



Housing Health and Safety Rating System (HHSRS)

Case Studies

Group B
Physiological
Requirements

Hazard B10
Radiation

Example B10.2
1920–45
Semi-detached House

Vulnerable Group
Over 60s
Lifetime exposure

Multiple Locations
Yes

Related Hazards B11
Damp and
Mould Growth



Dwelling

Description of Dwelling

This is a three-bedroomed semi-detached house, built in around 1930, in a radon-affected area.

It has solid 9-inch brick external walls that are rendered, and all of the ground-floor rooms have suspended timber floors. The house, which is in generally good condition throughout, is centrally heated by a wall-mounted boiler in the kitchen, with a fan flue. There is an unused open fire in the living room that is kept for decorative purposes.

The property is situated in an area of the East Midlands identified on UK Radon.org information maps as having the highest radon potential (greater than 30%).



1
Front exterior
view of house

Radon (bq/m ³)	Likelihood of Harm	Rating Score	Rating Band
800	1 in 300	3,033	High
400	1 in 500	1,820	High
200	1 in 1,000	910	Medium
150	1 in 1,000	910	Medium
100	1 in 5,000	455	Medium
50	1 in 5,000	182	Medium
25	1 in 5,000	182	Medium

Deficiencies

Description of Deficiencies

The floors to the ground-floor front and rear living rooms, kitchen and hall are tongue-and-groove timber boards laid on joists, with a 250mm gap to the subfloor. The subfloor space should be ventilated by airbricks at the front and rear of the house, but these are obstructed. There are openable windows but no mechanical extract ventilation.

Measurements over a three-month period using a domestic radon detector show a radon level in the living room and kitchen of 800Bq/m³.



2
Blocked air bricks
at the property



3
Open fire in the
living room

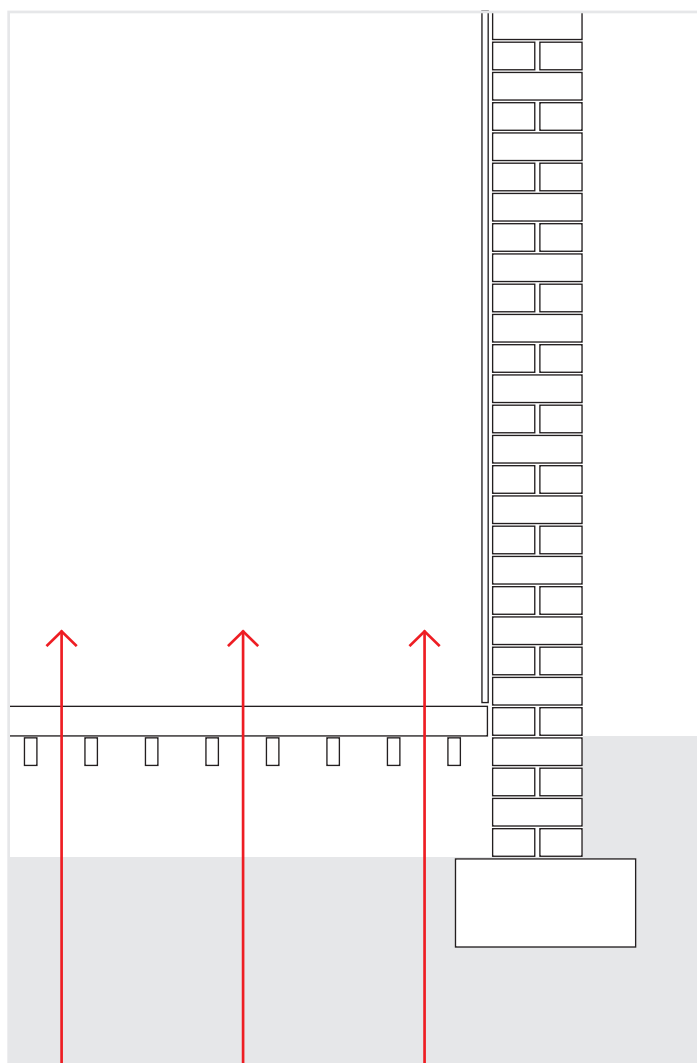


Diagram illustrating entry routes of radon into a property. Radon gas can accumulate in the sub-floor space due lack of ventilation and enter the property via gaps between the timber boards.

Relevant Baseline Indicators

0

Satisfactory
or N/A

1

Not
Satisfactory

2

Defective

3

Seriously
Defective

Subject		Score				BI	Baseline Indicator
16	Ventilation	0	1	2	3	16.2	All habitable rooms must have at least one window, door or skylight which opens to the outside and can be fixed in an open position. In addition, ventilation may also be provided by the presence of trickle vents, air bricks or passive stack ventilation.
		0	1	2	3	16.3	In each habitable room, the size of the openable windows, doors and skylights together must be at least 5% of the floor area of that room.
		0	1	2	3	16.4	All means of ventilation shall be maintained in good repair and working order.
17	Moisture and Contaminant Control	0	1	2	3	17.4	Dwellings must not have radon concentrations greater than 200 Becquerels per cubic metre (Bq/m ³)

