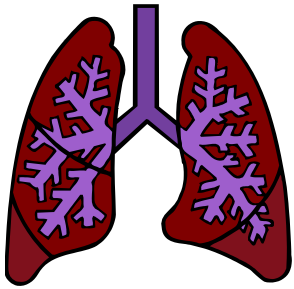


Radon in Ireland and the New National Radon Strategy



Radon Protection Conference
Dresden, 2-12-2013



Eamonn Smyth

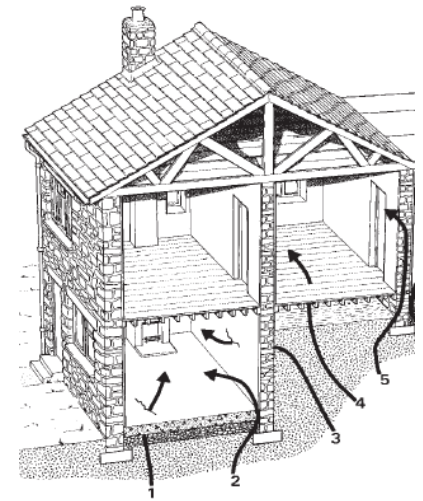
Building Standards Section
Dept. of Environment, Ireland



Comhshaol, Pobal agus Rialtas Áitiúil
Environment, Community and Local Government



Presentation Overview



1. Background to Radon in Ireland
2. Current Building Regulation requirements
3. Radon in Schools program.
4. Why a Radon strategy-Current problems
5. Radon Strategy proposals for:
 - Training
 - Improved Prevention methods
 - Research



What is the scale of the problem

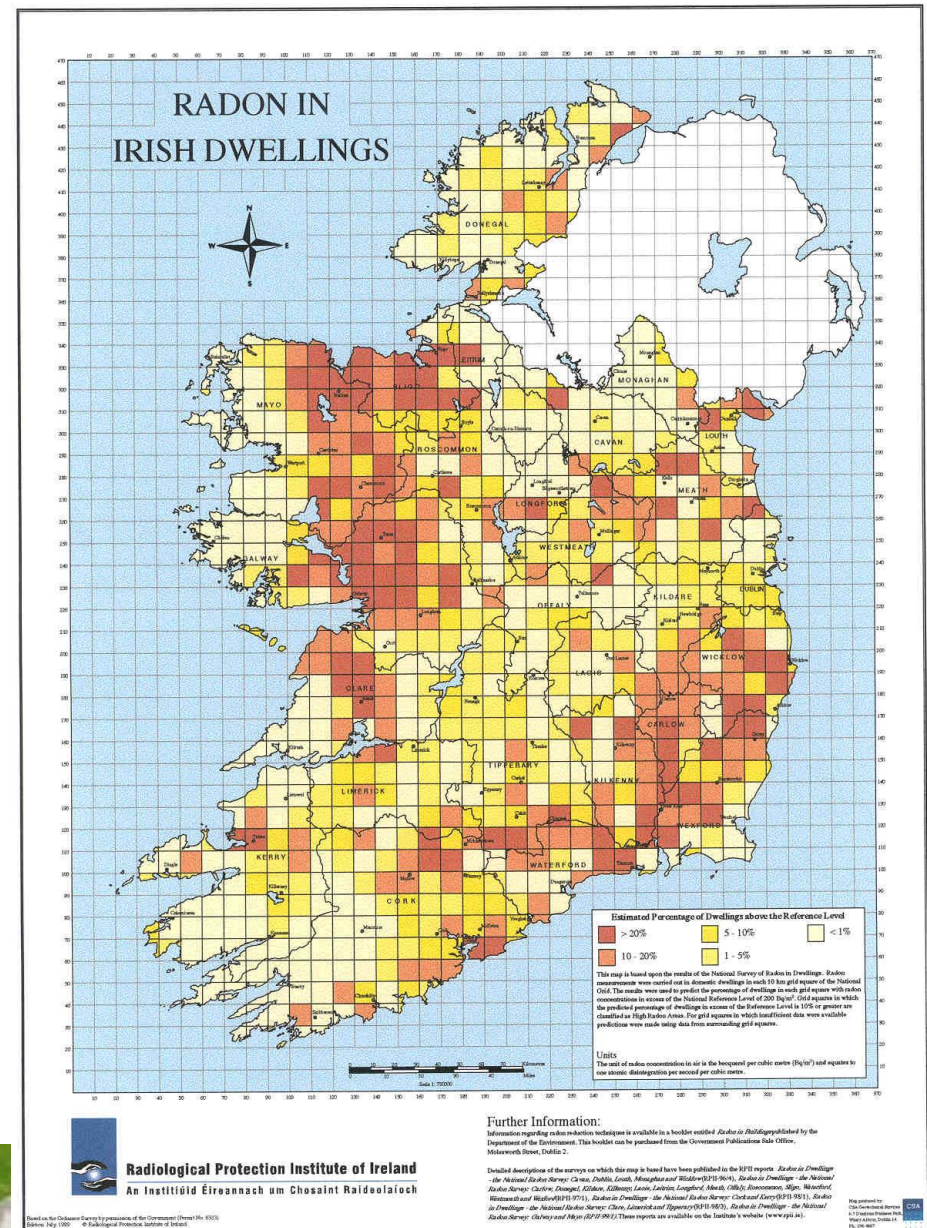
- A National Radon Survey (NRS) was carried out between 1992 to 1999.
- 11,319 houses were tested ie 1 per 116 of National housing stock
- Measurements ranged from 10-1,924 Bqm³
- 7% of houses (approx 91,000 houses) are predicted to be above Reference Level 200 Bqm³ with 700 over 1000 Bqm³
- Further surveys/ measurements in schools and workplaces present a similar picture.



