Radon Survey
Final Report

April 2011
1. EXECUTIVE SUMMARY

Radon is a colourless, odourless gas that originates from uranium in rocks. Long term exposure to very high levels of radon has been linked to lung cancer. The Management of Health and Safety at Work Regulations 1999 require employers to assess the risk of exposure to radon in the workplace and indicative measurements are required where premises are in a radon affected area or if workplaces are wholly or partially underground. Where radon concentrations above the actions levels exist, the Ionising Radiation Regulations (IRR) 1999 come into effect and the employer is required to reduce dose rates associated with radon exposure to as low as reasonably practicable.

To comply with relevant legislation, the University adopted a new Radon Policy Standard in April 2010 and has set benchmark standards to measure performance against. A comprehensive survey, including indicative radon measurements in all occupied University buildings except those recently purchased or renovated has also been completed.

Of the 86 University buildings surveyed, six buildings were found with radon concentration levels above the action levels. Where radon concentrations above the action level have been found, arrangements have been put in place to reduce exposure. In affected buildings where occupancy levels are traditionally low and the radon concentration is only just above the action level, management controls have been used to reduce exposure time in line with recommendations from the Health Protection Agency (HPA). Where the radon concentrations are substantially above the action level, radon mitigation measures involving structural alterations to the building to control the ingress of radon have been or will be adopted.

A competent Radiation Protection Supervisor has been appointed to manage ongoing radon control measures identified during previous surveys, to design and implement future radon surveys and ensure subsequent actions are addressed. The University is compliant with all current, relevant legislation and can be considered to demonstrate best practice with regards to radon management. It is also one of the first UK Universities to undertake such a comprehensive radon survey.

The University receives advice from an external specialist Radiation Protection Adviser on all aspects of its radon management arrangements and procedures.

2. SCOPE OF REPORT

The scope of this Report is to provide a brief summary of the findings of a number of radon surveys carried out between May 2009 and March 2011. A more detailed report will be made available electronically.

3. BACKGROUND

Radon is a radioactive gas which originates from uranium that occurs naturally in many rocks and soils. Radon can seep out of the ground and build up in houses and in-door workplaces. As radon gas is 9 times heavier than air, the highest concentrations are usually found in underground spaces such as basements, caves and mines but high concentrations can also be found in the ground floor of buildings.

Most radon gas breathed in is immediately exhaled and presents little hazard. However, decay products of radon behave more like particles and attach themselves to minute atmospheric dust and water droplets which, when breathed in, may become lodged in the lungs and airways. Some of these decay products emit a particularly hazardous type of radiation know as alpha particles which can cause significant damage to cells of the lung. Radon is now recognised to be the second largest cause of lung cancer in the UK after smoking.
Because of the hazardous nature of radon, legislation exists that requires employers to protect their employees from exposure to radon in the workplace. The Management of Health and Safety at Work Regulations 1999 require the assessment of all health and safety risks, including those arising from radon. Indicative measurements of radon concentrations are required in all buildings located in radon affected areas and where wholly or partially underground work spaces exist.

Historically high radon concentrations were thought to be limited to granite rich areas of the UK such as the South West of England. However, as more radon surveys are undertaken it is becoming apparent that radon is more widespread than initially thought. The most recent radon map issued by the HPA (see Appendix A) indicates that many parts of Wales are affected by radon. As some University buildings are within radon affected areas and others contain underground work places, the Safety Executive Task Group agreed to fund a series of radon surveys to ensure the health and safety of staff and students.

4. SURVEY METHODOLOGY

Radon concentrations were measured by means of passive radon monitors supplied by the Health Protection Agency. A Preliminary Survey to measure radon concentrations in buildings with the highest potential for radon exposure was undertaken in summer 2009 with risk assessed on building age and location, occupancy, and the presence of underground work places.

Buildings identified as having radon concentrations close to, or above the action level were re-surveyed during Winter 2009 / 10 when radon concentrations tend to be highest. In addition, radon measurements were undertaken in all buildings located in radon affected areas.

A further survey, involving all occupied University buildings which had not previously been measured was undertaken in Winter 2010 / 11.

5. RESULTS AND ACTIONS

Following the three month radon measuring period, monitors were returned to the HPA for analysis. Results were then issued for each building with specific guidance provided for locations identified with radon concentrations above the action levels of 400 Bq m$^{-3}$ (workplaces) and 200 Bq m$^{-3}$ (residential accommodation) as designated in the Ionising Radiation Regulations (IRR) 1999.

