

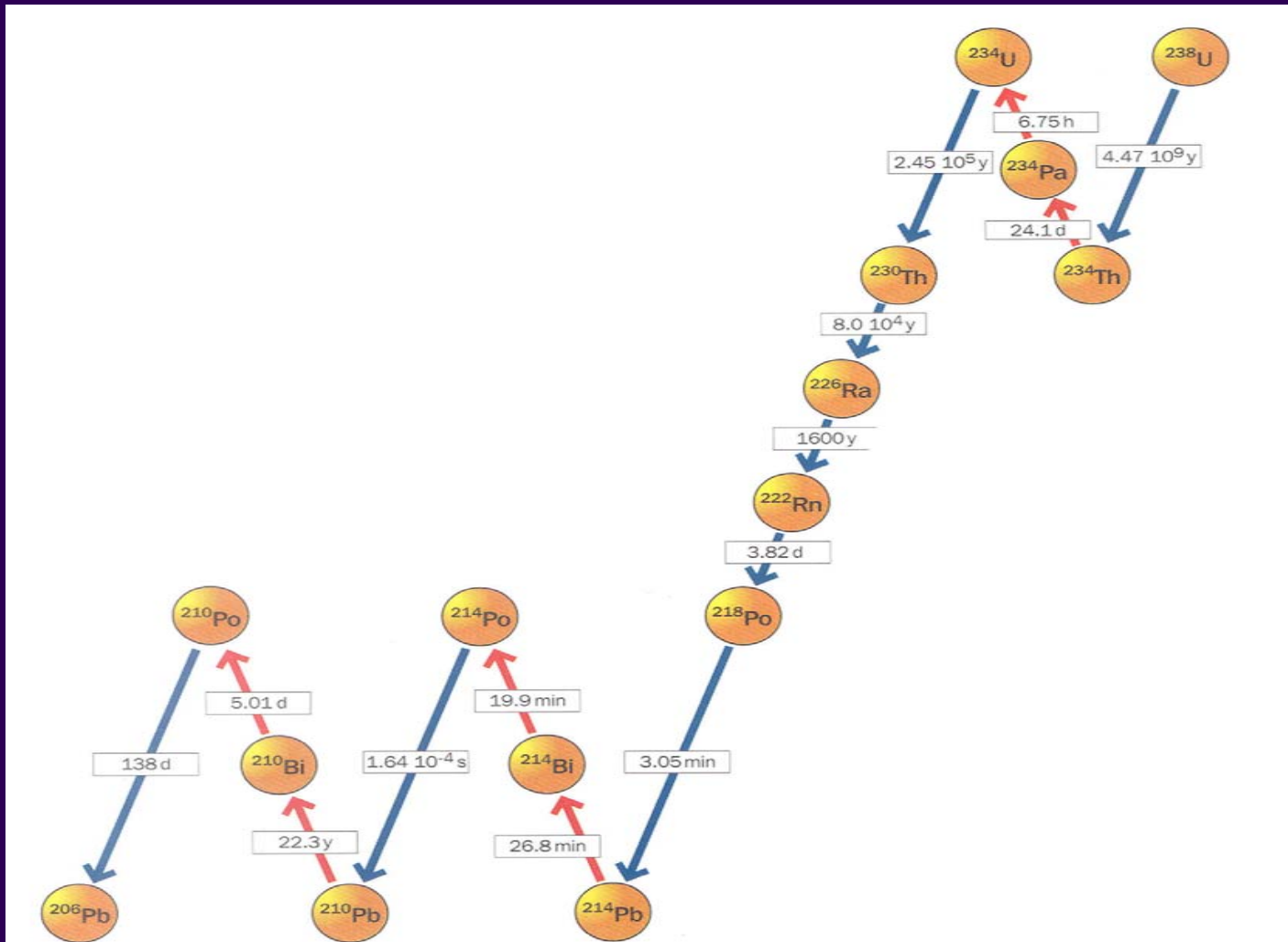
# Radon : international and national developments



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# Radon-222 in the U-238 decay chain



