilitated by ensuring that information packs, provided by the builders to the buyers, include relevant radon information identified in Section 1.2.

Information leaflets could be developed in partnership with house builders, etc, to detail information that buyers need to know with reference to relevant websites such as www.ukradon.org. The website could be developed to include information on radon specifically for owners of new homes.

To support these improvements, discussions were held with the authors of the BRE building guidance for radon protective measures and additional content was agreed for inclusion in the updated guidance (Scivyer, 2015). Radon awareness and 'best practice' could also be raised through articles in builders' journals and newsletters.

4.1.6 Information received by home owners from other information providers

Around 10% of the home owners received information from their local authority, mainly general information and advice to test for radon.

Around 5% of radon information was received from warranty providers. Warranty providers underwrite newly built properties and give a structural guarantee. A completion certificate confirms building regulations have been met.

Less than 10% of home owners received information from surveyors. However, surveyors are not generally employed by buyers when purchasing newly built properties.

Less than 10% of home owners carried out their own investigations.

No respondents reported that radon information was received from estate agents. The reason for this could be that many new homes are sold directly by the builder, rather than through an estate agent.

4.1.7 Public health outcomes

This study raised awareness of radon in home owners that received the questionnaire and highlighted the need to carry out a radon test. Home owners who tested and had radon concentrations above the action level were given advice on how to reduce the level. The reduction in radon concentration will result in a reduced risk of developing lung cancer for the occupants.

4.1.8 Future work

The process of cross-matching new domestic addresses (using Royal Mail Just Built™ files) with areas where full radon protection is expected proved to be a reasonably effective means of identifying homes where radon information is likely to be needed. This approach could be used to raise awareness of the likely provision of full measures and to encourage householders to test for radon. A rolling annual programme to target relevant newly built homes in areas where full measures are expected would raise awareness in relevant groups of people about radon, testing and the radon protective measures that are installed.

4.2 Summary – what home owners need to know

Table 10 summarises what home owners may need to know when buying a new house, what the current arrangements provide and recommendations for improving information flow.

Table 10: What buyers of new homes need to know about radon – summary

Buyers need to know	Potential source of information	How do they find out?	Recommendations to improve communication
Is the property in a radon Affected Area?	Solicitors	Conveyance forms	Raise stakeholder radon awareness through publications, eg professional magazines
	Builders	Builder information packs and other communications	
	Local authorities	Local authorities through the CON 29 and public or environmental health teams	
	Own research	UKradon website (www.ukradon.org)	
What radon protective measures are installed?	Builders	Builder information packs and other communications	Builders to include relevant information in their literature/information packs Encourage builders to communicate with buyers about radon protective measures fitted to the property Updates of building regulation guidance document BR211 to advise builders to share details of protective measures with the buyer
	Solicitors	Conveyance forms	Improve questions in TA6 and/or TA8 conveyance forms
A radon test should be carried out within the first year of occupation	Builders	Builder information packs and other communications	Encourage builders to communicate the need to test to buyers Updates of building regulation guidance document BR211 should state that buyers carry out a radon test in the first year of occupation
	Solicitors	Conveyance forms	Amend TA6 and/or TA8: add a statement to carry out a radon test
	Local authorities		Information could be disseminated through publications, ie professional magazines
	PHE	UKradon website	Add information specific to 'new homes' on www.ukradon.org including the need to test even if protective measures are fitted PHE could periodically identify new homes in relevant areas and write to the owners advising them to test
What to do if the radon levels are high	Builders	Builder information packs and other builder communications	Guidance could be included on the actions to take if the levels are high in updates of building regulation guidance document BR211 and that this information should be shared with the buyer Encourage builders to include information on how to activate protective measures in full radon protection areas within their home information packs
	Own research	UKradon website	Amend www.ukradon.org to include radon preventive measures in newly built properties

5 Conclusions

In specific areas, new homes are expected to be built with provision for full radon protective measures. In order to determine whether these full measures need to be activated, the householder needs to have an awareness of, and information about, radon and what action to take. This study sought to identify the extent to which home owners who have recently bought newly built homes in relevant areas were provided with, and were aware of, relevant information and whether they had acted on any advice.

When someone buys a new home in an area where full radon protection is expected, there is a limited set of information and advice that they need in order to be aware of this situation and to be able to take appropriate action. This study has identified that there are appropriate communications routes in place as part of the home buying process. However, it appears that there is scope for improving the extent to which these routes are used for providing radon information and the format and detail of the information that is provided.

Home buyers have to address many issues during the process of buying and moving into a new home. Radon itself is imperceptible to the human senses and any protective measures may not be visible or obvious, so radon protection in the new home can easily be overlooked, even if good quality information is provided at the time of purchase. Follow-up communications to the owners of relevant new homes, potentially in the form of a rolling programme undertaken by PHE or others, may provide a means of stimulating awareness and action.

