



GGs RadonPack[®]

Understanding the hazards and risks at your site

The Piggott C of E School, Twyford Road, Wargrave

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GGS RadonPack™ Report

The Piggott School, Wargrave

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GGS RadonPack™ Report

The Piggott School, Wargrave

FOREWORD

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GGs RadonPack™ Report

The Piggott School, Wargrave

Contents Page



1	Introduction	1
2	What is Radon?	2
3	Current guidance & legislation.....	4
4	Site details	6
4.1	Site overview	6
4.2	Site location.....	6
4.3	Radon risk potential	6
5	Radon monitoring	8
5.1	Passive radon monitoring	8
6	Conclusions and recommendations	10
6.1	Conclusions.....	10
6.2	Recommendations.....	10

GGS RadonPack™ Report The Piggott School, Wargrave

Appendices

Appendix A – BGS Radon Geo Report

Appendix B – GGS Site Photographs

Appendix C – Radon Certificates

Appendix D – Monitoring Location Plan

GGS RadonPack™ Report

The Piggott School, Wargrave

1 Introduction

Ground-Gas Solutions (GGs) has been commissioned by Wokingham Borough Council (the Client) to provide radon monitoring and consultancy services at The Piggott School, Wargrave (subsequently referred to as 'the site' throughout this report).

New extensions and alterations to parts of the existing school are proposed, and a radon assessment is required to determine the current risk profile of the site and inform mitigation design. A site walkover by GGS radon specialists and 90-day passive radon monitoring has been proposed to inform the assessment and allow for the direct comparison of results against reference levels.

A GGS RadonPack™ has been prepared, containing the following information:

- What is Radon?
- Current guidance and legislation.
- Methodologies.
- Radon monitoring results.
- Recommendations.

GGs RadonPack™ Report

The Piggott School, Wargrave

2 What is Radon?

Radon (^{222}Rn) is a naturally occurring, colourless, odourless and tasteless, radioactive gas that comes from uranium in many rocks and soils. It is present at very low concentrations in the normal outdoor air we breathe, however, radon is considered a hazard when it is allowed to build up in places where people live and work.

In buildings, the highest levels are usually found in underground spaces such as basements, or buildings set within soil embankments. High concentrations can also be found within the ground floor of buildings as they are usually at a slightly lower pressure than the surrounding atmosphere; this allows radon from the ground underneath buildings to be drawn into the building through cracks and gaps in the floor.

Most radon gas breathed in is immediately exhaled and presents little radiological hazard. However, the decay products of radon (polonium-218, lead-214, bismuth-214 and polonium-210 isotopes) are solid particulates and are themselves radioactive.

These solid decay products attach to atmospheric dust and water droplets which can then be breathed in becoming lodged in the lungs and airways. Some decay products emit hazardous alpha particles which can cause significant damage to the sensitive cells in the lung, potentially leading to lung cancer.

Radon is now recognised to be the second most important risk factor for lung cancer after smoking. Lung cancer is also the biggest cause of cancer related death in the UK. It is estimated that the annual mortality from radon exposure in buildings represents 9% of all deaths from lung cancer, and 2% of all cancer deaths, in Europe. In the UK, this equates to approximately 1000 premature deaths per year¹

Radon contributes by far the largest component of background radiation dose received by the general UK population (approximately 50%) and, while the largest radon doses pose a higher risk, low exposures are still of concern as there is no “safe” level.

The average radon level in UK homes is 20 Becquerel per cubic metre (Bq m^{-3}), which gives us half of our exposure to background radiation from all sources. The average outdoor radon concentration is approximately 4 Bq m^{-3} .²

¹ <https://www.hse.gov.uk/radiation/ionising/radon.htm>

² <https://www.ukradon.org/information/whatisradon>

GGS RadonPack™ Report

The Piggott School, Wargrave

Note that the Becquerel is the unit of activity applied to a radioactive material and is a measurement of the rate at which radioactive atoms decay to form other elements. One Becquerel is defined as the activity at which one radioactive atom disintegrates on average every second in one cubic metre of air.

