



Housing Health and Safety Rating System (HHSRS)

Case Studies

Group B
Physiological
Requirements

Hazard B10
Radiation

Example B10.1
1946–79
Mid-terrace House
(Non-HMO)

Vulnerable Groups
All persons aged
60 and over or with
lifetime exposure

Multiple Locations
Yes

Related Hazards B11
Damp and
Mould Growth



Dwelling

Description

This is a 1970s mid-terrace house on a steeply sloping site. It has cavity brick walls with retro-fitted insulation. The property is situated in an area of the South West identified on UK Radon.org information maps as having the highest radon potential (greater than 30%). There is mechanical extract ventilation to both the bathroom and the kitchen.



1
Front elevation of terrace

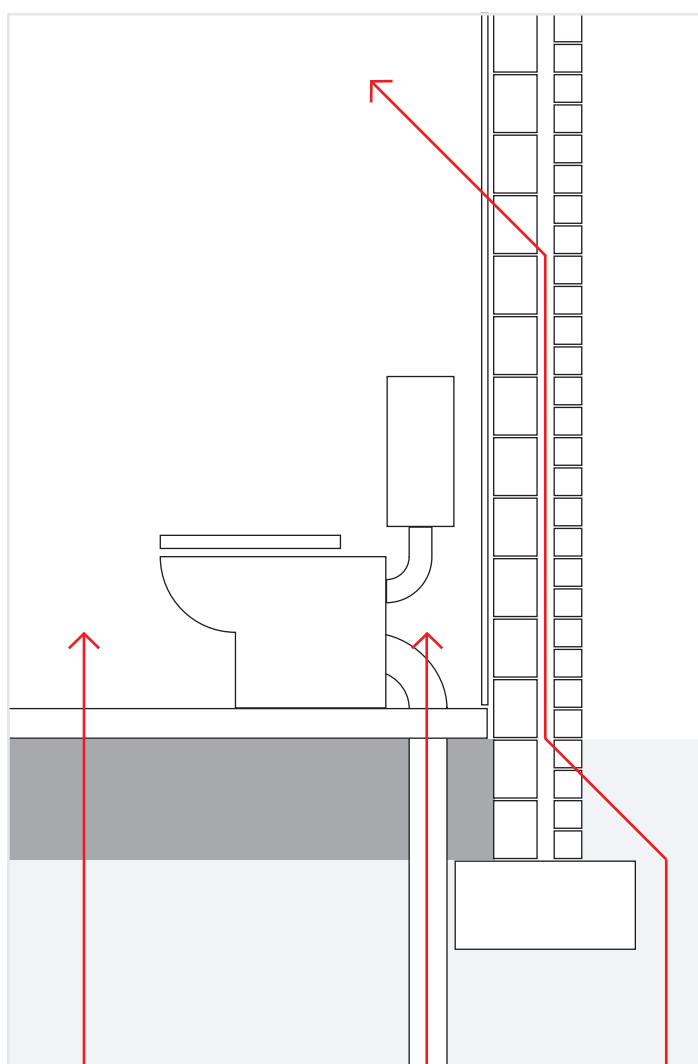
Radon Rating			
Radon (Bq/m³)	Likelihood of Harm	Rating Score	Rating Band
800	1 in 300	3,033	High
400	1 in 500	1,820	High
200	1 in 1,000	910	Medium
150	1 in 1,000	910	Medium
100	1 in 5,000	455	Medium
50	1 in 5,000	182	Medium
25	1 in 5,000	182	Medium

Deficiencies

Description of Deficiencies

All the houses in the terrace are affected by the gas but to varying degrees, the larger end houses having the highest levels. The house being assessed has the lowest level in the terrace, and with a radon measure of 196Bq/m^3 , it falls just below the radon action level. The other houses in the terrace have levels of 914, 739, 226 and $2,274\text{Bq/m}^3$. These measurements were taken during winter months.

All the ground-floor rooms have solid concrete floors in sound condition. Built before radon-protective measures became a requirement of the building regulations, all floors have a damp-proof membrane, but this of an insufficient specification to stop the ingress of radon gas around the joints with the walls and pipes and via the cavity walls.



2
Ingress of radon gas can occur around the joints with the walls and pipes and via the cavity walls.

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 on 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
0	1	2	3		Sealing around services

Score					Matters affecting Harm Outcomes
0	1	2	3		Radon levels in the area
0	1	2	3		Ventilation on 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
0	1	2	3		Sealing around services

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
		1 in 300
		1 in 500
Very Unlikely	Example Dwelling	1 in 1,000
		1 in 2,000
		1 in 3,000
	National Average	1 in 5,000

Score

1 in 1,000

Justification of Scoring

Likelihood of Harm

This property is located in a terrace where all the houses are affected by radon gas, but this property has the lowest level in the terrace, with a radon measurement of 196Bq/m³. Given the property was built before the requirement to have radon prevention measures in place, the damp-proof membrane that is present provides inadequate protection to prevent the ingress of gas, and there is a risk that over the next 12 months the radon level could increase (given the levels in the other properties). As the measured level approaches the action level of 200Bq/m³, the likelihood has been increased to 1 in 1000.

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		Example Dwelling + National Average 0.0		
Score	90.0%	Score	10.0%	Score	0.0%	Score	0.0%

Justification of Scoring

Harm Outcomes

The basis of the estimates for harmful outcomes under this hazard, contained in the operating guidance, takes account of all dwelling types, with the vulnerable group being persons subjected to a lifetime of exposure to radiation. The spread of harm outcomes remain constant regardless of the radon level. There is therefore nothing to suggest that the spread of harms will differ from the national averages.

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 1,000

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

Example
Dwelling +
National
Average

Score
910

Scenario 2

After works meeting baseline indicators

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

Justification of Scoring

After works meeting baseline indicators

There is very little prospect of a reduction in the likelihood or spread of harm outcomes for this hazard simply through meeting baseline indicators, as the measures are unlikely to appreciably alter the ingress of radon gas into the dwelling or increase ventilation to reduce levels.

Scenario 3

After further improvements

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

Justification of Scoring

After further improvements

Works should be undertaken to attain a target level of 100Bq/m³. This would change the likelihood to 1 in 2,000. The spread of harms would remain as for the national average. The works are not essential as the current levels do not cause a category 1 hazard, however, they are desirable, as the radon concentration is only marginally below the action level of 200Bq/m³. Given the difficulty of excavating all solid ground floors and re-laying with enhanced radon-proof barriers, other options might involve radon sumps being fitted under the ground floor which are continuously ventilated to the outside air and/or positive pressure ventilation systems incorporating heat recovery, which provide an increased rate of air change to prevent radon gas accumulating.

Other 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