



Housing Health and Safety  
Rating System (HHSRS)

Case Studies

Group B  
Physiological  
Requirements

Hazard B10  
Radiation

Example B10.3  
Pre-1920  
Detached  
Farmhouse

Vulnerable Group  
All persons aged  
60 years and over with  
a lifetime exposure to  
radon gas

Multiple Locations  
Yes

Related Hazard B11  
Damp and  
Mould Growth



Dwelling

Description

This is a four-bedroomed detached farmhouse built in the 1850s in a radon-affected area. It is built with random rubble stone, with rendered walls and has a variety of floor constructions.

The four bedrooms are on the first floor. There are two living rooms, a kitchen and a utility room on the ground floor. Every room has an openable window which is 10% of the floor area. There are three chimneys from fireplaces that are no longer in use, and fully sealed. Extractor fans are fitted to the kitchen and bathroom, which are in good working order.

The property is situated in an area of the West Country identified on UK Radon.org information maps as having the highest radon potential (>30%)

| Radon<br>(Bq/m <sup>3</sup> ) | Likelihood<br>of Harm | Rating<br>Score | Rating<br>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         |



1  
Front elevation  
Photo credit:  
Mike Higginson/  
Shutterstock.com



2  
Damp to kitchen walls/  
floors



3  
Crack to dining room floor

## Deficiencies

### Description

#### Kitchen

At the rear of the house, there is a flagstone floor to the kitchen, the flags being laid directly onto the soil. The kitchen floor and walls show signs of rising damp.

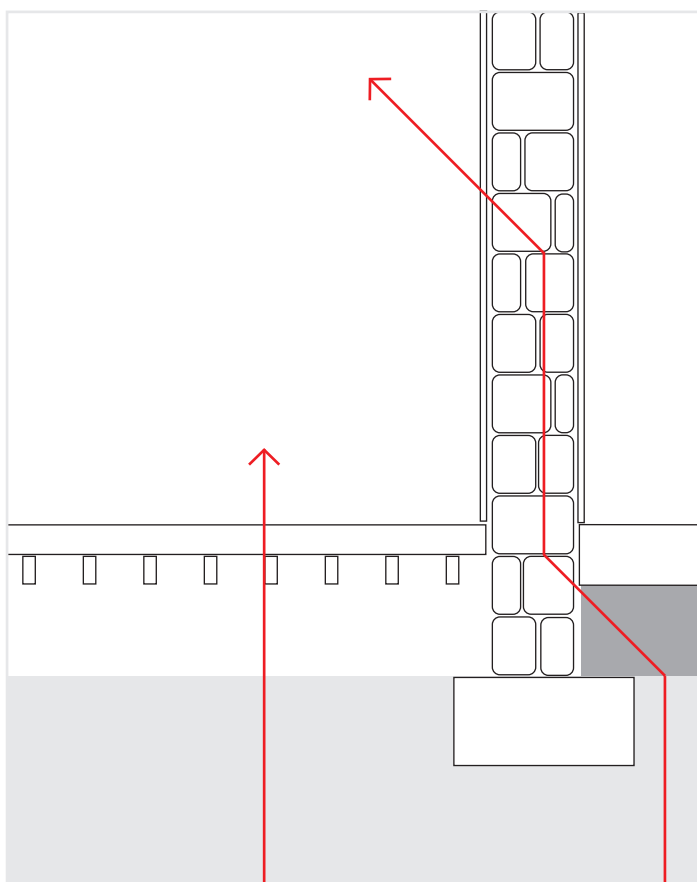
#### Dining room

There is a solid concrete floor to the rear dining room that has a crack (as shown in the diagram). As with the kitchen floor, this also shows evidence of rising damp, as do two of the walls.

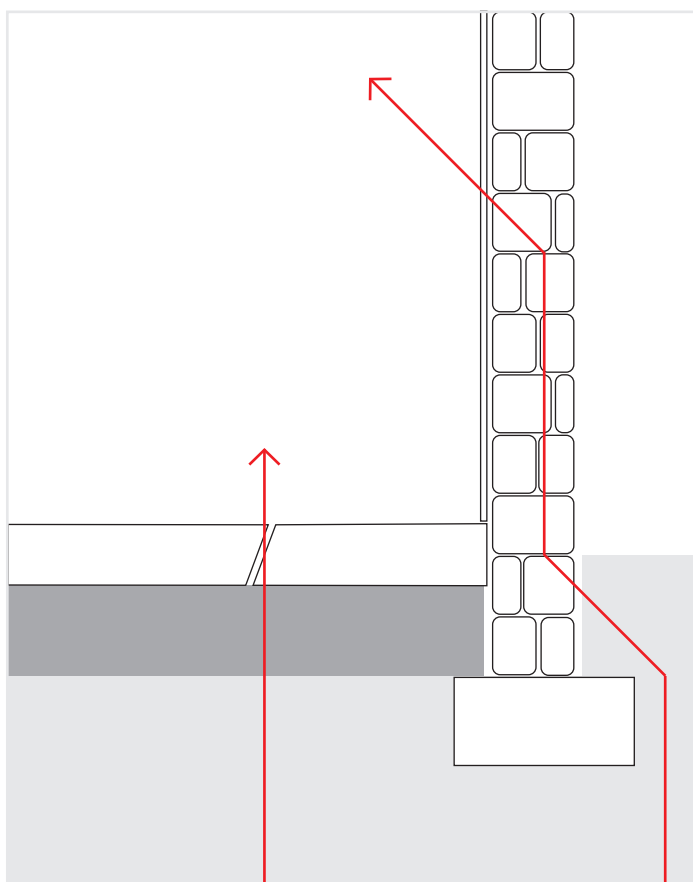
#### Front rooms

The two living rooms have butt-jointed, suspended timber floors. There are two air-vents to the front wall but no others, and there is rising damp in the spine wall.