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The Piggott School, Wargrave

3 Current guidance & legislation

Under the Health and Safety at Work Act 1974, employers must, so far as is reasonably practicable, ensure the health and safety of employees and others who have access to their work environment. The Management of Health and Safety at Work Regulations 1999 require the assessment of health and safety risks, and this should include radon. Where significant exposure occurs to a worker within a calendar year then the Ionising Radiation Regulations 2017 (IRR17)³ may apply. Should concentrations be sufficiently high that the IRR17 apply, the Health & Safety Executive (HSE) must also be notified.

Action levels for radon exposure have been issued in the UK. If the annual averaged exposure exceeds these levels, action should be taken to reduce radon concentrations. The action level is currently set at 200Bq m⁻³ in the home and 300Bq m⁻³ in the workplace. If levels exceed 300Bq m⁻³ in the workplace, the employer has a duty of care to reduce radon exposure.

Current advice from UKHSA is to strongly consider reducing radon levels below the target level of 100Bq m⁻³ where possible. UKHSA further state *“for levels below 100Bq m⁻³, your individual risk remains relatively low and is not a cause for concern. However, the risk increases as the radon increases above this value”*⁴. On new homes, buildings subject to redevelopment, or where radon mitigation has been completed, it is recommended that the ideal outcome would be that radon levels are at or below the target level.

Whilst the radon risk to a given individual remains relatively low below the target level, the individual risk profile depends on individual circumstances. For example, the lifetime risk of lung cancer with indoor radon levels at 200 Bq m⁻³ for a non-smoker is estimated at 1 in 190, whilst for a current smoker risk is estimated at 1 in 5⁵. The greater the radon exposure, the greater the risk. As such, radon levels should be lowered as far as practically possible.

UKHSA also advise to complete a radon test in routinely occupied basements irrespective of their geographical location. This advice applies to all basements or below ground structures that are occupied for at least one hour per week, or approximately 50 hours per year. The radon risk potential in basements is considered greater as they have proportionally large

³ <http://www.legislation.gov.uk/ukxi/2017/1075/contents/made>

⁴ <http://www.ukradon.org/information> accessed on 02/05/2018

⁵ <https://www.ukradon.org/information/risks>

GGS RadonPack™ Report

The Piggott School, Wargrave

areas in contact with the ground with often limited ventilation and exchange/dilution with outdoor air.

GGS RadonPack™ Report

The Piggott School, Wargrave

4 Site details

4.1 Site overview

The site comprises The Piggott School, Wargrave, which has proposed plans for newly constructed buildings, extensions and building alterations. During the monitoring assessment completed by GGS, the site was under normal occupancy behaviour.

Figure 1 below presents selected GGS site photographs of the site.



Figure 1 Selected GGS site overview photographs.

Additional site photographs are presented in Appendix B, whilst radon competency certification is presented in Appendix C.

4.2 Site location

The site is located off the A321 Wargrave Road, approximately 800m southeast of Wargrave Train Station. The approximate UK grid reference of the site is SU 78440 77442, and the post code of the site is RG10 8DS.

4.3 Radon risk potential

GGG understands that previously the site was not considered to be located within a radon affected area. However, following the December 2022 update to the UKHSA/BGS indicative radon atlas, the site is shown to be within a radon affected area where 5-10% of homes are estimated to be at, or above the action level⁶. This is indicated by the free online radon search, which provides the indicative radon atlas at a 1km grid scale.

⁶ <https://www.ukradon.org/information/ukmaps>

GGs RadonPack™ Report

The Piggott School, Wargrave

GGs has obtained a site specific BGS Radon Geo Report, which provides an indicative assessment of the radon atlas in higher resolution. The school has a lower estimated risk profile where 1-3% of homes are estimated to be at, or above, the action level. Figure 2 below presents an extract from the report.