- 59,000 houses > 200 Bq/m³ in High Radon areas.**

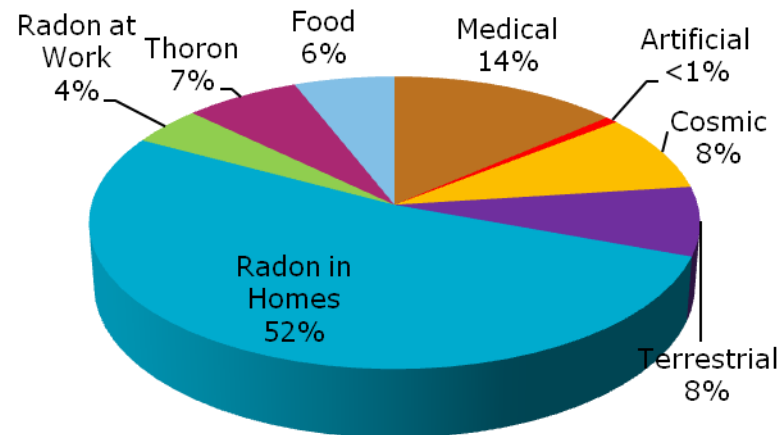


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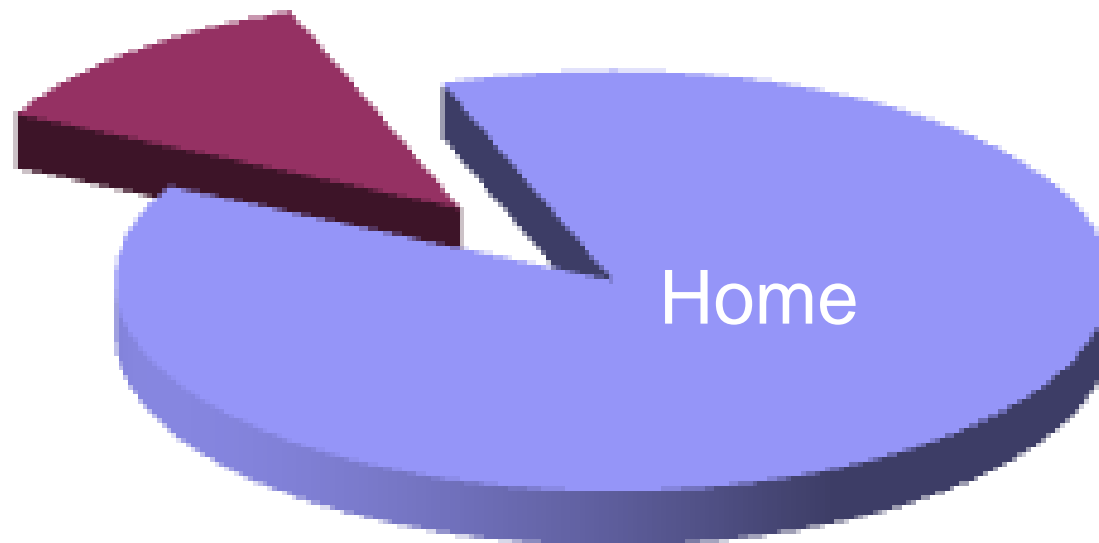


Health risks due to radon

- 2nd cause of lung cancer **after smoking**
- **More than 250 lung cancer deaths annually are linked to radon (13% of all lung cancers)**
- **The risk to smokers is 25 times the risk of that to non-smokers**
- **56% of radiation dose to Irish population from radon**



Where does exposure to Radon gas occur



Per Caput
Exposure to
radon



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When is radon a problem?

