



Department of

Finance

An Roinn

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The Building (Amendment) Regulations (Northern Ireland) 2022

Final Regulatory Impact Assessment for proposals on Radon

Part C (Site preparation and resistance to contaminants and moisture)

January 2022

Title: Part C of the Building Regulations – Revision of building regulation policy with current radon risk maps	Regulatory Impact Assessment (RIA)		
	Date: January 2022 (Final)		
	Type of measure: Secondary Legislation		
Lead department or agency: Department of Finance (the Department)	Stage: Final		
	Source of intervention: Domestic NI		
Other departments or agencies:	Contact details: Building Standards Branch		
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Summary Intervention and Options

What is the problem under consideration? Why is government intervention necessary? Radon is a naturally occurring radioactive gas linked to lung cancer. Alongside a health and awareness programme and testing and remediation of existing buildings, current Government policy includes targeted intervention through the Building Regulations which requires radon protection in new dwellings in radon potential ($\geq 1\%$) risk areas. This combats market failure arising from information failure (householders may not understand radon risks) and from agency issues (house-builders may not fully take account of health benefits to future occupants when developing a building). This Regulatory Impact Assessment deals with amending regulation & guidance to reference the most up-to-date radon maps.	
What are the policy objectives and the intended effects? The policy objective is that the Building Regulations and supporting statutory guidance is clear on current radon risks, and ensures dwellings are fitted with proportionate measures to prevent the ingress of radon and thus reduce radon-related lung cancers. Current guidance refers to radon maps issued in 2009 but more detailed maps were published in 2015. By amending regulation & guidance in Technical Booklet C the Department will ensure that radon measures are installed based on the latest assessment of radon risk.	
What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base) Option 1 - Do Nothing Option 2 - Update Building Regulations & guidance to align it with the current radon risk maps. This Draft stage Regulatory Impact Assessment considers the chosen policy option, updating Building Regulations & guidance to align it with the current radon risk maps (Option 2), against a counterfactual 'do-nothing' scenario (Option 1). The Department of Finance issued an Information Note in 2016 promoting the use of the new radon maps as good practice. This non-regulatory action supported the house-building industry referenced BR211 standards for protective measures in line with these maps. The chosen policy will maintain a targeted regulatory intervention (aligned to the most up-to-date radon maps), to ensure that new dwellings in radon potential ($\geq 1\%$) risk areas incorporate appropriate radon protection measures.	
Note	If applicable, set review date:

Cost of Preferred (or more likely) Option		
Total outlay cost for business £m	Total net cost to business per year £m	Annual cost for implementation by Regulator £m
0.1033 year 1	0.0809	N/A

Does Implementation go beyond minimum EU requirements?				N/A	YES
Are any of these organisations in scope?	Micro Yes <input checked="" type="checkbox"/> No	Small Yes <input checked="" type="checkbox"/> No	Medium Yes <input checked="" type="checkbox"/> No	Large Yes <input checked="" type="checkbox"/> No	

The Final RIA supporting legislation must be attached to the Explanatory Memorandum and published with it.

Approved by: Desmond McDonnell

Date: 26 February 2022

Summary: Analysis and Evidence Policy Option 1

Description: **Do nothing**

ECONOMIC ASSESSMENT (Option 1)

Costs (£m)	Total Transitional (Policy)		Average Annual (recurring)	Total Cost
	(constant price)	Years	(excl. transitional) (constant price)	(Present Value)
Low	Optional		Optional	Optional
High	Optional		Optional	Optional
Best Estimate	N/A		N/A	N/A

Description and scale of key monetised costs by 'main affected groups'

Option 1 - Do nothing, imposes no monetised costs on the main affected groups.

Other key non-monetised costs by 'main affected groups'

Option 1 - Do nothing, imposes no direct costs on the main affected groups, however the use of out-of-date radon maps could lead to some house-builders incorporating radon protection where it is not proportionate to do so, or not incorporating radon protection to new affected areas.

Benefits (£m)	Total Transitional (Policy)		Average Annual (recurring)	Total Benefit
	(constant price)	Years	(excl. transitional) (constant price)	(Present Value)
Low	Optional		Optional	Optional
High	Optional		Optional	Optional
Best Estimate	N/A		N/A	N/A

Description and scale of key monetised benefits by 'main affected groups'

Option 1 - Do nothing, produces no additional benefits for the main affected groups.

Other key non-monetised benefits by 'main affected groups'

Option 1 - Do nothing, produces no additional benefits for the main affected groups.

Key Assumptions, Sensitivities, Risks

Without reference to the most up-to-date radon maps, some dwellings that should have appropriate protection might not be targeted, with the potential risk of increased incidents of related lung cancer. The use of out-of-date risk maps would be inconsistent with building statutory requirements of other jurisdictions and other Member States, as well as current house-building industry standards.

BUSINESS ASSESSMENT (Option 1)

Direct Impact on business (Equivalent Annual) £m		
Costs: N/A	Benefits: N/A	Net: N/A

Cross Border Issues (Option 1)

How does this option compare to other UK regions and to other EU Member States (particularly Republic of Ireland)

Do nothing option using out-of-date risk maps would lead to inconsistency of building statutory requirements with other jurisdictions and Member States (though in this circumstance not the Republic of Ireland). The Irish National Radon survey (10 km grid) maps referenced are RPII February 2002 dated.

ECONOMIC ASSESSMENT (Option 2)

Costs (£m)	Total Transitional (Policy) (constant price)	Years	Average Annual (recurring) (excl. transitional) (constant price)	Total Cost (Present Value)
Low	Optional	1	Optional	Optional
High	Optional		Optional	Optional
Best Estimate	0.0224		0.0809	Year 1 0.1033

Description and scale of key monetised costs by ‘main affected groups’

Option 2 – most of industry follows house-building industry referenced BR211 standards for protective measures in line with these indicative 1 km grid maps, but Government anticipate some smaller firms do not - the main affected groups. The change will impose additional costs to include targeted dwelling radon protection measures in new homes (£0.063m) and in extensions (£0.018m). There will also be a small transition cost (one-off cost in year 1) for construction industry (professionals, consultants, builders, etc.) however this may be overstated as many firms will already have experience of working in existing radon affected areas.