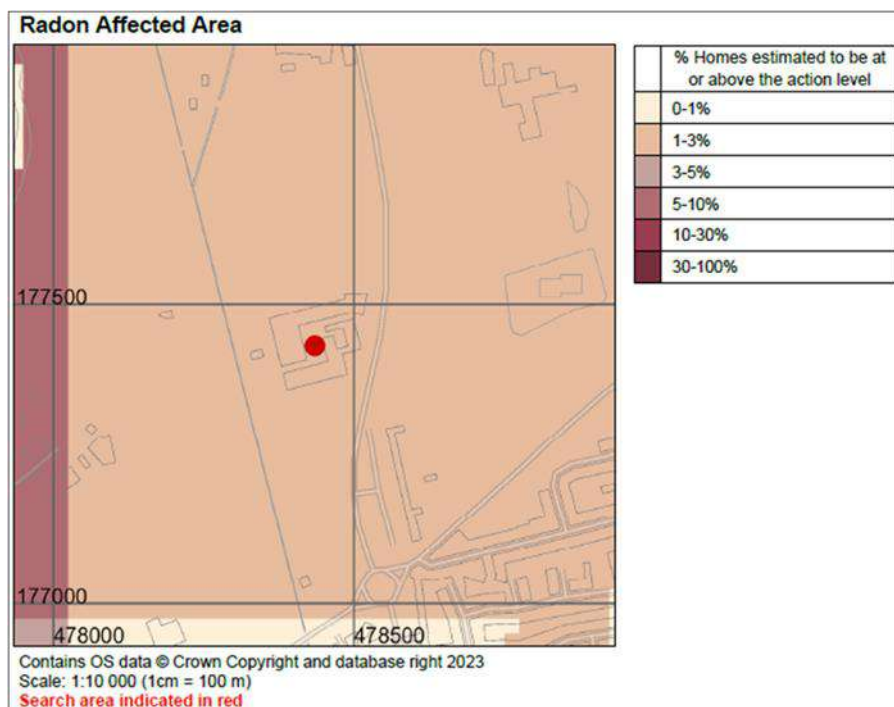


Figure 2 BGS Radon probability map at 100m square grids. Figure 1 was taken from the British Geological Society (BGS) GeoReport (Report Id: BGS_335758/49964), dated 13th November 2023. See Appendix A for full details.

As illustrated by Figure 2, the 5-10% classification of the site by the free 1km grid square risk mapping tool is due to areas of higher risk potential located to the west of the site. The more detailed mapping shows the site and immediate area to be classified as a 1-3% area. The report therefore states that no radon protective measures are required for the report area.

However, although the indicative radon atlas is a very useful tool for radon assessment, it is important to note that the only way to determine the actual radon significance within existing buildings is to undertake radon measurements. Current standard UK practice is to undertake passive radon monitoring over a 90-day period, with the results seasonally corrected to provide an estimated annual average, which can be directly compared to reference levels.

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The Piggott School, Wargrave

5 Radon monitoring

5.1 Passive radon monitoring

GGS deployed a total of 20 No. Track Etch passive radon detectors within selected internal locations. All passive monitoring was completed over a 90-day exposure period, between 21st November 2023 and 19th February 2024.

The passive monitoring locations were assessed for suitability by GGS specialists, considering all on-site observations, including occupational behaviours, proposed building works/renovations and spatial distribution of each measurement point, to suitably inform project objectives. All detectors were deployed in line with best practice and following collection were dispatched to an UKHSA accredited laboratory for analysis.

Figure 3 below presents selected GGS site photographs of the passive radon detectors deployed on site.



Figure 3 Selected GGS site photographs of the passive radon detectors deployed on site.

The passive monitoring results are presented in Table 6.1 below, whilst a monitoring location plan is presented in Appendix D.

GGS RadonPack™ Report

The Piggott School, Wargrave

Table 6.1 Track etch passive monitoring results.

Monitoring location number (refer to Appendix E)	Radon result Bq m ⁻³	Annual average Bq m ⁻³
1	-	-
2	12	9
3	14	11
4	13	10
5	11	9
6	42	33
7	14	11
8	9	7
9	15	12
10	6	5
11	12	9
12	47	37
13	16	13
14	10	8
15	17	13
16	18	14
17	12	9
18	22	17
19	15	12
20	21	17
Average	17	13

GGSRadonPack™ Report

The Piggott School, Wargrave

6 Conclusions and recommendations

6.1 Conclusions

The passive monitoring results indicate that the radon significance at the site is low. The majority of the results remained below the average radon concentration of 20 Bq m⁻³ in UK homes⁷ and all were below the Target Level of 100Bqm⁻³, which is the ideal outcome for remediation works in existing buildings and protective measures in new buildings⁸. As such, no immediate actions with respect to radon are required.

6.2 Recommendations

The following recommendations pertaining to radon should be considered.

Radon awareness and information

All information pertaining to radon at the site should be documented and retained on the building management file.