Reference Levels:

- **Homes:** 200 Bq/m³ (1990)
- **Schools:** 200 Bq/m³ (1998)
- **Workplaces:** 400 Bq/m³ (S.I. 125 of 2000)

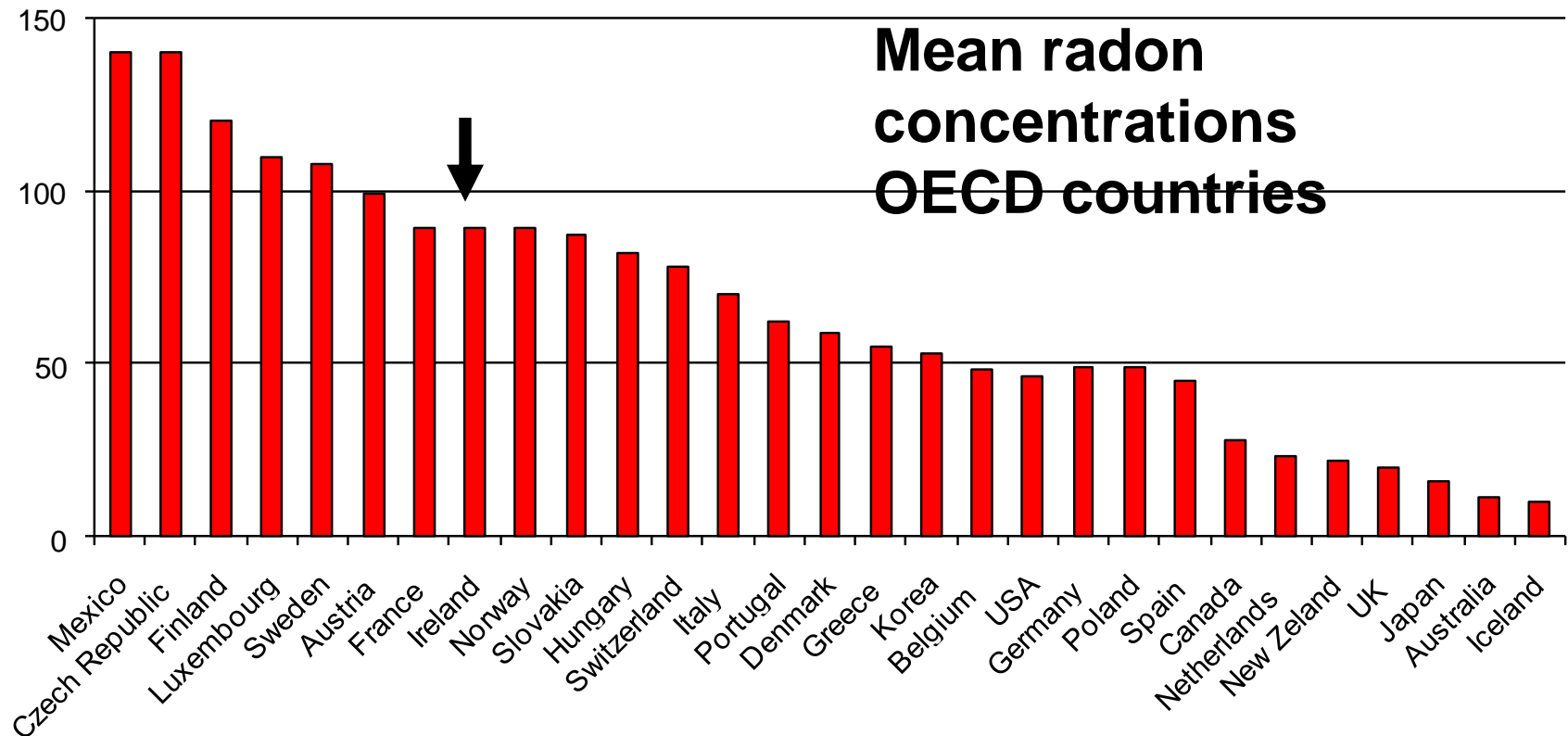


How much of a problem is radon for Ireland?