Other key non-monetised costs by ‘main affected groups’

Option 2 – None.

Benefits (£m)	Total Transitional (Policy) (constant price)	Years	Average Annual (recurring) (excl. transitional) (constant price)	Total Benefit (Present Value)
Low	Optional		Optional	Optional
High	Optional		Optional	Optional
Best Estimate	N/A		N/A	N/A

Description and scale of key monetised benefits by ‘main affected groups’

Option 2 – UK Government anticipate the policy will deliver health benefits as the installation of radon protection measures in a more accurate risk proportionate manner, will reduce future lung cancer incidences. Uncertainties associated with projected health benefits estimating would deter from the monetising of health benefits.

Other key non-monetised benefits by ‘main affected groups’

Option 2 – The amendment to regulation and Technical Booklet C will establish up-to-date guidance on compliance with the Building Regulations for house-building constructions in a Radon affect area. The amended legislation and guidance will ensure that where radon action levels indicate protective measures installation, effective enforcement action can be taken accordingly.

Key Assumptions, Sensitivities, Risks

This policy is to acknowledge and promote up-to-date informative radon mapping for dwellings. The noted mapping is already house-building industry available (6 years prior) and best practice followed, therefore the policy is judged to be low-risk.

Key assumptions are – low impact on industry due to current best practice take-up, and – the number of construction industry personnel affected and the associated familiarisation (one-off year one) costs.

BUSINESS ASSESSMENT (Option 2)

Direct Impact on business (Equivalent Annual) £m			
Costs: 0.0809	Benefits: N/A	Net: 0.0809	2018 prices

Cross Border Issues (Option 2)

How does this option compare to other UK regions and to other EU Member States (particularly Republic of Ireland)

Technical Booklet C in support of Part C regulations, would set building statutory up-dated radon mapping comparable with other UK regions, and provide industry with consistent technical guidance. The Republic of Ireland current mapping system (10 km grid) also implements the Euratom Basic Safety Standards Directive.

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Evidence Base (for summary sheets)

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INTRODUCTION

The Department of Finance has policy responsibility for maintaining the Building Regulations.

The Building Regulations apply to most building work and are made principally to secure the health, safety, welfare and convenience of people in or about buildings, further the conservation of fuel and power, further the protection and enhancement of the environment and promotion of sustainable development.

The regulations set mainly functional requirements and are supported by Technical Booklets giving guidance, including performance standards and design provisions, relating to compliance with specific aspects of the Building Regulations for the more common building situations

PURPOSE AND INTENDED EFFECT OF MEASURES

The main purpose and effect of the amendment is to maintain the objectives of building regulations by providing updated regulation and technical guidance, relating to contaminants including guidance on how to protect against potential radon gas and how to establish where this may be necessary (based on reference to current Northern Ireland radon maps).

SCOPE

This Final Regulatory Impact Assessment (RIA) addresses an amendment of the Building Regulations and related supporting Technical Booklet, specifically providing updated guidance within Part C regulation 25 Interpretation and Technical Booklet C, relating to radon protective measures.

OBJECTIVE

The overall objective of the amendment is to update current statutory interpretation (supporting effective enforcement action) and update radon guidance within the existing system of building regulations for the welfare and convenience of people in and about buildings, without imposing disproportionate bureaucracy and costs on building owners, developers or on district councils whose role it is to enforce building regulations.

The necessity for updated supporting statutory guidance on current radon risks is clear, to ensure relevant dwellings are fitted with proportionate measures to prevent the ingress of radon, in a properly targeted manner and thus reduce radon-related lung cancers.

This Final RIA is a review of the Building Regulations (Northern Ireland) 2012 (as amended) considering the Costs and Benefits (where applicable) of the proposals to amend current building regulations covering contaminants, specifically radon mapping - to inform and ensure that dwellings are fitted with proportionate measures to prevent the ingress of radon.

The amendment, to varying degrees, affects those in the construction industry who are involved in the development, construction or extension of dwellings and those who are tasked with ensuring compliance with building regulations.

BACKGROUND – RADON PROTECTIVE MEASURES

Since 1994 the contaminants addressed by Part C have included radon gas. Radon is a naturally occurring colourless and odourless radioactive gas that can seep out of the ground and build up in houses, or any building indoor environments. Epidemiological studies have established that exposure to radon is a cause of lung cancer, with a linear dose-response relationship. Exposure to radon is now recognised as the second largest cause of lung cancer in the UK after smoking and analysis for the Public Health England (PHE) indicates that about 1100 UK deaths from lung cancer each year are caused by exposure to radon (most caused jointly by radon and smoking) – which would equate to 30 deaths per year in Northern Ireland.

Radon concentrations within buildings are determined by various factors including the geology of the ground, construction details and factors such as the methods of heating and ventilation. The concentration is measured in Bequerels per cubic metre (Bq m⁻³). PHE advice published explains how health experts estimate that an increase in radon concentration of 100 Bq m⁻³ in a dwelling increases an occupant's risk of lung cancer by up to 31%, with a central estimate of 16%.