Future monitoring

Within newly constructed buildings, passive monitoring should be considered to confirm radon activity remains below reference levels. Monitoring should be undertaken during normal occupancy and over a 90-day duration to ensure that results can be directly compared with reference levels.

Additional passive radon monitoring within parts of the site not previously subject to monitoring would increase confidence levels that there is no significant spatial variation in radon significance across the site.

Should any significant changes occur on site, such as extensions, or new buildings, additional passive radon monitoring should be considered to confirm that radon remains suitably low.

As the site is situated within a radon affected area, where 1-3% of homes are estimated to be at, or above, the action level, repeated radon testing every 5-10 years should be considered to confirm that radon remains suitably low.

⁷ <https://www.ukradon.org/information/whatisradon>

⁸ <https://www.ukradon.org/information/level>

GGs RadonPack™ Report
The Piggott School, Wargrave

Appendix A

BGS Radon Geo Report

GGG Limited
Pythia House
Hibbert Street
Stockport
SK4 1PL

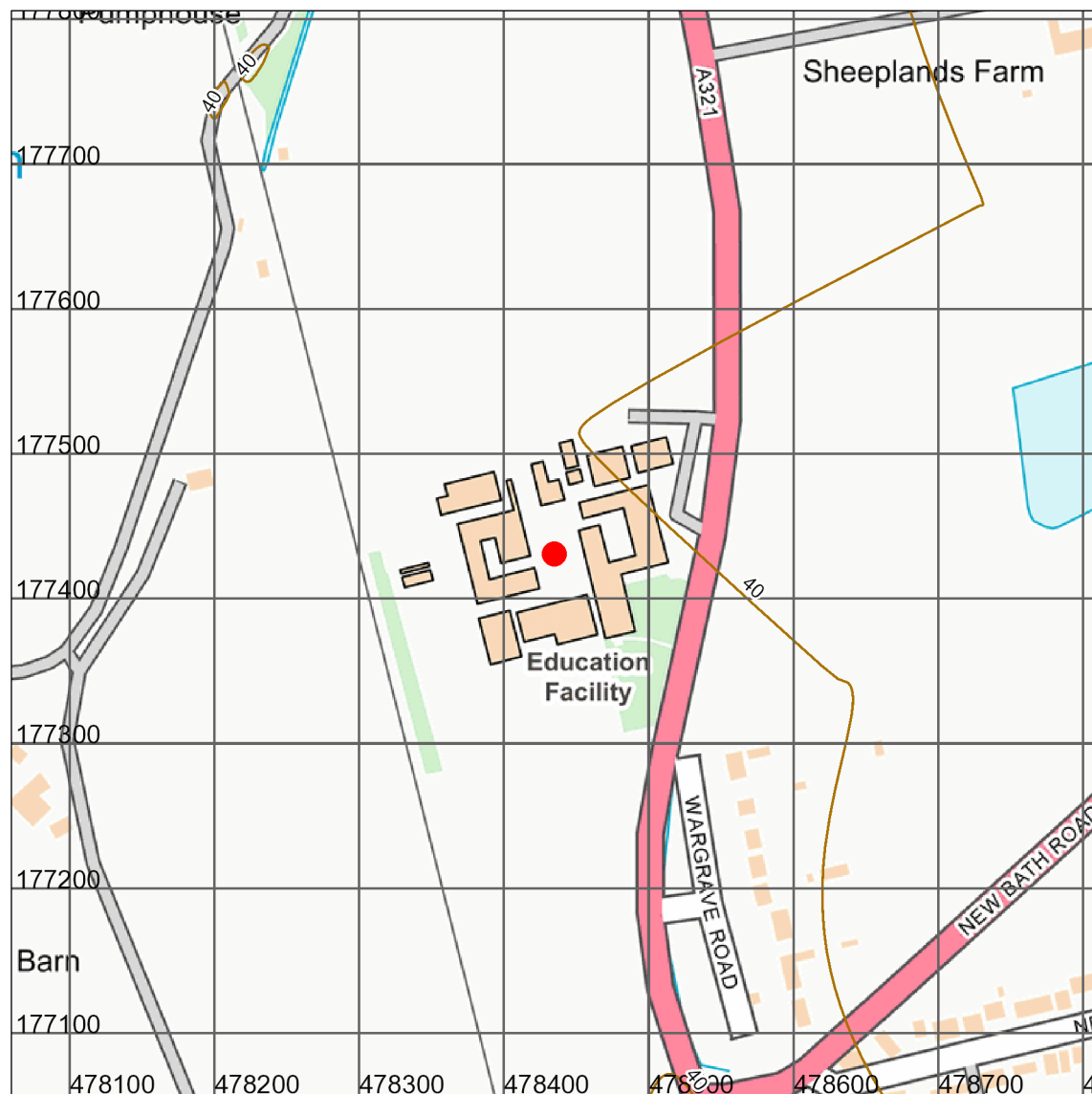
Radon Report

Advisory report on the requirement for radon protective measures in new buildings, conversions and extensions to existing buildings. The report also indicates whether a site is located within a radon Affected Area

Report Id: *BGS_335758/49964*

Client reference:

Search location



Contains OS data © Crown Copyright and database right 2023. OS OpenMap Local: Scale: 1:5 000 (1cm = 50 m)

Search location indicated in red