Relevant Matters

0

Satisfactory
or N/A

1

Not
Satisfactory

2

Defective

3

Seriously
Defective

Score					Matters affecting Likelihood of Harm
0	1	2	3		Radon levels in the area
0	1	2	3		Ventilation in ground floor
0	1	2	3		Repair to solid floors
0	1	2	3		Damp-proof membrane
0	1	2	3		Ventilation in upper floors
0	1	2	3		Open chimneys
0	1	2	3		Repair to remedial measures
0	1	2	3		Extractor fans
0	1	2	3		Private water supply

Score					Matters affecting Harm Outcomes
0	1	2	3		Radon levels in the area
0	1	2	3		Ventilation in ground floor
0	1	2	3		Repair to solid floors
0	1	2	3		Damp-proof membrane
0	1	2	3		Ventilation in upper floors
0	1	2	3		Open chimneys
0	1	2	3		Repair to remedial measures
0	1	2	3		Extractor fans
0	1	2	3		Private water supply

Likelihood of Harm

Scale Points	
Likelihood of harm from this hazard over the next twelve months	
Very Likely	1 in 1
	1 in 2
	1 in 3
	1 in 5
Likely	1 in 10
	1 in 20
	1 in 30
	1 in 50
Unlikely	1 in 100
	1 in 200
	Example Dwelling 1 in 300
	1 in 500
Very Unlikely	1 in 1,000
	1 in 2,000
	1 in 3,000
	National Average 1 in 5,000
Score	
1 in 300	

Justification of Scoring
Likelihood of Harm

A radon problem is confirmed by measurements within the dwelling of 800Bq/m³, substantially above the average for all dwellings and recommended action level of 200Bq/m³. According to a review of the literature, this concentration is indicated to present a likelihood of harm of 1 in 300. A number of deficiencies contributing to this include the property being located in an area of high radon background levels, limited ventilation particularly to the sub-floor space and no barrier, allowing soil gas to enter the property with relative ease. The presence of open chimneys provides continuous extraction of air such that they draw soil gas into the structure and in so doing, increase the radon levels.

Harm Outcomes

Extreme		Severe		Serious		Moderate		
Example Dwelling + National Average	90.0	Heart attack, serious fractures, etc.		Chronic stress, severe concussion, etc.		Broken fingers, moderate cuts, etc.		
	50.0	Very Likely	50.0	Very Likely	50.0	Example Dwelling 0.0 National Average 0.0 These scores are simply calculated as the sum of the other three harm outcomes subtracted from 100%		
	30.0		30.0		30.0			
	20.0		20.0		20.0			
Likely	10.0	Example Dwelling + National Average	10.0	Likely	10.0			
	5.0		5.0		5.0			
	2.0		2.0		2.0			
Unlikely	1.0	Unlikely	1.0	Unlikely	1.0			
	0.5		0.5		0.5			
	0.2		0.2		0.2			
Very Unlikely	0.1	Very Unlikely	0.1	Very Unlikely	0.1			
	0.0		0.0		0.0			
				Example Dwelling + National Average	0.0			
Score 90.0%		Score 10.0%		Score 0.0%		Score 0.0%		

Justification of Scoring

There is no evidence to suggest that harm outcomes would differ from the national average.

Safety Ratings

Scenario 1
As described in this document

Key

Category	Band	Score
1 Legal duty to take action	High	10,000
2 Discretion to take action	Medium	1,000
	Low	100

Likelihood of Harm 1 in 300		
Extreme 90.0%	Severe 10.0%	Serious 0.0%
		Moderate 0.0%
Category	Band	Score
1 Legal duty to take action	High	10,000
	Example Dwelling	3,033
2 Discretion to take action	Medium	1,000 910
	Low	100

Score
3,033

Scenario 2

After works meeting baseline indicators

Likelihood of Harm
1 in 2,000

Extreme 90.0%	Severe 10.0%	Serious 0.0%	Moderate 0.0%
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Category	Band	Score
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1 Legal duty to take action	High	10,000
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2 Discretion to take action	National Average	Medium 1,000 910
	Example Dwelling	455
	Low	100

Score

455

Scenario 3

After further improvements

Likelihood of Harm
1 in 3,000

Extreme 90.0%	Severe 10.0%	Serious 0.0%	Moderate 0.0%
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Category	Band	Score
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1 Legal duty to take action	High	10,000
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2 Discretion to take action	National Average	Medium 1,000 910
	Example Dwelling	303
	Low	100

Score

303

Justification of Scoring

After works meeting baseline indicators

Baseline Indicator 17.4 requires that where levels of more than 200Bq/m³ are initially detected, measures must be implemented to reduce radon levels to be less than 100Bq/m³. In order to achieve this it will be necessary to provide a collection sump and venting system under the suspended floors. The unused fireplace should also be properly sealed.

Justification of Scoring

After further improvements

Further works could be carried out, such as providing a positive pressure ventilation system to counteract any infiltration of radon through the floors. A monitoring system could also be put in place to ensure that elevated radiation levels do not occur or, if they do, appropriate urgent action can be taken. Given the elevated levels of radon in the locality, even after these works, there may be more exposure to radiation than average so the likelihood of harm will remain slightly above the national average.

Other Relevant Legislation and Guidance

Updates

Matters for consideration listed in this section were correct at the time of publication. For the most up-to-date legislation and guidance in these areas, please visit the [gov.uk](https://www.gov.uk) website