An independent Advisory Group 2009 Report¹ indicates that available evidence suggests this percentage increase in lung cancer risk applies for men and women, across all age groups and for current smokers, ex-smokers and lifelong non-smokers. Since the baseline risk of lung cancer is much higher among smokers than non-smokers, and as radon appears to act to increase cancer risks in smokers in a multiplicative way, this concludes that the increase in lung cancer risk due to radon is much higher among smokers than non-smokers. The respective cumulative risks of lung cancer affecting people by age 75 years in the UK at 100 and 200 Bq m⁻³ are 0.42% and 0.47% for non-smokers and 17% and 19% for continuing smokers. The risks for ex-smokers will be in between the risks for these two groups, with a risk level which varies according to when they stopped smoking.

The PHE (in addition to examining the health risk evidence), carries out surveys and tests of radon background levels in existing buildings in the UK. The information from these is used in radon mapping by the Agency with the British Geological Survey and the Northern Ireland Environment Agency. The PHE publishes atlases of indicative (probabilistic) radon activity maps for the UK. The Building Research Establishment has, since 1998, published Northern Ireland specific guidance² that shows the areas of increased radon levels and technical details of measures that can be installed to provide precautions against radon.

Building Research Establishment (1998) BR413 guidance, referenced in the current 2012 Technical Booklet C outlines the radon action areas ('zones' of elevated risk) in Northern Ireland where radon protective measures should be installed. These are described as zones where either "basic" or more comprehensive "full" protective measures should be provided: these are "Zone 1" where 1-10% and "Zone 2" where above 10% of homes surveyed were found to have radon levels above 200 Bq m⁻³, respectively. This publication also provides technical guidance on different construction approaches that can

¹ 'Radon and Public Health: Report of an independent Advisory Group on Ionising Radiation' RCE 11, HPA 2009

² BR413 'Radon: Protective Measures for New Homes in Northern Ireland' – published 1998 & 2009 withdrawn 2015

be used in these areas to provide targeted/proportional (“basic” and “full”) protective measures against radon.

“Basic” (Zone 1) radon protective measures involve the fitting of a gas tight ground barrier to protect against radon ingress. This, which also acts as a damp-proof membrane, should cover the whole building foot print and be lapped to a preformed damp proof course system (cavity trays) in the walls and sealed around service penetrations.

“Full” (Zone 2) radon protective measures require the radon-proof ground barrier, together with a sump in the foundation, ready to take a fan if high levels of radon are detected after occupancy.

BACKGROUND - MAPS UPDATE

In 2015, following detailed surveys and studies, the PHE and the British Geological Survey (BGS), along with Geological Survey of Northern Ireland, published an updated atlas of radon maps³. These show how the areas with targeted radon risk levels are more widespread than those identified in 2009. BRE also published a revised BR211 “Radon: Guidance on protective measures for new buildings” in 2015, with the maps of areas where radon protection is required updated in line with the revised atlas. The inclusion of the Northern Ireland specific atlas maps in the 2015 BR211 update effectively superseded BR413 Northern Ireland document, with this guidance withdrawn from UKRadon publication thereafter.

The 2015 published maps are available at higher resolution than their predecessors and therefore provide a more accurate identification of radon risk in a particular area.

RATIONALE FOR GOVERNMENT INTERVENTION

In 2016, the Department issued a Building Standards Branch Information Note highlighting the revised Northern Ireland radon maps, their implications, the updated BR211 guidance (which now includes Northern Ireland atlas maps) and the withdrawal of previous BR413 Northern Ireland radon measures guidance. It also indicated that we would look to update Technical Booklet C to align it with this revised guidance – work we have now finished. The Department also used that Information Note to recommend as good practice the use of the latest revised Northern Ireland guidance within BR211.

The Department Information Note in tandem with the National House Building Council (NHBC) had considerable influence in promoting this good practice, suggesting as a result at least 70% of new housing development in actionable Affected Areas is constructed using appropriate protective measures. This figure is based on the fact that the NHBC (who provide building standards warranties for 80% of new housing development in the UK) advice⁴ would expect developers to provide protective measures in line with the 2015 BR211 version radon maps. The 2013 England Radon policy Consultation tested this figure, which was endorsed by the house-building industry. In practice this figure is likely to be slightly underestimated, particularly where NHBC require specific risk identification data capture and provision of information. However, there is still the concern that not all new homes and major domestic extensions are being built with suitable radon protection measures in the current Affected Areas.

³ ‘Radon in Northern Ireland: Indicative Atlas’ Public Health England - published 2015: PHE-CRCE-017

⁴ NHBC Risk Guide: Radon/Gas protection (HB2852 01/16)

This potential housing market failure may result from builders lacking sufficient incentive to build radon protection into work in these new areas, when it is not seen as a regulatory requirement described in Technical Booklet C. They are exposed only to costs that arise from installing protective measures and do not receive the benefits that subsequently accrue. Furthermore, as householders and homebuyers often lack awareness of radon, they may not make informed decisions about their homes and radon protective measures and so fail to create a demand for these measures.

If a significant minority of housing development activity is not providing appropriate radon protective measures in line with the updated maps, because this is not seen as a requirement described by the statutory guidance in Technical Booklet C, the absence of suitable radon protective measures in new developments will place occupants at higher risk of exposure to radon and associated health impacts. The Department considered intervention to address this in Option 2.

SUMMARY OF AMENDMENTS

Part C (Site preparation and resistance to contaminants and moisture)

The proposals amend the current definition of the term “Radon affected area” within the Building Regulation and amend the associated Technical Booklet C guidance on “Resistance to contaminants”, updating the radon affected area map reference from the 2009 publication to the current 2015 publication. Additionally, reference to the withdrawn BRE Northern Ireland specific radon protective measure guidance and BRE radon protection to new domestic extensions/conservatories, have been replaced with the current 2015 BRE publication BR211.

The Department also takes the opportunity to reference site-specific radon risk reports, currently included within 2015 BR211 (Section 4: Determining the level of protection.)

SUMMARY OF COMPLIANCE COSTS & BENEFITS

The cost impact is considered to be minimal, given that the regulatory change is light and there may also be potential health benefits that may apply a compensating effect to the costs of the amendments – however these have been excluded due to uncertainty with projected health benefit estimating.