Point centred at: 478435,177431

Radon Report: UK

When extensions are made to existing buildings in high radon areas, or new buildings are constructed in these areas, the Building Regulations for England, Wales, Scotland and Northern Ireland require that protective measures are taken against radon entering the building.

This report provides information on whether radon protective measures are required. Depending on the probability of buildings having high radon levels, the Regulations may require either:

1. No protective measures
2. Basic protective measures
3. Full protective measures

This is an advisory report on the requirement for radon protective measures in new buildings, conversions and extensions. The report also indicates whether a site is located within a radon Affected Area

Requirement for radon protective measures

The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2023 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

Is the property in an area where radon protective measures are required for new buildings or extensions to existing ones as described in publication BR211 (2023 edition) Radon: Guidance on protective measures for new buildings?

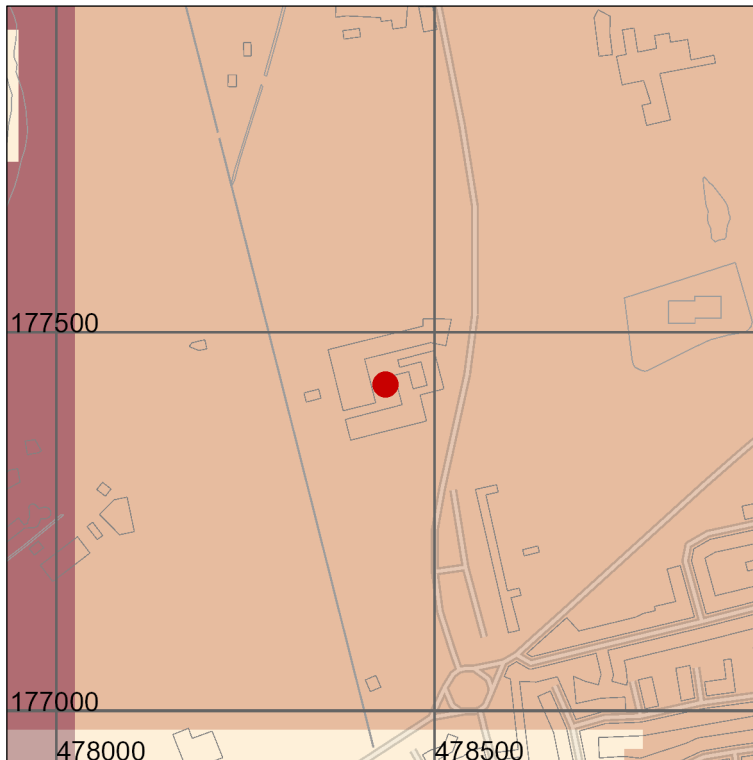
NO RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

More details of the protective measures required are available in *BR211 Radon: Guidance on protective measures for new buildings (2023 Edition)*.

Whether or not the radon level in a building is above or below the radon Action Level can only be established by having the building tested. The UKHSA provides a radon testing service which can be accessed at www.ukradon.org or by telephone (01235 822622).