Measurements over a 3-month period show a level of over 2,000Bqm<sup>3</sup> in the living room, way above both the average for radon-affected areas and the recommended action level of 200Bqm<sup>3</sup>. A second detector in a bedroom recorded a level over 800Bqm<sup>3</sup>.



4  
Radon gas can accumulate in the sub-floor space due to lack of ventilation, and enter the property via gaps between the timber boards.



5  
Cracks in solid floors allow radon gas to be drawn from the underlying ground, into the house.

## Relevant Baseline Indicators

0

Satisfactory  
or N/A

1

Not  
Satisfactory

2

Defective

3

Seriously  
Defective

| Subject | Score                                               | BI   | Baseline Indicator                                                                                                                                                                                                                                            |
|---------|-----------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16      | <div>0</div> <div>1</div> <div>2</div> <div>3</div> | 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. |
|         |                                                     |      | 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.                                                                                                               |
|         |                                                     |      | 16.4 All means of ventilation shall be maintained in good repair and working order.                                                                                                                                                                           |
| 17      | <div>0</div> <div>1</div> <div>2</div> <div>3</div> | 17.1 | Every foundation, roof, roofing component, exterior wall, floor, door, skylight and window shall be watertight, weathertight, free of persistent dampness or moisture and in good condition.                                                                  |
|         |                                                     |      | 17.4 Dwellings must not have radon concentrations greater than 200 Becquerels per cubic metre (Bq/m <sup>3</sup> ).                                                                                                                                           |

## Other 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 |  | Sealing around services              |
| 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 |  | Sealing around services         |
| 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      | <div>Example Dwelling</div> 1 in 100   |
|               | 1 in 200                               |
|               | 1 in 300                               |
|               | 1 in 500                               |
| Very Unlikely | 1 in 1,000                             |
|               | 1 in 2,000                             |
|               | 1 in 3,000                             |
|               | <div>National Average</div> 1 in 5,000 |

Score

1 in 100

Justification of Scoring

Likelihood of Harm

The radon levels measured in the living room are 10 times the recommended action level of 200 Bqm-3, and the level in one of the bedrooms was above 800 Bqm-3. At these levels of radiation, someone in the vulnerable age group will have been, and will continue to be, exposed to extremely high radon levels for most of their time spent at home, greatly increasing their likelihood of cancer.

# 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<br>National Average 0.0<br><br>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

### Harm Outcomes

There is no reason to alter the harm outcomes from the national averages.

Safety Ratings

Scenario 1  
As described in this document

Key

| Category                          | Band   | Score  |
|-----------------------------------|--------|--------|
| 1<br>Legal duty to<br>take action | High   | 10,000 |
| 2<br>Discretion to<br>take action | Medium | 1,000  |
|                                   | Low    | 100    |

Likelihood of Harm  
1 in 100

|                  |                 |                 |                  |
|------------------|-----------------|-----------------|------------------|
| Extreme<br>90.0% | Severe<br>10.0% | Serious<br>0.0% | Moderate<br>0.0% |
|------------------|-----------------|-----------------|------------------|

| Category                          | Band   | Score  |
|-----------------------------------|--------|--------|
| 1<br>Legal duty to<br>take action | High   | 10,000 |
| Example<br>Dwelling               |        | 9,100  |
| 2<br>Discretion to<br>take action | Medium | 1,000  |
| National<br>Average               | Low    | 182    |
|                                   |        | 100    |

Score  
9,100

**Scenario 2**

After works meeting baseline indicators

Likelihood of Harm  
1 in 2,000

|                  |                 |                 |                  |
|------------------|-----------------|-----------------|------------------|
| Extreme<br>90.0% | Severe<br>10.0% | Serious<br>0.0% | Moderate<br>0.0% |
|------------------|-----------------|-----------------|------------------|

| Category                          | Band   | Score                      |
|-----------------------------------|--------|----------------------------|
| 1<br>Legal duty to<br>take action | High   | 10,000                     |
| 2<br>Discretion to<br>take action | Medium | 1,000                      |
|                                   |        | Example<br>Dwelling<br>455 |
|                                   |        | National<br>Average<br>182 |
|                                   | Low    | 100                        |

Score

455

**Scenario 3**

After further improvements

Likelihood of Harm  
1 in 3,000

|                  |                 |                 |                  |
|------------------|-----------------|-----------------|------------------|
| Extreme<br>90.0% | Severe<br>10.0% | Serious<br>0.0% | Moderate<br>0.0% |
|------------------|-----------------|-----------------|------------------|

| Category                          | Band   | Score                      |
|-----------------------------------|--------|----------------------------|
| 1<br>Legal duty to<br>take action | High   | 10,000                     |
| 2<br>Discretion to<br>take action | Medium | 1,000                      |
|                                   |        | Example<br>303             |
|                                   |        | National<br>Average<br>182 |
|                                   | Low    | 100                        |

Score

303

**Justification of Scoring**

After works meeting baseline indicators

In order to meet Baseline Indicator 17.4 (requiring radiation levels to be less than 100 Bqm<sup>3</sup>), it will be necessary to provide impervious membranes under the solid floors and a collection sump and venting system under the suspended floors.

**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. There will inevitably be some exposure to radiation when people are in the garden of the property so the likelihood of harm will remain slightly above the national average.

# Other Relevant Legislation and Guidance

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## 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