Part	Change	Cost Impact
C	Regulation 25 Interpretation of 'Radon affected area' update of the Northern Ireland 2009 Review & Atlas to current 2015 PHE published Atlas maps.	<p>For an Affected Area masonry constructed new house, 'basic' protective measure cost would be in the region of £400.</p> <p>For an Affected Area timber frame constructed new house, 'basic' protective measure cost would be in the region of £100.</p> <p>For an Affected Area masonry constructed new house, 'full' protective measure cost would be in the region of £500.</p> <p>For an Affected Area timber frame constructed new house, 'full' protective measure cost would be in the region of £200.</p>
		<p>For an Affected Area dwelling extension, 'basic' protective measure cost would be in the region of £90.</p> <p>For an Affected Area dwelling extension, 'full' protective measure cost would be in the region of £300.</p>

BUSINESS SECTORS AFFECTED

The amendments impose some additional burdens on substructure designers, developers, and domestic builders (based on England's modelling). House-building industry would already appear to be aware of these updated indicative atlas maps, with many businesses being familiar with good practice in the installation of radon protection as a result of carrying out work in the existing radon areas. They should not require any new skills so it is anticipated that these costs will relate to initial year one familiarisation costs and, some initial transitional costs in understanding the requirements in newly classified radon areas.

Drawing on the experience within the housing sector, along with the building standards warranty schemes requirements and following the logic set out in England's initial Impact Assessment (IA) based on this best practice counterfactual, the conclusion is that a percentage of all new housing and domestic extensions (with relevant affected ground footprint) may not have suitable radon protective measures installed. Figure of 30% has been applied to take account for this factor on newly built dwellings, and newly extended dwellings.

The costs relating to radon protection in extensions have been treated as a cost to business in this assessment (even though the expectation is this is a cost that will be passed on to consumers in a competitive marketplace). Given that consumers may decide not to undertake an extension project in the face of a price rise there is an impact on business although the approach taken here is likely to, if anything, overstate that impact.

The benefits of amending guidance have been excluded from the headline figures of the impact assessment and the costs to business calculations as they are uncertain, but the potential clearly exists for this change to significantly reduce the net cost to business.

OTHER IMPACT ASSESSMENTS

The Department considers that the amendments will have no significant effect on competition in any markets.

The amendments apply to relevant dwelling buildings (where building regulations apply) and therefore have an effect on the house-building sectors, property owners, developers, etc. with no adverse impact on equality of opportunity or the needs of rural customers.

The Department does not expect an Environmental Impact from the preferred Option to affect the wider environment outside the homes and it will not result in additional greenhouse gases being emitted.

The preferred Option is primarily focused on population health improvement. The proposed amendments are likely to lead to a positive impact on public health and welfare which will bring a number of non-monetised social benefits with cancers avoidance which might otherwise have been caused by radon.

The Department does not expect the proposal to have any sustainable development implications, although ensuring buildings are built with appropriate precautions for the occupant's, will support the principle of building the right buildings in the right places, suitable for future generations.

MICRO & SMALL FIRMS IMPACT

Even though the compliance costs above are small, some consideration has been given as to whether there may be a net cost to small business. However, single dwelling and extension developments are usually undertaken by individuals, usually in contract with a number of companies. This means that if there is any limited cost it would fall to that person(s) rather than the companies.

There could be some transitional costs to firms, particularly small builders carrying out extensions, although it is considered that the estimate included here is higher than that

which will be incurred in reality, since many firms will already have experience of installing radon protection having carried out work in the existing risk areas.

The UK Ministry of Housing, Communities and Local Government (MHCLG), when proposing the equivalent England Part C amendment of their building regulations, interviewed relevant construction sector businesses. The aim was to gauge their reaction to the proposed changes. Overall, no businesses had any strong objections to the proposals and the amendment. The Department considers it reasonable to assume that local micro and small firms will be similarly unconcerned by the proposed amendments.

ENFORCEMENT AND SANCTIONS

The amended regulation will continue to be enforced by district councils through the existing mechanisms and sanctions provided through the Building Regulations (Northern Ireland) Order 1979 (as amended) (the 1979 Order).

MONITORING AND REVIEW

MHCLG undertakes reviews of amendments made to the Building Regulations. The outcomes of these reviews and additional research undertaken by MHCLG (on behalf of England, and the devolved administrations) inform the need for further amendments to the Building Regulations. It is thought likely that these proposals will be reviewed in light of future PHE (or equivalent UK Agent), or BGS developments relating to mapping or risk reporting.

CONSULTATION

GOVERNMENT CONSULTATION

Building Standards Branch (BSB) has been involved in discussions with the two Public Bodies with specific responsibility for Northern Ireland new indicative atlas radon mapping, Northern Ireland Environmental Agency, Industrial Pollution and Radiochemical Inspectorate (NIEA/IPRI) and Public Health England Centre for Radiation, Chemical and Environmental Hazards (PHE/CRCE).

PUBLIC CONSULTATION

There is a statutory duty to consult the Northern Ireland Building Regulations Advisory Committee (NIBRAC) and such other bodies as appear to the Department to be representative of the interests concerned.

The consultation documents were sent to NIBRAC alongside the release of the consultation explaining that the nature of the proposed amendment to Part C of the Building Regulations and the update of associated Technical Booklet to align with the current radon risk maps.

BSB has an extensive database of names of individuals and organisations that have expressed a specific interest in building regulations and technical guidance. As well as directly contacting stakeholders with a known interest, this consultation exercise was also promoted on the BSB Building Regulations homepage of the DoF website.

The public consultation period ran for 8 weeks, commencing on 14 August 2020 and closing on 9 October 2020.

