Radon Statement – Derby House

1.0 Introduction:

Radon is a naturally occurring radioactive gas formed by the radioactive decay of small amounts of uranium present in all rocks and soils. Low background levels of radon are not considered to be harmful, however the gas may become more concentrated in buildings within areas known for high natural radon levels, leading to an increased risk of lung cancer caused by absorption of the gas into lung tissues. More than 1000 premature deaths are recorded each year as a result of exposure to radon.

The average radon level in UK homes is 20bq/m³.

At levels above 100bq/m³, the risk to health increases with the radon level.

The UK Action Level for radon is 200bq/m³. At this level, radiation exposure through radon gas is considerably higher than would be permitted for a worker in a nuclear fuel plant.

Where radon levels exceed 200bq/m³, Public Health England recommends that action should be taken to reduce radon levels, to an ideal target of no more than 100bq/m³.

Where radon levels are between 100bq/m³ and 200bq/m³, action to reduce radon levels should be seriously considered.

2.0 Radon levels in Buxton:

The maximum radon potential for Buxton, as defined by the Public Health England radon Affected Area map is greater than 30%, the highest possible risk category, where more than 1 in 3 homes are likely to experience high levels of radon.

3.0 Radon levels at Derby House:

A retrofit radon extraction system has been fitted at Derby House in response to very high recorded levels of radon. Although the current system has improved the readings, the limitations of the listed building fabric have restricted the scope and performance of the system, with the result that very high radon levels remain in some areas.

Radon levels were tested at six locations within Derby House in May-August 1997, for a 90 day period.

The levels recorded were in the range of **253** to **4900**bq/m³

Levels have decreased since the installation of the extraction system, however the latest test results dating from 2007,recorded **1630**bq/m³ in the cellar and **650**bq/m³ in room 1 (room G9).

Previous results taken in the cellar, also after the radon extraction system was installed, were **946**bq/m³ in 1999 and **420**bq/m³ in 2006.

These levels are considerably above the UK Action Level of **200**bq/m³.

4.0 Consequences of the residential conversion of Derby House:

The residential conversion of Derby House will effectively create six completely new dwellings.

These dwellings must therefore be designed to provide suitable levels of protection from radon gas. The refurbishment works offer a rare opportunity to properly address the radon risk as part of a comprehensive strategy.

Failing to do so may place the occupants of the new dwellings at risk of exposure to unacceptably high radon levels.

Public Health England recommend that new dwellings in radon-affected areas are tested during their first year of occupation. The conversion must therefore be carried out to provide the highest possible level of protection, in order that such testing can be carried out to provide confirmation that the radon levels have been mitigated appropriately.

5.0 Appropriate radon protection measures:

Radon protection measures are classified as either 'Basic' or 'Full' depending on the level of protection offered.

In general, Basic protection comprises the use of an impermeable membrane laid underneath new floors. Full protection enhances this provision through the use of an increased specification of radon-proof membrane combined with negative pressure ventilation of the area under the membrane.

Building Regulations Approved Document C (paragraph 2.40) refers to the Building Research Establishment's report BR 211. BRE 211 requires that new dwellings in any areas having radon potential of more than 10% should incorporate Full radon protection.

Buxton's radon potential of greater than 30% classifies it as an area where Full protection should be used. The current radon extraction system does not meet the standards for Full protection.

6.0 Originally submitted radon mitigation proposals:

The nature of a historic building such as Derby House inevitably places restrictions upon the level of protection which can be achieved (for example, linking radon-proof membranes to damp proof courses in walls is not possible where no damp proof courses exist).

In our view it would be appropriate to take measures to achieve the highest level of protection available within these constraints.

The originally submitted proposals included the removal of all existing ground floors, and the construction of new solid concrete floor slabs throughout to incorporate radon-proof membranes and negative pressure sumps, in order to achieve Full protection standards as far as reasonably practicable.

BRE best practice guidance indicates that mechanically ventilated negative pressure systems without sumps (such as those currently fitted at Derby House) are likely to cause noise and discomfort to occupiers, and recommend the use of negative pressure sump systems with radon-proof barriers. This is optimally achieved by way of new solid floors as originally proposed.

If new solid floors are not installed, the alternative requires concrete slabs to be installed under the floors, over radon sumps and a radon-proof membrane. All existing timber suspended floors would have to be removed for the duration of this work. BRE however note that the installation of concrete slabs and radon-proof barriers under timber suspended floors will not be appropriate in

areas which may be liable to flooding. The high external ground levels around Derby House are a cause for concern in this respect. In our view this approach would therefore not be suitable in this instance.

7.0 Revised radon mitigation proposals:

Due to concerns raised by HPBC regarding the impact on the historic building fabric, we have proposed a revised radon mitigation solution, based on a reduced scope of floor replacement as requested by HPBC. That solution is documented here and on the associated sketch 16182-E-020-SK01. Whilst the originally submitted solution remains our preferred approach, the revised solution nevertheless represents a considerable enhancement in comparison with the current level of protection.

Whilst not original, the decorative tiled finish in the hall is arguably the most important element of the existing ground floor. In some areas (such as where located over the cellar chambers) the tiling is known to be laid on a sound concrete substrate, however the nature and condition of the tile substrate elsewhere is not known.

Where the floor tiles are on sound and stable substrates, they will be retained in–situ. If any areas of tile are laid on less stable substrates, e.g direct to earth, or on degraded concrete, those areas of tile will be carefully taken up to allow the substrates to be repaired and consolidated as required, before being re-laid in their original arrangement. This is indicated as Zone 1 on sketch 16182-E-020-SK01.

The existing timber suspended floors located over the cellars will be retained. The heavily modified existing floorboards will be replaced with plywood sheeting (as proposed with the upper suspended floors) over a radon-proof membrane sealed to the surrounding walls. The existing modern ceilings in the cellar will be removed. Fire and thermal upgrades will be carried out to the floors as required. New ceilings (plasterboard or similar) will be underdrawn to the retained joists. Carefully sited radiators will be installed in the rooms above these floors, due to the lack of underfloor heating. A separate radon extraction system will be required to serve the cellar chambers directly. This is indicated as Zone 2 on sketch 16182-E-020-SK01.

Existing timber floors elsewhere will be removed and replaced with new insulated solid floors incorporating underfloor heating and a radon-proof membrane, as per the original proposals. This is indicated as Zone 3 on sketch 16182-E-020-SK01.

Existing solid floors (which are all non-original and generally of modern construction) are to be taken up and replaced with new insulated solid floors incorporating underfloor heating and a radon-proof membrane, as per the original proposals. This is indicated as Zone 4 on sketch 16182-E-020-SK01.

Bench Architects

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Bibliography:

Public Health England UK Radon website www.ukradon.org

Building Regulations Approved Document C: Site preparation and resistance to contaminants and moisture. 2004 edition incorporating 2010 and 2013 amendments.

Radon – Guidance on protective measures for new buildings (report BR 211). BRE 2015.