- **Average radon levels 89 Bq/m³ (8th highest in WHO survey)**
- **About 91,000 homes above 200 Bq/m³**
- **Only 7,600 of these have been identified**
- **A total of only 54,000 homes measured nationally**



How do levels compare internationally



How do we reduce Radon levels

- Prevent the problem in new buildings through building controls
- Persuade home owners and employers to test and, where necessary, fix the problem in existing homes and workplaces
- Legal requirements concerning exposure to radon in workplaces



Building Regs - Requirements

- Part A - Structure
- Part B - Fire Safety
- Part C - Site preparation and moisture resistance
- Part D - Materials/workmanship
- Part E - Sound
- Part F - Ventilation
- Part G - Hygiene
- Part H - Drainage, waste water disposal
- Part J - Heat producing appliances
- Part K - Stairways, Ladders, ramps & guards
- Part L - Conservation of fuel & energy
- Part M- Access for disabled people



Building Regulation C & TGD C

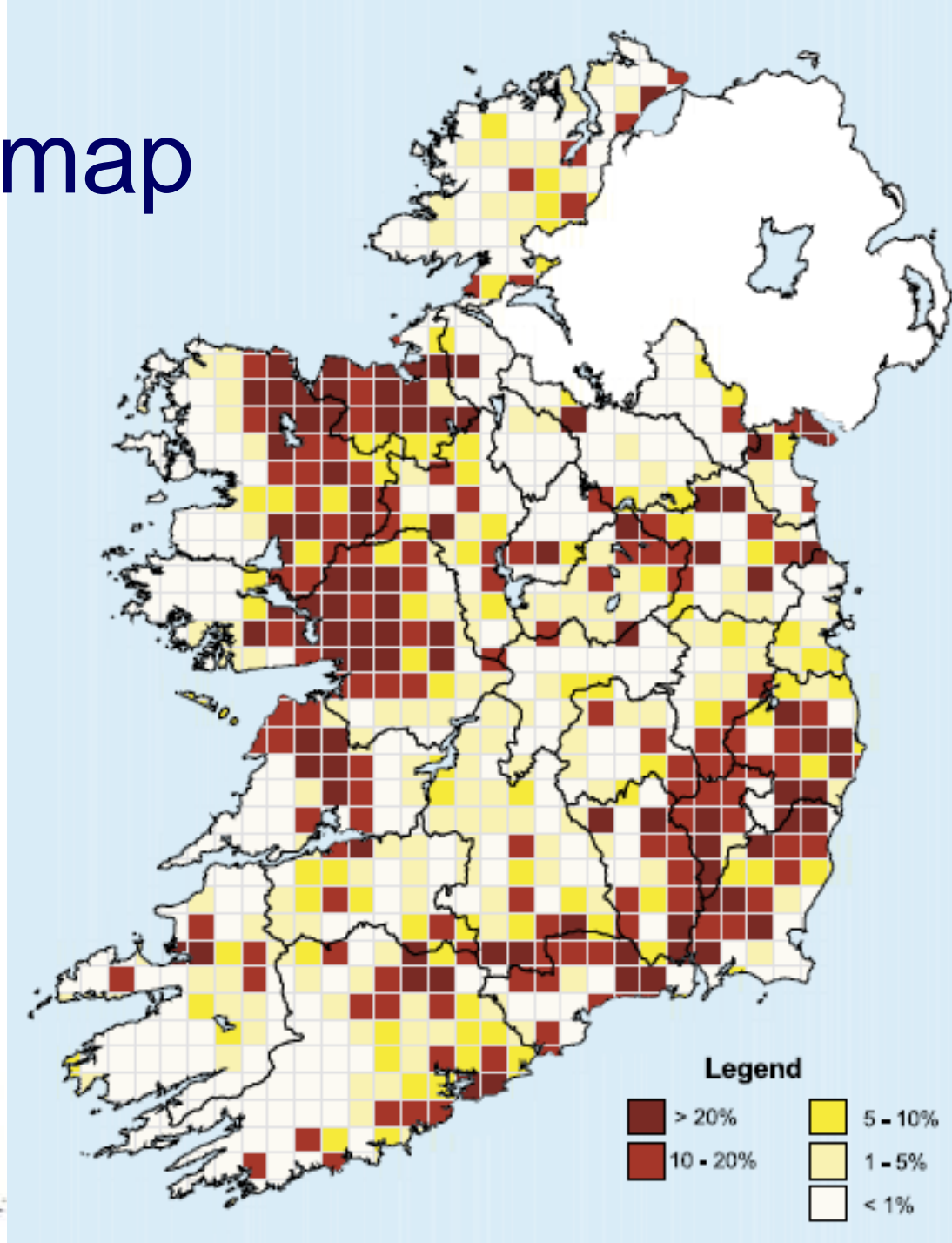
Site Preparation and Resistance to Moisture



- C3 Reasonable precautions shall be taken to **avoid danger to health and safety caused by substances (including contaminants) found on or in the ground** to be covered by a building.
- “contaminant” includes any substance which is or could become flammable, explosive, corrosive, toxic or **radioactive** and any deposits of faecal or animal matter;
- Section 2 addresses Radon for designated High and Low areas.