CONTACT POINT

This Regulatory Impact Assessment, and the Departments Response to Public Consultation, may be downloaded from www.finance-ni.gov.uk/articles/building-regulations-consultations or a hard copy may be obtained from Karen McKernon at:

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AMENDMENT TO PART C (Site preparation and resistance to contaminants and moisture) Revision of building regulation policy with current radon risk maps, including Technical Booklet C amendment

BACKGROUND

- C1. The Northern Ireland Building Regulations require radon protection in new dwellings in radon potential ($\geq 1\%$) risk areas. The PHE has published atlases of indicative (probabilistic) radon activity maps for the UK, for assessing the need for protective measures.

The policy objective is that the Building Regulations and supporting statutory guidance is clear on current radon risks, and ensures that relevant dwellings are fitted with proportionate measures to prevent the ingress of radon and thus reduce radon-related lung cancers. Current guidance refers to radon maps issued in 2009 but more detailed maps were published in 2015. By amending guidance in Technical Booklet C the Department will ensure that radon measures are installed based on the latest assessment of radon risk.

RISK ASSESSMENT

- C2. The Department considered the original 2012 English Consultation IA which used the Radon maps 1999/2007 proportionate difference between affected areas (1km grid generic risk averages). Whereas the 2013 Final IA economic assessment, used the UK Radon website GIS (Geographical Information System) postcode level specific radon risk reports 1999/2011 proportionate difference between affected areas – *'because the indicative radon atlas is based upon the highest risk within a 1km grid square whereas the radon risk report offers greater granularity'*. In real terms the *indicative* atlas map level of detail is set @ 1km, where the *definitive* GIS postcode report level of detail is set @ 25m.

Northern Ireland is not in the same position as England with (a) Local Authorities free licensed access to GIS site-specific postcode level risk report data, and (b) GIS site-specific 'Georeport' radon risk reports are currently not available as standard to Northern Ireland, therefore the RIA costs have been developed using the indicative atlas map 1km grid data – inevitably this approach will lead to higher levels of radon protection measures.

- C3. The Department also considered the 2013 English Final IA noted Benefits, whilst deciding to exclude the projected health benefit savings, as tangible deductions from the direct impact costs on business (due to the potential uncertainties associated with projected health benefits estimating), nonetheless the 2013 IA further developed the original health benefit QALY (Quality Adjusted Life Years) values, & applied further sensitivity analysis.

Northern Ireland is not in the same position as England with their access to Independent Ionising Radon Advisory Group Health Economic calculations, and

there has been no specific modelling for Northern Ireland or modelling at a 1% radon potential action level, subsequently there has been no QALY values interpretation for Northern Ireland.

OPTIONS

C4. Regulation 25 of the current 2012 (as amended) Northern Ireland Building Regulations and Technical Booklet C radon guidance refer to the 2009 HPA Review and Atlas, so in considering how to update this reference, only two options were examined:

Option 1 – ‘do nothing’, continue referencing out-of-date radon maps and rely on house-building industry to follow good practice; or

Option 2 – amend the application & interpretation regulation, together with the existing supporting guidance within the Technical Booklet, to reference the most up-to-date maps and ensure protective measures are properly targeted to Affected Area dwellings.

C5. The ‘do nothing’ Option is not preferred because:

- a) it undermines the rationale for a targeted regulatory intervention, if the provisions are not targeted on the basis of the most accurate and up-to-date information;
- b) consequently some dwellings or domestic extensions that should be protected would not be, leading to potential increased incidence of lung cancer, and;
- c) some homes would incorporate radon protection where it is not proportionate to do so.

Option 2 is preferred to avoid the adverse impacts set out under the ‘do nothing’ Option above. It will require either “basic (Zone 1) or full (Zone 2)” radon protective measures, as appropriate, to be provided to new dwellings and relevant domestic extensions in the newly mapped areas of action level radon risk. This maintains but extends the current policy of targeted intervention in actionable areas of higher risk and has clear health benefits over the current situation.

C6. PHE analysis conducted on the two sets of radon maps indicates that the updated radon risk map increases the number of properties within an identified radon risk area by around 65,000 homes. This constitutes an increase of around 8.9% of the total number of Affected Area dwellings in Northern Ireland.

The 2015 PHE published radon maps are compiled at a more detailed resolution than the 2009 maps. The net figure is the difference between the current map dwellings within the radon action level risk area (155,000), less those dwellings within the previous map action level radon risk area (90,000).

C7. In developing this Final RIA the Department has drawn upon work carried out by PHE and the 2013 English Final IA. This has highlighted the fact that there are effectively two possible options/ways of deciding whether a particular site needs radon

protection – either by using the higher-level information provided by the indicative radon atlas or by using the definitive GIS risk reports information, provided (where available) for a minimal charge.

Unlike the English scenario, Northern Ireland Building Control does not have free licensed access to the definitive risk report assessments as a matter of course, and the house-building industry would appear to depend on the ‘traditional’ indicative radon maps approach. Historically in Northern Ireland, with the availability of GIS site-specific postcode risk reports from 2009, there has been no effective industry take-up of this UKRadon reporting service. BGS site-specific radon risk reports (Georeports – where a postcode is not available) currently are not available to Northern Ireland, as a BGS standard radon report service. Subsequently, the Final RIA will be developed to reflect the current industry applied methodology, however, the Department will take the opportunity to reference radon risk reporting alternatives within BR211, with the aim of guiding building control, developers and householders to make informed decisions regarding radon protection based on the most appropriate local data.

BENEFITS

Option 1 – do nothing

C8. There are no benefits associated with this option. The use of out-of-date risk maps, might result in relevant dwellings not being targeted for appropriate protection, with the potential risk of increased incidents of related lung cancer. Superseded risk maps use would be inconsistent with building statutory requirements of other jurisdictions, as well as current house-building industry standards.