# Radon – the basics



Natural uranium gives radon gas

Higher underground uranium plus a path for radon gives higher radon potential

Buildings draw up and contain radon gas

We breath in radioactive decay products

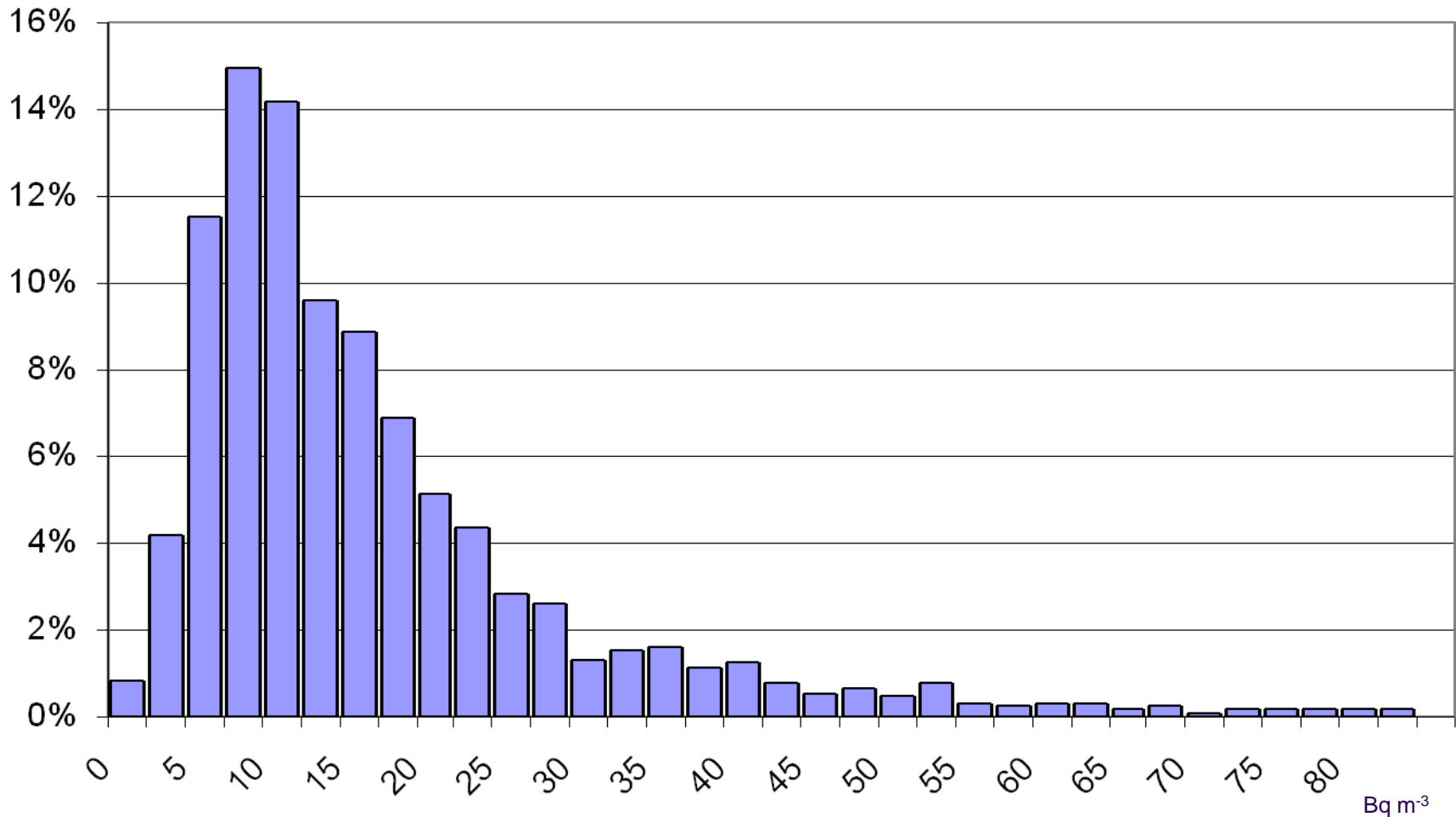
Radiation exposure increases lung cancer risk