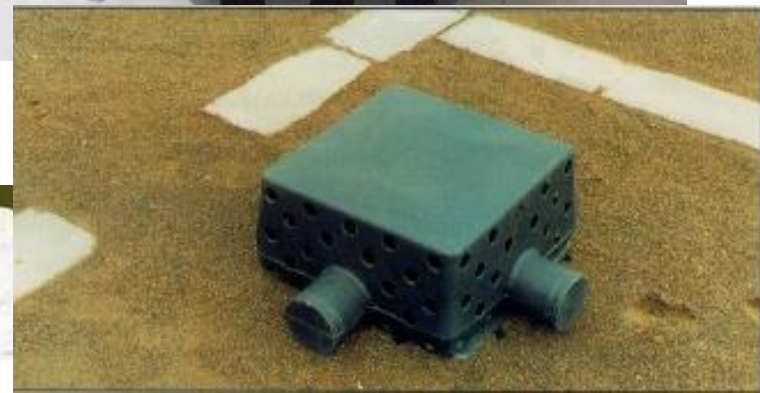
Radon map



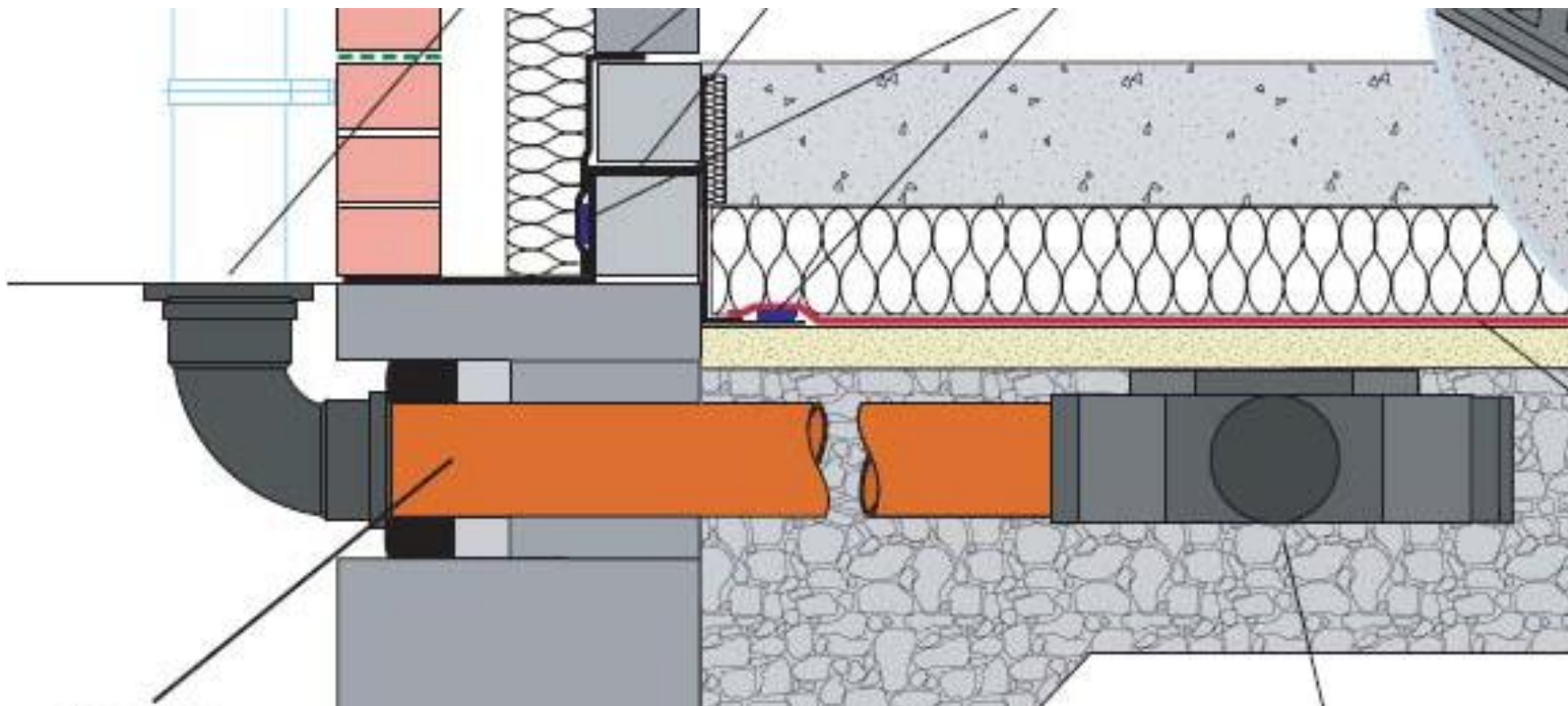
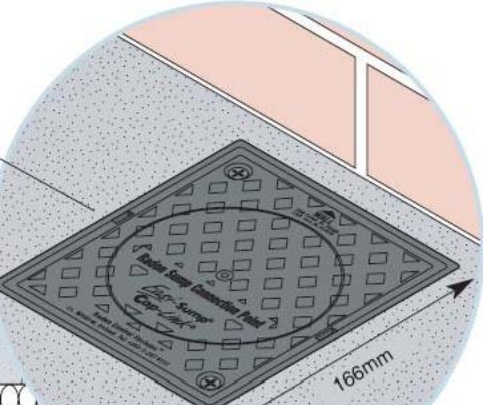
Standby Radon Sump in all new dwellings