Option 2 – revision of building regulation policy with current radon risk maps, including Technical Booklet C supporting guidance amendment

Benefits – Protective measures in targeted new houses and domestic extensions

- C9. Radon is linked with lung cancer, and therefore the benefit of the requirement for and provision of radon protective measures will be a reduced number of lung cancers. It is known that both radon and smoking can cause lung cancer and that the combination of radon and smoking increases the risk further in a multiplicative relation. People have about a 25 times greater risk of lung cancer in a high radon atmosphere if they smoke. Indeed, most radon-related lung cancers occur in smokers.
- C10. In a large population the lung cancers which can be attributed to radon will therefore occur in both smokers and non-smokers, and the average population risk will be a weighted average of the risks to smokers and non-smokers. The Health Protection Agency had previously estimated that this risk increases by 16% per 100 Bq m⁻³. Survival rates from lung cancer remain low so the major health benefit of increased radon protection is the additional years of life resulting from the reduction in the number of cancers.
- C11. It is known that radon protective measures reduce radon levels in domestic buildings and the occupants’ exposure to radon. Different studies take different views on the effectiveness of membranes in reducing the levels of radon. The 2013

English IA work on the number of lung cancers averted, follows 'Gray et al' and assumes an average 50% reduction in the radon level when a membrane is installed. The English IA factored in typical occupancy, smoking prevalence, annual potential lung cancers averted, discounted/lagged benefits, with adopted QALY values developed from England specific 2009 HPA Health Economic calculations⁵. The Department does not intend to model speculative health economic projections/calculations for Northern Ireland, as noted in paragraph C3. Nonetheless Northern Ireland Housing Executive House Condition Survey research does suggest that the protective measures based the 2015 published Radon Atlas map could increase projected potential NHS annual savings.

- C12. The 2009 HPA 'Radon and Public Health' report Table 4.5 (Radon-induced lung cancers occurring each year) estimated 25% of lung cancer occurrences above the current action level of 200 Bq m⁻³. Where radon exposure lung cancers equate to 30 deaths per year in Northern Ireland, this could suggest some 7-8 likely Northern Ireland radon induced future lung cancers proportionally targeted in the affected 20% of new homes, where the installation of a basic radon protective membrane could reduce the radon exposure levels by 50%.

COSTS

OPTION 1 – do nothing

- C13. This option imposes no implementation costs on the house-building industry plus imposes no transition costs, with a suggested 70% of industry already best practice referencing the updated BR211 standards which include the updated Northern Ireland indicative radon maps. Nonetheless Government anticipate some 30% of the industry does not apply updated best practice - this position neglects to address this percentage of Affected Area homes not receiving appropriate radon protective measures.

OPTION 2 – revision of building regulation policy with current radon risk maps, including Technical Booklet C supporting guidance amendment

OPTION 2 – Transition costs

- C14. The Department would expect there to be some minor transition costs, based upon an estimate of the number of small business operating in the newly classified radon areas. This is likely to be an over estimate since many businesses will be familiar with good practice in the installation of radon protection as a result of carrying out work in existing radon areas within the Province.
- C15. DCLG modelling and feedback from consultation set transition costs for three key house-building businesses. Assuming that sub-structure design/engineering firms, property developers and building contractors are equally likely to be located in

⁵ Chapter 6 - 'Radon and Public Health: Report of an independent Advisory Group on Ionising Radiation' RCE 11, HPA 2009

radon affected areas, this suggests an estimate of 422 firms⁶, which might face some transitional costs in understanding the requirements in new areas.

- C16. Hourly rates have been calculated from 2017 Northern Ireland market salary research for the average/central case (the 50% median) then attaching a 30% overheads and a mid-range weighting between these wage rates & English Consultant developed industry wage rates, this equates to previous English modelling mid-range weighting between the Consultant developed rates and the wage rates derived from the Annual Survey of Hours and Earnings (ASHE). This reflects the value by the market of a professional including wage, on costs and other business costs to the organisation, and is the rate a firm would charge someone else per hour of an individual's time. This approach is widely used in the construction industry. However, more generally in Impact Assessments the ASHE forms the basis to estimate the cost of someone's time (plus an additional estimate of 30% for additional overheads such as pension contributions and national insurance contributions).
- C17. The Department believes it will take the 422 sub-structure design/engineering firms, property developers and building contractors half an hour to become familiar with the map change. A midpoint hourly wage rate across the affected professions of £37.11⁷ yields a year one familiarisation cost of £7,850. The English IA Consultant included a small-scale exercise to test the familiarisation assumption, which was undertaken with a number of small contractors and this concluded that there was "general agreement on time to familiarise staff with the regulation/maps (and some firms had already done this)".
- C18. Small domestic building contractors may require some up-skilling and training. Assuming this might take one day, the estimated cost, in terms of both lost time and the training itself, for 39 contractors would total £14,550 as a year one familiarisation cost. This cost is based on a direct cost of training of £225 and a loss of earnings of 8 hours based on the blended hourly wage rates. However, this is likely to be extremely conservative because many will have experience from installing radon protection in the old map areas.