Radon is the biggest source of UK radiation exposure

Radon is second biggest cause of lung cancer

Smoking multiplies the lung cancer risk

# Radon – how it varies from house to house





# International developments

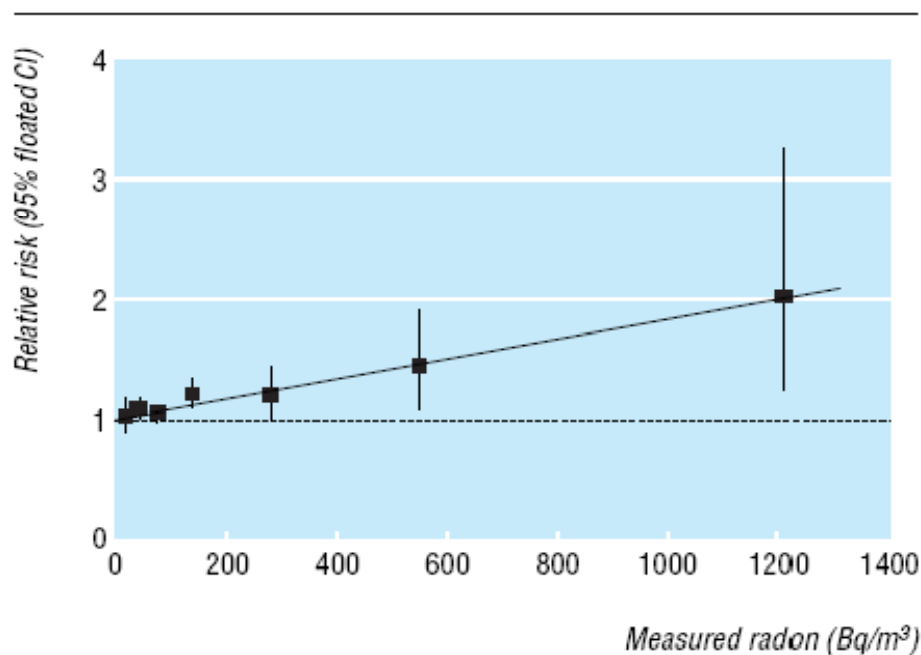
## Radon induced lung cancer

→ *Mines*

→ *Homes*

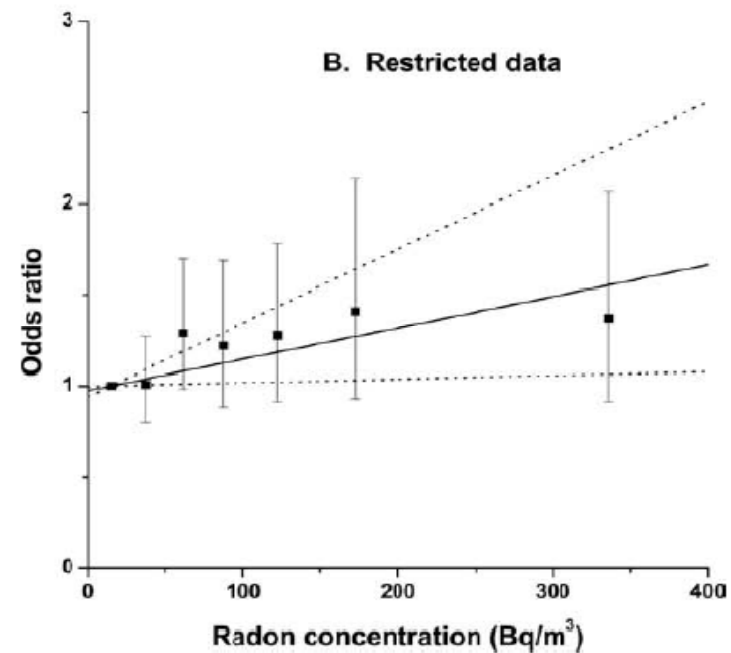
Residential poolings :  
*USA*  
*Europe*  
*China*

## Europe



Darby et al **2005**

## North America



Krewski et al **2005**

United Nations Scientific Committee on the Effects of Atomic Radiation

UNSCEAR 2006 Report, Vol II, Annex E

International Commission on Radiological Protection

ICRP 2007 Recommendations

World Health Organisation

WHO 2009 Handbook on Indoor Radon

- Review data
- Good agreement on lung cancer risks
- Control residential exposures on basis of risks

## Upper value of Reference Level

Domestic dwelling

600 Bq / m<sup>3</sup>

Workplace

1500 Bq / m<sup>3</sup>

- Nominal Risk Coefficient from miner data x 2
- Dosimetric models indicate doses x 2

Upper reference level for homes =  $300 \text{ Bq} / \text{m}^3$

Entry point for occupational protection =  $1000 \text{ Bq} / \text{m}^3$

- National Reference Levels of 100 Bq / m<sup>3</sup> for homes
- If unachievable, then < 300 Bq / m<sup>3</sup>
- ensure good uptake/remediation first?

- Consistent information on radon induced lung cancer at levels down to  $< 200 \text{ Bq} / \text{m}^3$
- **UNSCEAR** provides excellent reviews of data
- **ICRP** recommends upper reference level of  $300 \text{ Bq} / \text{m}^3$
- **WHO** proposes reference level of  $100 \text{ Bq} / \text{m}^3$



# National developments

HPA recommendations on Radon



Protective Measures in New Buildings

An overview

The distribution of radon exposures in buildings across the UK indicates that most lung cancers attributable to radon are due to exposures in buildings below the UK Action Level. Reducing the average level will reduce the number of deaths: changes to the Building Regulations is an affordable method.