Standby Radon Sump

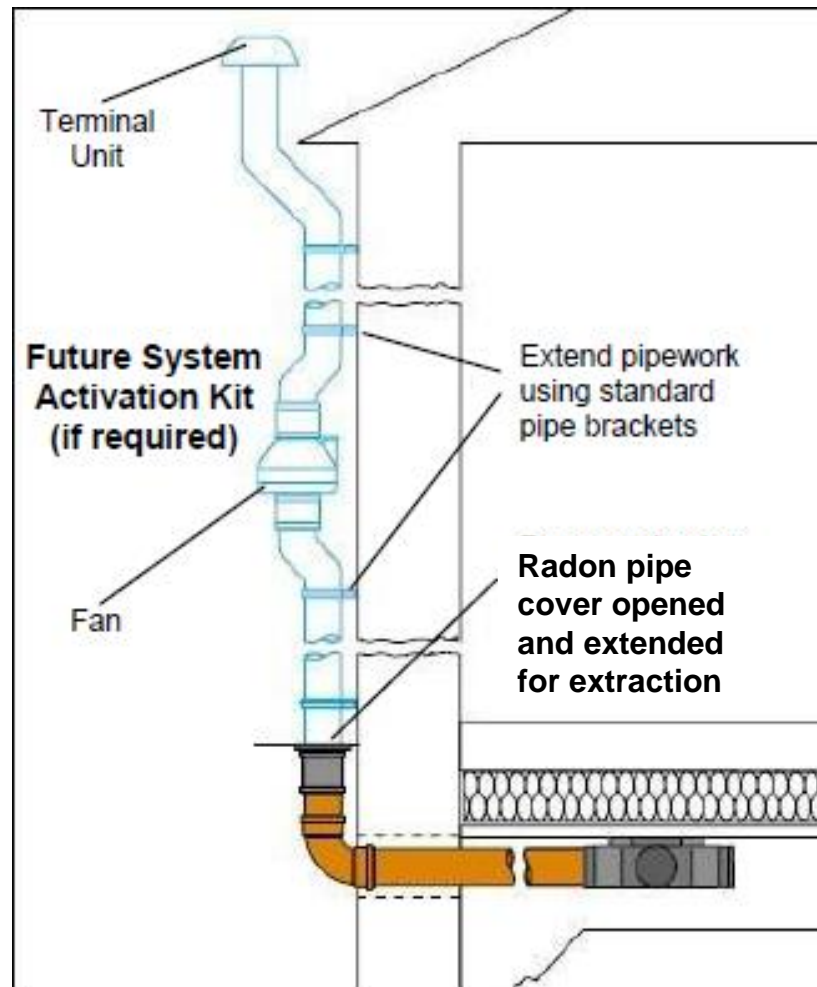
- Design, location and frequency (influence area at least 250m²)
- No obstructions
- Pipework connecting sumps should terminate outside the external walls of the building or in the attic space.
- Pipes should be **capped** and external pipes should be **sealed** to prevent ingress of rainwater or rodents
- **Clearly identified** as potential outlets for Radon Gas
 - Marker plate
 - Pipe cap incorporating raised lettering



Radon Sump with capped extraction pipe.