Familiarisation / Transition Cost Analysis

New affected area House construction firm costs	
UK current market salary research suggests;	
Sub-structure designer/engineer	
- So: £19.65 + £5.90 (30%) = £25.55 then mid £64.00 (ECH)	£44.78 (S-St)
Domestic builder	
- So: £12.24 + £3.67 (30%) = £15.91 then mid £21.00 (ECH)	£18.46 (Bld)
Project developer	
- So: £20.13 + £6.04 (30%) = £26.17 then mid £70.00 (ECH)	£48.09 (Dvl)
So the median hourly rate weighted across the 3 affected	

⁶ From 2016-17, NI Quarterly Construction Bulletin (registered businesses) 206 structural design/engineer firms, 1648 domestic building firms, 255 developers = 2,109 firms with 20% affected (based on 20% of dwellings being within Radon affected areas in 2015)

⁷ Blended hourly wage rates – NI Market wage average/median, with 30% overheads + mid-range weighting from English Consultant EC Harris (ECH): structural engineer (£44.78) developer (£48.09) domestic builder (£18.46)

domestic construction professions; - $(£44.78 + £18.46 + £48.09) \div 3 = £37.11$ per hour average	= £37.11
Replicating English 2013 IA modelling; - NI affected domestic firms @ 422 - Affected 3 professions average wage per hour @ £37.11 - ½ hour familiarisation to map change - So: $(422 \times £37.11) \times 0.5 = £7,830$	
Total Construction firm's Cost (Year 1 familiarisation)	= £7,850
2016-17 NI Quarterly Construction Bulletin (Construction employee jobs) - Construction of domestic buildings = 4,841 employees - New NI radon affected area increased % @ 8.9% - Counterfactual 30% not applying good practice - New employees with no experience of old or new radon maps, say conservative 30% So: $4,841 \times (0.09 \times 0.3 \times 0.3\%) = 39$ NI small house contractors (Requiring up-skilling & training)	= 39
England 2013 IA modelling assumed a direct cost of training @ £225 & a loss of earnings of 8 hours based on weighted hourly rate. Replicating English 2013 IA modelling; - NI affected small house contractors @ 39 - Domestic builder weighted wage per hour @ £18.46 - Loss of earnings @ 8 hours for training - Cost of training @ £225 So: $(£18.46 \times 8) + £225 = £373$ $39 \times £373 = £14,547$	
Total Small Contractor training Cost (Year 1 familiarisation)	= £14,550

OPTION 2 – Protective measures in targeted new houses

C19. The 2013 English IA affected dwellings considered both new houses & new (ground level affected) flats, where English 2012 new flats construction figures continued increase to 38% of dwelling completions, a consistent trend over their 10 year projection period. In contrast Northern Ireland new dwelling development is over 90% house construction, & similarly in sharp contrast, Northern Ireland existing flat stocks are diminishing with a continued programme of flats/maisonette conversions to house stock. Urban flat block design would also suggest that the norm for ground floor accommodation is communal use (car parking/stores) or commercial let. On this basis, the Northern Ireland affected new properties proposed costs are limited to constructed house units.

- C20. Estimates of the additional cost of basic radon measures for new houses (i.e. over and above the cost of installing a normal damp-proof membrane) vary with the size, type and proposed construction of the building. The 2013 English IA modelling established the various elements of radon protection relevant to this assessment and the total cost of providing “basic and full” radon protection in various property types. The Department has considered the relevant house unit costs and averaged the cost estimate for “basic” (Zone 1) radon protective measures at £400, with “full” (Zone 2) radon protective measures at £500 (extra cost due to sump installation).
- C21. The number of new houses assumed to be built with radon protective measures has been developed from the 2018 new build house completions⁸ (which notes almost 6,900 new units). This suggests that 610 additional houses should have been built in 2018 with the need for radon protective measures as a result of the 2015 map changes. This was based on an approximate analysis of new houses sourced from District Council Building Control and the proportion estimated to fall within radon Affected Areas. However, assuming a counterfactual that house-building industry good practice would be delivering 70%⁹ of this target, the Department calculated the costs of regulating as the incremental increase in costs that would occur by a change to the “Radon Affected Area” zones with Technical Booklet C update, to ensure the remainder (up to 30%) are provided with appropriate protective measures. This led to an estimated number of targeted new houses to be built in radon areas of 184 in 2018, the modelling for the one year projections¹⁰.
- C22. When comparing the additional radon risk maps with housing projections, the Northern Ireland 2015 radon risk areas PHE predictive data suggests that 90% of new affected houses will require “basic” protection measures and 10% will require “full” measures in accordance with the guidance in BR211 2015. The calculations have also considered that 23% of Northern Ireland new house completions would be of timber frame construction¹¹.

Typical timber frame ground level structure would involve continuous cavity tray detailing in conjunction with a 1200 gauge dpm with lapped/sealed joints, in effect equating to BR211 radon guidance “basic” radon protective measures. Subsequently of the 166 “basic” measure targeted houses, 38 should be of timber frame construction and already include equivalent protective barrier materials, subsequently reducing “basic” radon measure costs down to £100 (for additional workmanship).

⁸ Ref L&PS August 2019 publication ‘Northern Ireland new dwelling statistics’ Table 2.2

⁹ Counterfactual based on; a) 01/2016 NHBC Radon risk pro-forma where NHBC covers 80% of new homes built, b) 09/2016 DoF Building Regulations new radon maps Information Note, c) 2013 England IA applied a 70% good practice industry take-up

¹⁰ The English IA 10 year housing development projections were based on the Europe Economics 2010 report, subsequently replaced by the 2015 Housing Standards Review projections – however similar housing development projections data is not available locally. The rationale for a one year period is to identify the initial (one-off) transition/familiarisation cost, and cost for targeted full industry take-up.

¹¹ NHBC Housing Market Report 2017 Statistics.