# New HPA advice in May 2008



HPA has recommended that UK Building Regulations and Standards should be changed to ensure that all new property incorporates the basic materials and measures necessary to reduce internal radon levels...

# New HPA advice in May 2008



1. Building Regulations and supporting documents should be amended to ensure that all new buildings, extensions, conversions and refurbished buildings in the UK include basic radon protective measures
2. Building Regulations and supporting documents should be amended to ensure that all new buildings which require full radon protection are subject to appropriate radon tests during the first year of occupation. ... if above the relevant Action Level, measures should be implemented to reduce the radon concentration...

Basic radon protective measures in new homes as currently applied can reduce indoor radon concentrations by an average of 50% compared with similar homes built without such measures. This figure could increase if installation became routine in all new homes.

The current regulations require builders to implement different rules in different areas.

# Regulation revision timetable



In England and Wales, the review of building regulations has been placed on a rolling timetable by DCLG (Dept of Communities and Local Government).

Part C (including radon) will be reviewed in time for the 2013 update to the Regulations.

The HPA response to the AGIR report on Radon  
and consultation on radon advice

# AGIR recommendations



AGIR report included 16 recommendations

HPA responded to these in the Consultative Document on new radon advice (Appendix A)

Responses to the AGIR recommendations are presented here

Responses to the HPA consultation are being considered.

## 1. HPA should review its advice on control of indoor radon exposure

*HPA is doing so - Consultative document includes proposals and options including retaining 200 Bq m<sup>-3</sup> or moving to 100 Bq m<sup>-3</sup> together with options for categorising radon risk in different areas (Radon Affected Areas)*

## 2. Greater emphasis should be given to reducing mean indoor radon across UK and hence number of radon-induced lung cancers

*HPA supports this – reflected in advice on “new build” and in some questions in Consultative Document*

3. HPA should review the concept of radon Affected Areas (RAA) – to counter belief that outside RAA – no radon problem

*HPA addresses this in the Consultative Document which includes an option to move to probability of being over radon Action Level in an area being Low, Medium or High*

4. HPA should consider moving to using mean long term annual indoor radon level to represent radon risk in an area

*HPA recognises that total number of radon deaths is related to mean radon level – advice on “new build” is the main long term means. However, HPA considers that the mean would not support work on reducing the highest exposures (individual risks) and that probability of being over Action Level remains appropriate*

5. [on grounds of health economics] HPA should consider advising that effective radon barriers be required in new-build dwellings throughout the UK.

*HPA supports this – reflected in “new build” advice*

6. HPA should consider a policy for new homes in high radon areas to have under-floor ventilation (eg sump) in addition to basic measures and to have a fan where measurement after “moving in” is over Action Level.

*HPA supports this – reflected in “new build” advice*

7. The main policy should be minimising radon-induced lung cancers and meeting NIHCE cost-effectiveness parameters

*HPA notes this and supports the general concept but needs to take account of other radiation protection principles – including reducing individual risks, workplace and intervention criteria*

8. Measures to improve uptake of testing and remediation should continue to be explored

*HPA supports this – feature of current and future programmes and in consultative document*

9. The programme of radon measurements should be considered on the same terms as other medical screening procedures

*HPA notes this but needs to take account of other radiation protection principles – including reducing individual risks, workplace and intervention criteria. HPA recognises potential funding implications for government*

10. HPA should give advice on practical measures to deal with houses with exceptionally high radon levels

*HPA supports this – feature of current and future programmes – including practical and financial help via local authority*

11. Most radon-induced lung cancers occur in smokers. Measures to reduce smoking should be given a high priority

*HPA fully supports action to reduce smoking*

12. It may be cost effective to remediate in houses already measured and in range 100-200 Bq m<sup>-3</sup> and encourage the “unremediated” at higher levels

*If Action Level reduces to 100 Bq m<sup>-3</sup> HPA would develop a programme for houses with known high levels*

13. Basic radon prevention may be cost-effective in premises other than homes, including schools. These should be considered.

*HPA supports this – reflected in “new build” advice and in consultative document looking at other higher public occupancy premises, including schools*

14. An analysis should be completed of pooled epidemiological data on residential radon exposure and lung cancer – including effect of age of exposure on lung cancer risk

*HPA supports this – reflected in current work programme*

15. Studies should be undertaken to raise the effectiveness and durability and reduce the cost of radon prevention measures in “new build” homes

*HPA supports this – BRE is in the lead – HPA is contributing to work programme*

16. Research should be undertaken into remediation and its effectiveness at lower radon levels - less than 200 Bq m<sup>-3</sup>

*If Action Level changes this would be reflected in work programme that currently focuses on remediation at higher levels*



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