**Radon – a brief explanation**

Radon is a naturally occurring gas that has no colour, smell or taste. The gas comes from minute amounts of uranium present in all earth materials such as rocks, soil, bricks and concrete.

Radon is present in all parts of the UK, but in the most populous areas the levels are quite low. Some of the highest levels are found in the south west, but levels well above average have been found in some other parts of England and parts of Scotland, Wales and Northern Ireland. However, even in these areas most homes have low levels. Maps showing the areas of the country affected by radon are available from the National Radiological Protection Board (NRPB). However, radon can be found in other areas and, even though levels may be low, isolated high levels can occur. The only way to be sure is to conduct a radon test in the building.

**Basic methods of radon reduction**

The objective of all radon reduction schemes is to reduce radon levels within a building so that levels of exposure to occupants is reduced. It is not possible to remove radon entirely.

**New Buildings**

Given that radon enters a building from the ground on which it is built, it follows that the most effective means of reduction is to prevent it entering in the first place. This can be achieved by placing a radon barrier over the entire footprint of the building prior to construction. Providing the barrier is gas tight and not perforated, very low indoor levels can be achieved, even in areas known to have high levels of radon.

**Existing Buildings**

The majority of the housing stock in the UK consists of existing buildings, many of which are older and built using traditional methods. It has been necessary to design suitable systems for radon reduction, once a building has been found to have high levels. Available methods of radon reduction include mechanical ventilation. Three methods of radon reduction using mechanical ventilation have proved to be effective and are described below.

1) **Sump with extract fan**

This is the most effective method so far devised for reducing high levels of radon. The sump is constructed either by
vertical internal coring or external horizontal coring into the sub-slab space beneath the damp proof course membrane. The sump is connected via ducting to an in-line fan that sucks out soil gases and exhausts them to atmosphere. The extract fan is mounted either inside the building or, in most cases, externally on an outside wall giving reduced noise and easier access.

**Advantages:**
- Effective at high and very high radon levels.

**Disadvantages:**
- The installation is frequently not effective for timber (suspended) floors.
- The installation is clearly visible in the case of the external fan arrangement.

2) **Positive pressurisation**
A building has an inherent negative pressurisation because warm air rises and the method of positive pressurisation partly overcomes this natural airflow. Positive pressurisation is achieved by fitting a purpose-built fan system in the attic space. The fan blows air downwards into the property through a ceiling diffuser, usually above a stairwell. Such systems were initially used for reducing condensation but have subsequently been found to be effective at reducing levels of radon. For reasons of reducing draughts and noise the fan operates at low speed and power level, hence it is only suitable in ‘air tight’ properties with relatively low radon levels.

**Advantages:**
- Easy and unobtrusive installation, condensation reduction.

**Disadvantages:**
- Only effective in certain properties and at fairly low radon levels. Opening the windows and doors, in summer for example, reduces the effectiveness of the system.

3) **Dilution**
Radon levels in properties with suspended timber floors can be reduced by increasing the air-flow beneath the floor. Increased air flow is achieved by the use of an in-line fan forcing air from one side of the building and exhausting via airbricks on the other.

**Advantages:**
- The fan can be mounted beneath the floor and would be unobtrusive.

**Disadvantages:**
- Not always successful and fan noise can be a problem.

**Recommendations applicable to fan-operated radon reduction systems**
The fan of a fan-operated radon reduction system should be supplied by a permanent connection to the fixed wiring of the installation. A fan should not be
connected via a 13A plug and socket arrangement or other removable means.

The supply for a fan-operated radon reduction system should be supplied by one of the following:

- An independent circuit at the dwelling’s main distribution board, in which case no other electrical equipment should be connected to the circuit and RCD protection should not be provided, unless necessary for reasons of electrical safety.
- A separate electrically-protected regularly-used local lighting or ring or radial final circuit.

The use of moulded, non-conductive fan assemblies is recommended.