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

Radon Affected Area



% Homes estimated to be at or above the action level
0-1%
1-3%
3-5%
5-10%
10-30%
30-100%

Contains OS data © Crown Copyright and database right 2023

Scale: 1:10 000 (1cm = 100 m)

Search area indicated in red

Is the property in a radon Affected Area as defined by the UK Health Security Agency (UKHSA) and if so what percentage of homes are estimated to be at or above the Action Level? YES

Additional Information

THE PROPERTY IS IN A RADON AFFECTED AREAS WHERE 1 TO 3% OF HOMES ARE ESTIMATED TO BE AT OR ABOVE THE ACTION LEVEL.

The UKHSA recommends a radon 'Action Level' of 200 Becquerels per cubic metre of air (Bq m^{-3}) for the annual average of the radon gas concentration in a home. Where 1% or more of homes are estimated to be at or above the Action Level the area should be regarded as a radon Affected Area.

This report informs you whether the property is in a radon Affected Area and the percentage of homes that are estimated to be at or above the radon Action Level at this location. Being in an Affected Area does not necessarily mean there is a high radon level within the property; the only way to determine the radon level is to carry out a radon measurement.

The UKHSA advises that radon gas should be measured in all properties within radon Affected Areas and that homes with radon levels at or above the Action Level (200 Bq m⁻³) should be remediated. Householders with levels between the Target Level (100 Bq m⁻³) and Action Level should seriously consider reducing their radon level, especially if they are at greater risk, such as if they are current or ex smokers. Whether or not a home is in fact above or below the Action Level or Target Level can only be established by having the building tested. The UKHSA provides a validated radon testing service which can be accessed at www.ukradon.org.

The information in this report provides an answer to one of the standard legal enquiries on house purchase in England and Wales, known as Law Society CON29 Enquiries of the Local Authority (2016); 3.14 Radon Gas: Do records indicate that the property is in a “Radon Affected Area” as identified by the UKHSA. The data can also be used to advise house buyers and sellers in Scotland and Northern Ireland.

If you are buying a new build property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.

If you are buying a currently occupied property in a radon Affected Area, you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were at or above the radon Action Level and if so, whether remedial measures were installed, radon levels were re-tested, and if the results of re-testing confirmed the effectiveness of the measures.

Further information on radon is available from the UKHSA at www.ukradon.org.

What is radon?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m^{-3}). The Government advises householders that, where the radon level is at or above the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations 2017 require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293): **Radon in the workplace**. BRE publications may be obtained from the BRE Bookshop, Tel: 01923 664262, email: bookshop@bre.co.uk website: www.brebookshop.com

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- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
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The Piggott School, Wargrave

Appendix B

GGS Site Photographs

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The Piggott School, Wargrave



General site photograph.



Typical passive detector deployment.



Selected passive monitoring location.



General site photograph.



Selected passive monitoring location.



Selected passive monitoring location.

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The Piggott School, Wargrave

Appendix C

Radon Certificates



CERTIFICATE No: 13259

CERTIFIES THAT

ANDREW BRUNTON

HAS SUCCESSFULLY COMPLETED THE PART ONE EXAMINATION ON RADON DETECTION AND TREATMENT

QUALIFYING CPD POINTS - 7 HOURS

CHAIRMAN:

PETER ATCHISON

SECRETARY:

DIANE V. PEAD

DATE:

20TH JUNE, 2013

FOR AND ON BEHALF OF THE RADON COUNCIL





CERTIFICATE No: 20012

CERTIFIES THAT

DOMINIC NUNN
OF
GROUND GAS SOLUTIONS LTD

HAS SUCCESSFULLY COMPLETED THE EXAMINATION ON RADON DETECTION AND TREATMENT
QUALIFYING CPD POINTS - 7 HOURS

CHAIRMAN:


G. K. GILLMORE

DATE:

24 NOVEMBER 2022

FOR AND ON BEHALF OF THE RADON COUNCIL

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The Piggott School, Wargrave

Appendix D

Monitoring Location Plan



Note:
Drawing not to scale - for illustrative purposes only.

Title:
Monitoring Location Plan

Project:
GGS3457 - Piggott School, Wargrave

Drawing No:
GGS3457_MLP_19/02/24

Key:
 Passive Track Etch Deployment Locations

Note:
Drawing not to scale and all locations are approximate.
Drawing for illustrative purposes only.
Refer to original HLM Architects drawing 'Ground Floor GA existing', dated 25/10/22.

Rev.	Date	Dwn.	Description	App'd
0	19/02/24	PG	FINAL	AB

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