The detailed conclusions of this study are:

- a** Half of the home owners that completed the survey were aware of radon. A minority were aware of specific information about radon, radon protection in their home and of advice to test for radon and take action if required
- b** Builders and solicitors are the main providers of radon information for buyers of newly built homes. Around 20% of home owners reported that they had received information from each
- c** Of the home owners that received radon information, most received general information (80%). A minority recall receiving information about radon protective measures in their home (11%), being advised to test (35%) and what actions should be taken if a radon measurement was high (5%)
- d** A small proportion (around 10%) of home owners had already carried out a radon test
- e** In most cases, the size of the building company and the size of the housing development are not major factors in determining what information is provided. Owners of properties built as a single unit or self-build were slightly better informed
- f** Conveyance forms are informative, but minor amendments would further improve and clarify them
- g** It would be appropriate to undertake a similar study after a few years to determine what improvements have been made and whether home owner knowledge and action on radon has been improved

6 Recommendations

Recommendation 1: All home owners buying a property in a radon Affected Area should be provided with the following radon information and advice at the time of purchase:

- a** They are buying a home in a radon Affected Area
- b** Radon protective measures may be installed in their home
- c** The home may still have high radon levels even if it is installed with radon protective measures
- d** They should carry out a radon test
- e** What to do if the radon test result is high
- f** Where to find more information about radon

Recommendation 2: Standard conveyance (Law Society TA6 and TA8) forms could be improved by including the following amendments:

- a** Modify TA6 form question 7.5 to remove the reference to 'on construction' and rephrase the question along the following lines: 'Does the property have protective (installed during construction) or remedial (after construction) measures to reduce radon gas levels?'
- b** Modify TA6 form 'Radon notes', Section 7.4, to advise home owners to complete a radon test, if the property is in a radon Affected Area
- c** Modify TA8 form (used for newly built properties) to add a question on radon: 'What radon protection measures, if any, were installed on construction?' and add a statement that 'Home owners in radon Affected Areas should carry out a radon test once the property is occupied'

Recommendation 3: Builders of new homes in radon Affected Areas should be encouraged to provide buyers with relevant radon information and advice from the list at recommendation 1. PHE could usefully contribute to this; for example, in supporting the preparation of standardised information.

Recommendation 4: Radon awareness among housing professionals should be improved. This could be achieved by a combination of permanently available information (for example, on relevant websites) and periodic, targeted communications, such as articles and training opportunities.

Recommendation 5: The UKradon website should include better information about radon in new homes including what home buyers need to know (see recommendation 1) and where to find relevant information.

Recommendation 6: PHE should implement a rolling programme to target newly built homes with full radon protective measures to support the provision of information and advice in recommendation 1.

Recommendation 7: A follow-up study, similar to this, should be conducted after a few years to review the position and assess the impact of any changes such as action based on these recommendations.

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Appendix Invitation Letter: To Test and Complete the Questionnaire



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www.ukradon.org

The Occupier
«A1»
«A2»
«A3»
«Postcode»

Our ref: «Password»

22 February 2013

Dear Sir/Madam,

The Health Protection Agency (HPA) would like to ask you for help with an important research project. We would like to know specifically what you found out about radon when you purchased your property. The project is focused in areas where new homes may include built-in radon protection. The results will provide information so that communications and guidance about radon can be improved for those buying new houses in radon affected areas.

You may be aware that radon is a naturally occurring radioactive gas which comes from all rocks and soils. In some areas, there is a chance that some buildings could have high levels of radon. Long term exposure to high levels of radon increases the risk of developing lung cancer, especially if you smoke or have smoked in the past.

Our records show that your home is in a radon affected area and may already have radon protection installed. We would appreciate your input in our survey by either:

- Completing the enclosed questionnaire and return it to us using the envelope provided
- Or complete the questionnaire online at <https://hpa-surveys.org.uk> and enter the survey ID: **nb2010**. Then enter your unique ID which can be found at the top of this letter (above the date).

The questionnaire should take approximately 10 minutes to complete. We plan to publish a report on the results of this project but we will not identify any individual properties, individual information or pass any details onto third parties.

The HPA recommends that homes in radon affected areas, even if they were built with radon prevention, should be tested and that high levels should be reduced. To check your levels and to thank you for completing the survey, we would like to offer a free radon test for use at the above address. To accept this offer, please complete the section at the start of the questionnaire. If the radon level measured in your home is high, we will advise on what steps are needed to reduce it. Please note this is a time limited offer.

If you are a tenant, please give this questionnaire to your landlord to complete.

Please accept my thanks for your invaluable help in this research. You can find out more about radon at www.ukradon.org. You can also contact us on 01235 822622 or by email at radon@hpa.org.uk.

Yours faithfully,

A handwritten signature in black ink that reads "S.A. Hodgson".

Sue Hodgson
Principal Radiation Protection Scientist

«Batch»