**Prior to making an alteration or addition to an electrical installation**

No addition or alteration, temporary or permanent, can be made to an existing electrical installation unless it has been ascertained that the rating and condition of any existing equipment is adequate for the altered circumstances and that the earthing and bonding arrangements are adequate (Regulation 130-07-01 of BS 7671 refers).

In the case of a fan-operated radon reduction system, the additional load of the fan placed on an existing circuit will not be large. The installer must ascertain that the rating and condition of the existing circuit is adequate, that the protective device for the existing circuit is suitable and will provide protection for the modified circuit and any other relevant safety provisions are satisfactory.

The installer is also required to check that the installation’s earthing and bonding arrangements are adequate. The presence and adequacy of a means of earthing for the installation must be checked as much as the equipotential bonding arrangements.

**Sump and similar ventilation systems using a fan mounted inside the building**

Providing the protective device for the existing circuit is suitable and provides protection for the modified circuit, and that other relevant safety provisions are satisfactory, the fan should be supplied from an existing ring or radial final circuit via a fused spur. Isolation at the consumer unit would permit fan replacement or maintenance as necessary.

**Sump and similar ventilation systems using a fan mounted outside the building**

The external fan selected should be in a dust protected, splash proof housing to IP54 or better. The fan should be mounted on an external wall and due consideration should be taken of external influences such as the possibility of mechanical damage or the ingress of water, for example, due to leaking rainwater gutters and downpipes. External wiring should be minimised. Electrical connection should be made within the building to an existing local ring final or radial circuit via a fused spur. Isolation at the consumer unit would permit fan replacement or maintenance as necessary.

**Loft mounted positive pressurisation system**

The fan should be wired into the existing lighting circuit. A local double pole isolating switch should be provided to permit isolation of the supply so that the fan can be replaced or maintained as necessary without the need to switch off the lighting circuit. Alternatively, such maintenance could be performed by isolating the entire installation at the main switch in the consumer unit.

**Inspection, testing and certification**

It must be verified that every alteration or addition to an electrical installation complies with the requirements of BS 7671 (Regulation 721-01-02 of that Standard refers). Inspection and testing must be performed. (Chapter 71 refers). Inspection includes
checking that installed electrical equipment is suitable, correctly installed, not damaged so as to impair safety and that the detailed requirements of BS 7671 have been met (Refer to Regulation 712-01-03). Requirements for testing are detailed in Regulation 713 and should include, as a minimum, tests of continuity, insulation, polarity and earth fault loop impedance.

The electrical installer must issue either an Electrical Installation Certificate or Domestic Electrical Installation Certificate if the work involves a new circuit or a Minor Works certificate provided that the alteration or addition to the installation is minor and does not include the provision of a new circuit. A Minor Works certificate could be issued for the addition of a fused spur to an existing ring or radial final circuit or for the addition of a point to an existing lighting circuit.

**User instructions**

It is important that appropriate documentation and instructions are given to the user of the installation. Such instructions should include:
- An explanation of radon gas and its effects
- An explanation of the need to keep the fan operational
- Routine checks that should be made
- Contact numbers

**The Radon Council**

The Radon Council is a non-profit making self-regulatory body formed in 1991 in response to calls from the Chairman of a Parliamentary Select committee on Indoor Pollution. The organisation runs full day training courses with an examination, and issues an annual list of contractors who have successfully completed one of its courses and have signed a Code of Practice.

For further information on radon, contact the Radon Council at PO Box 39, Shepperton, Middlesex, TW17 8AD. Telephone 01932 221212 and website www.radonhotline.org.

Another valuable contact is the Building Research Establishment, Bucknalls Lane, Garston, Watford WD25 9XX. Telephone 01923 664707, Fax 01923 664711 or www.bre.co.uk/radon.

The National Radiological Protection Board (NRPB) may be contacted at Chilton, Didcot, Oxon OX11 0RQ, Telephone 01235 831600 and website www.nrpb.org.uk. A free answerphone for householders is available on 0800 614529 and a radon report service on 01235 822784.