Of the 86 University buildings surveyed, the following six were found to have radon concentration levels above the action levels. All remedial actions taken were in accordance with advice from the HPA and the University’s external Radiation Protection Adviser (RPA). The Health and Safety Executive were notified of any locations where radon concentrations exceeded the action levels.

<table>
<thead>
<tr>
<th>Location</th>
<th>Survey Date / Results (Bq m$^{-3}$)</th>
<th>Actions</th>
<th>Re-Survey</th>
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</thead>
</table>
| Ardudwy  | 1. Dec 2009 – Mar 2010, (290 – 850) | • Staff were informed of the nature and level of risk by the University Radiation Protection Officer and provided with relevant information  
• RPA appointed to undertake ‘instant’ radon measurements to determine the extent of mitigation measures required  
• Staff were relocated following the RPA’s survey to enable mitigation works to take place  
• Contractor appointed to advise / undertake radon mitigation works as part of the Ardudwy conversion | Following completion of mitigation works in 2011 |
<table>
<thead>
<tr>
<th>Location</th>
<th>Dates</th>
<th>Actions</th>
<th>Remarks</th>
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| Chiff Chaffs                     | 1. Dec 2010 – Mar 2011, (400 – 430) | • Staff were informed of the nature and level of risk by the University Radiation Protection Officer and provided with relevant information  
• Situation managed by time / exposure restriction as per HPA guidance | Winter 2011 |
2. Dec 2010 – Mar 2011, (180 – 400) | • Information and guidance provided immediately to appropriate staff  
• Situation managed by restricting access periods as per HPA guidance with records kept of room usage  
• Second Survey undertaken over the winter to confirm original measurements  
• Discussions taking place with Estates and Facilities on mitigation works | Winter 2011 |
| Henfaes Farmhouse                | 1. Dec 2010 – Mar 2011, (29 – 850) | • Staff were informed of the nature and level of risk by the University Radiation Protection Officer and provided with relevant information  
• RPA appointed to undertake ‘instant’ radon measurements  
• Discussions taking place with Estates and Facilities on mitigation works. Alternative accommodation being prepared for use during mitigation works | Winter 2011 |
2. Dec 2010 – Mar 2011, (200 – 290) | • Information and guidance provided immediately to the member of staff residing in the house  
• Second Survey undertaken over the winter to eliminate ‘winter correction’ of values  
• Results of second survey provided to member of staff residing in house  
• Discussions taking place with Estates and Facilities on mitigation works | Winter 2011 |
2. Dec 2009 – Mar 2010, (10 – 90) | • Staff were informed of the nature and level of risk by the University Radiation Protection Officer and provided with relevant information  
• Situation managed by restricting access as per HPA guidance with records kept of room usage. Ventilation improved by fitting extraction fans  
• Second Survey undertaken over the winter to eliminate ‘winter correction’ of values and assess the efficacy of the radon mitigation measures  
• Findings of Second Survey communicated to relevant staff. Restricted access is no longer required  
• Estates and Facilities briefed on the radon issue in preparation for the SEACAMs Project new build | Dependent on New Build |
6. ACKNOWLEDGEMENT

Thanks are expressed to all staff that answered questions and helped with regards to gaining access to areas. Their assistance was invaluable in enabling the Radon Surveys to be undertaken.

7. FOLLOW-UP ACTION

The Radon Radiation Protection Supervisor will design and implement further surveys to ensure continued protection of staff and students. The frequency with which buildings will be re-surveyed will depend on previous survey results, the age and condition of buildings and any changes of use resulting in increased occupancy. Further surveys will also be undertaken in those newly purchased and major refurbished buildings and buildings where remedial action has been undertaken to monitor the efficacy of radon mitigation measures. Some further survey work will also be undertaken in areas where radon concentration data has been derived from the few summer readings carried out, since the winter correction factors applied to such readings may not be accurate in all cases.
APPENDIX A: Anglesey and Bangor Radon Susceptibility *(Environmental Radon Newsletter, Summer 2010 issue)*

**Figure 1** - Map of equivalent uranium concentration (eU, ppm) across Anglesey as determined by airborne gamma-ray survey.

**Figure 2** - Map of radon Affected Areas of Anglesey.