New Houses Cost Analysis

Affected new houses	
NI 2018 new build house completions (Building Control Stats) which equates to 90% of dwelling completions	6886
Difference in using 2015 v 2009 map % 6886 new houses @ 20.0% = 1377 houses 6886 new houses @ 11.1% = 765 houses Difference = 612 additional new houses where noted requiring measures beyond 2009 map	612
Counterfactual good practice application of new maps @ 70% of the additional 612 houses built with appropriate 'affected area' protection measures, the remaining 30% will need targeted; 612 x 30% = 184 houses (without appropriate protection)	184
NI 2015 radon risk areas PHE predictive data suggests that 90% of new affected houses will require 'basic' protection measures, & 10% will require 'full' protection measures So 184 x 90% = 166 houses requiring "basic" protection measures, & 184 x 10% = 18 houses requiring "full" protection measures	166 "basic" 18 "full"
NHBC Housing Market 2017 stat's note 23% of NI new house market completions = timber frame construction So of the 166 additional new houses (@90%) requiring "basic" protection measures, approx. 23% will already include equivalent protective barrier materials; - 166 x 0.23 = 38 new timber frame dwellings Adjusted affected new houses: 166 – 38 = 128 (requiring basic measure: barrier materials & workmanship) So similarly, of the 18 additional new houses (@10%) requiring "full" protection measures, approx. 23% will already include equivalent protective barrier materials; - 18 x 0.23 = 4 new timber frame dwellings Adjusted affected new houses: 18 – 4 = 14 (requiring full measure: barrier materials, sump/vents & workmanship)	38(tbr frame) 128 "basic" 4(tbr frame) 14 "full"
Affected new houses x Measures costs	
128 houses requiring "basic" measures (barriers & workmanship) @ an average cost - £400; 128 x £400 = £51,200 38 timber frame x £100 (additional workmanship cost)	£51,200 £3,800

14 houses requiring “full” measures (barriers, sump/vents & workmanship) @ an average cost - £500; 14 x £500 = £7,000 4 timber frame x £200 (additional workmanship & sump/vents cost)	£7,000 £800
Total New Houses Cost (2018 modelled year)	= £62,800

OPTION 2 – Protective measures in targeted domestic extensions

- C23. Where the Building Regulations also apply to relevant extensions to dwellings, the 2018-19 Northern Ireland residential Planning approvals were considered, which note dwelling extensions in proportion to new dwellings approved approximately equates to 89%. Therefore in the absence of specific domestic extensions completion statistics, interpolating the 2018 Northern Ireland new dwelling statics estimate 6,060 domestic extensions, for modelling of the one year projections. This suggests that 545 additional domestic extensions should have been built in 2018 with the need for radon protective measures as a result of the 2015 map changes. Using the same counterfactual assumption as for new houses, i.e. that 70% are already being built with appropriate radon protective measures, this led to an estimated number of targeted (30%) extensions to be built in radon areas of 164 in 2018.
- C24. The 2013 English IA modelling established that the cost of “full” radon measures in an extension would depend on whether the dwelling had any existing radon protection, varying between £210 where the existing building already benefits from radon protection and £300 where there is no protection. Since the latter is the more likely scenario, the Department has based the RIA modelling on that estimate. The English modelling also quantified the cost of “basic” radon measures in an extension at £90. The calculations also adopt the same PHE predictive data assumption for new affected extensions that 90% will require “basic” protection measures and 10% will require “full” measures in accordance with the guidance in BR211 2015.

Domestic Extensions Cost Analysis

Affected dwelling extensions	
Interpolation of the NI 2018 new build house completions (Building Control Stats); 6886 x 89% dwelling extensions proportion =	6060
Difference in using 2015 v 2009 map % 6060 proportional extensions @ 20.0% = 1212 extensions 6060 proportional extensions @ 11.1% = 667 extensions Difference = 545 additional extensions where noted requiring measures beyond 2009 map	545
Counterfactual good practice application of new maps @ 70% of the additional 545 extensions built with appropriate ‘affected area’ protection measures, the remaining 30% will need	

targeted; 545 x 30% = 164 extensions (without appropriate protection)	164
NI 2015 radon risk areas PHE predictive data assumption that 90% of new extensions will require “basic” protection measures, & 10% will require “full” protection measures So 164 x 90% = 148 extensions requiring “basic” protection measures, & 164 x 10% = 16 extensions requiring “full” protection measures	148 “basic” 16 “full”
Note – In reality due to the advantages in speed of erection, onsite time efficiency, & cost efficiency - a number of the above dwelling extensions will be timber frame, however without specific NI available statistics the RIA calculations have not considered the associated equivalent protective barrier material deductions.	

Affected dwelling extensions x Measures costs	
148 extensions requiring “basic” protection measures @ an average cost - £90; 148 x £90 = £13,320	£13,320
16 extensions requiring “full” protection measures @ an average cost - £300; 16 x £300 = £4,200	£4,800
Total Extensions Cost (2018 modelled year)	= £18,100

COMPLIANCE COSTS

C25. Compliance costs are as follows:

- Option 1 maintaining the status quo attracts no compliance costs; however
- Option 2 is the better option as this targets the correct areas and level of protection needed. There will be some low level cost implications to address the anticipated percentage of affected homes not receiving appropriate radon protective measures.

RIA Radon maps update costs	Year 1
Affected new houses cost of radon protection	£62,800
Affected new dwelling extensions cost of radon protection	£18,100
Familiarisation / transition costs	£22,400
Total Costs (Year 1)	= £103,300

SUMMARY AND RECOMMENDATION

- C26. Option 1 was not considered valid as it would have maintained the use of out-of-date radon maps, where this position neglects to address this percentage of affected homes not receiving appropriate radon protective measures.
- C27. Option 2 may result in an overall cost implication however, this option targets the correct affected areas along with the levels of protection necessary; and

On the basis of the assessments presented herein, the Department proposes to adopt Option 2 which updates Part C regulation 25 and the supporting Technical Booklet C.

DEPARTMENTAL SIGNOFF

C28. The Department estimates that on this basis a year one cost to business will be around £103.5k with an annual cost around £81k per year thereafter. The updated map referencing should not require any new skills so familiarisation costs and, some initial transitional costs in understanding the requirements in newly classified radon areas, will only relate to initial year one. These transitional costs have been estimated for year one around £22.5k. These figures have been established as set out above.

Departmental signoff: Desmond McDonnell

Date: 26 February 2022