Activated standby sump

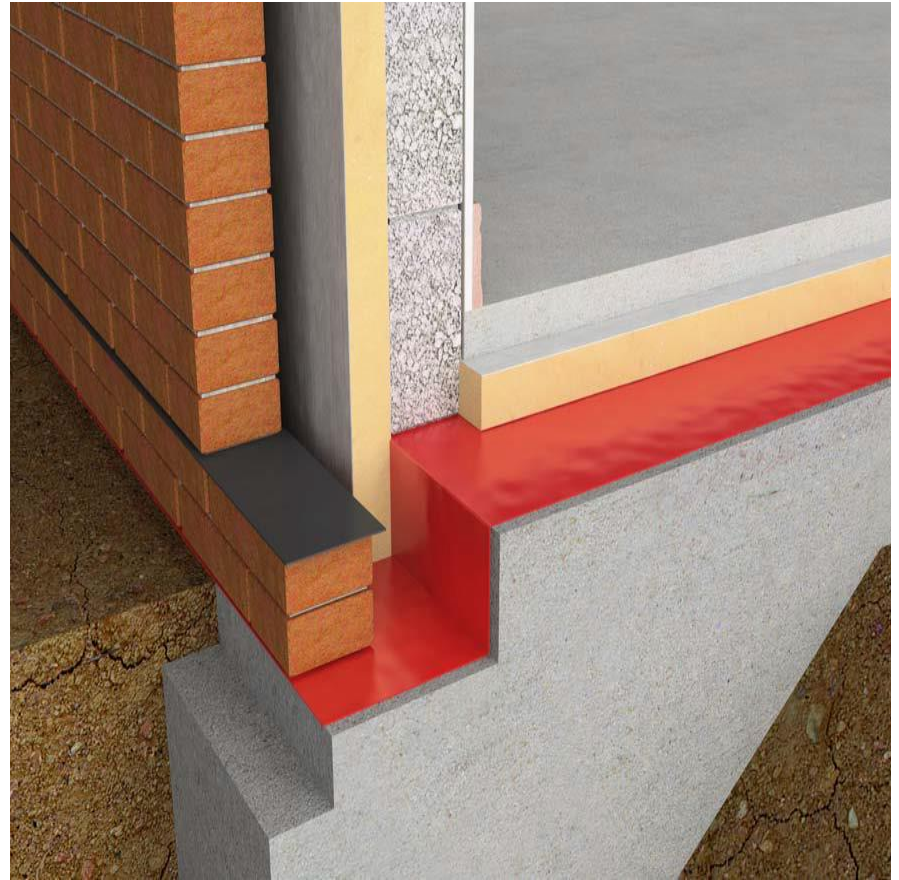


Example of Active sump



High Radon Areas

- a fully sealed membrane of low permeability over the entire footprint of the building
- a potential means of extracting Radon from the substructure such as a standby Radon sump





Radon Barrier



- A Radon Barrier is NO guarantee of a Low radon level in the finished dwelling.
- TGD C recommends a post occupation test so that the Radon Sump can be activated if necessary
- A Radon Barrier contributes significantly to reducing the overall Radon concentrations.
- The reduction appears to be inline with other EU countries using Barriers.



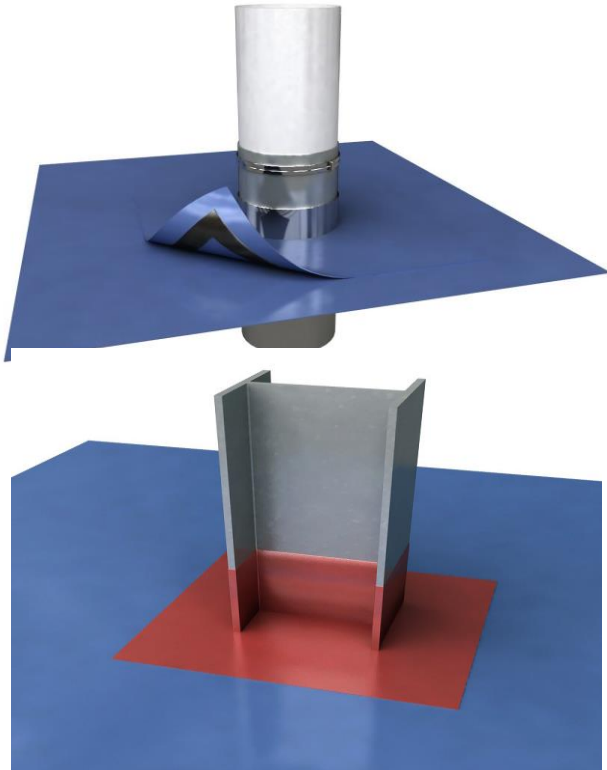
Radon Barrier with pipe penetration



The Barrier must be:

- In accordance with Part D of the Building Regulations – Materials and Workmanship (& TGD D)
- Independent Certification by an approved body eg NSAI Irish Agrément Board (IAB)
- Properly installed by trained personnel, attention to detail, and post – installation protection

Radon Barrier installation



- Radon Barrier extending to the outside leaf.
- All pipe penetrations sealed.

Typical seals around penetrations



Background to Schools Survey

- The national radon survey identified high radon areas in Ireland for dwellings.
- Studies in the early nineties in the West of Ireland identified a number of schools with high levels of radon gas
- In 1998, the Radiological Protection Institute of Ireland (RPII) carried out a national survey of radon levels in all primary and post primary schools in the Republic of Ireland.



- To identify schools with radon levels above 200 Bq/m³ so that remedial work could be carried out to reduce radon exposure to children and staff.



Survey Methodology



- Three Year Project (1998-2001)

Invitations to participate: April

Return of application form: June

Issue of detectors: September (start school year)

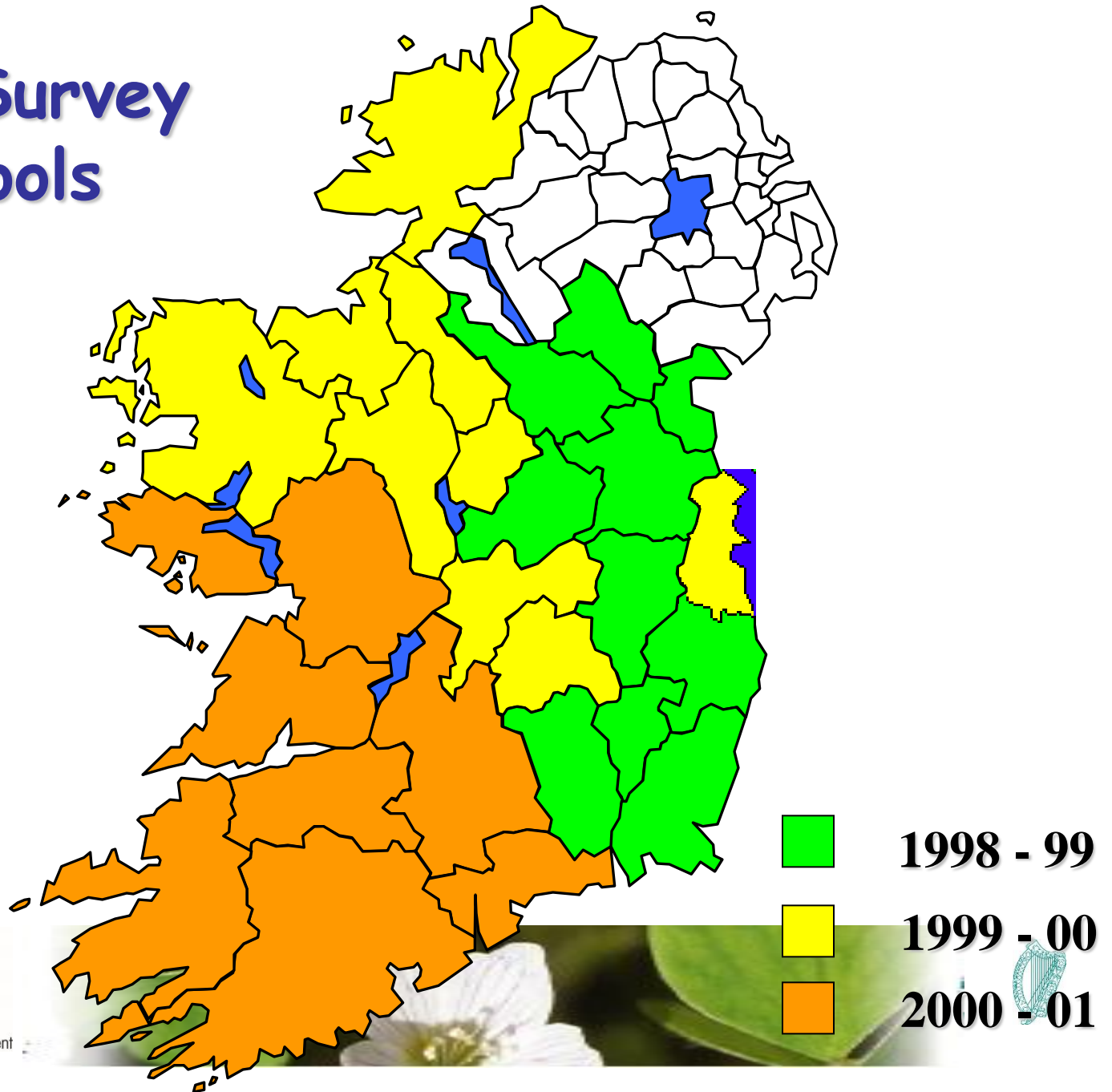
Return of detectors: May/June (end school year)

Issue of results November

Remediation November-



Radon Survey in Schools



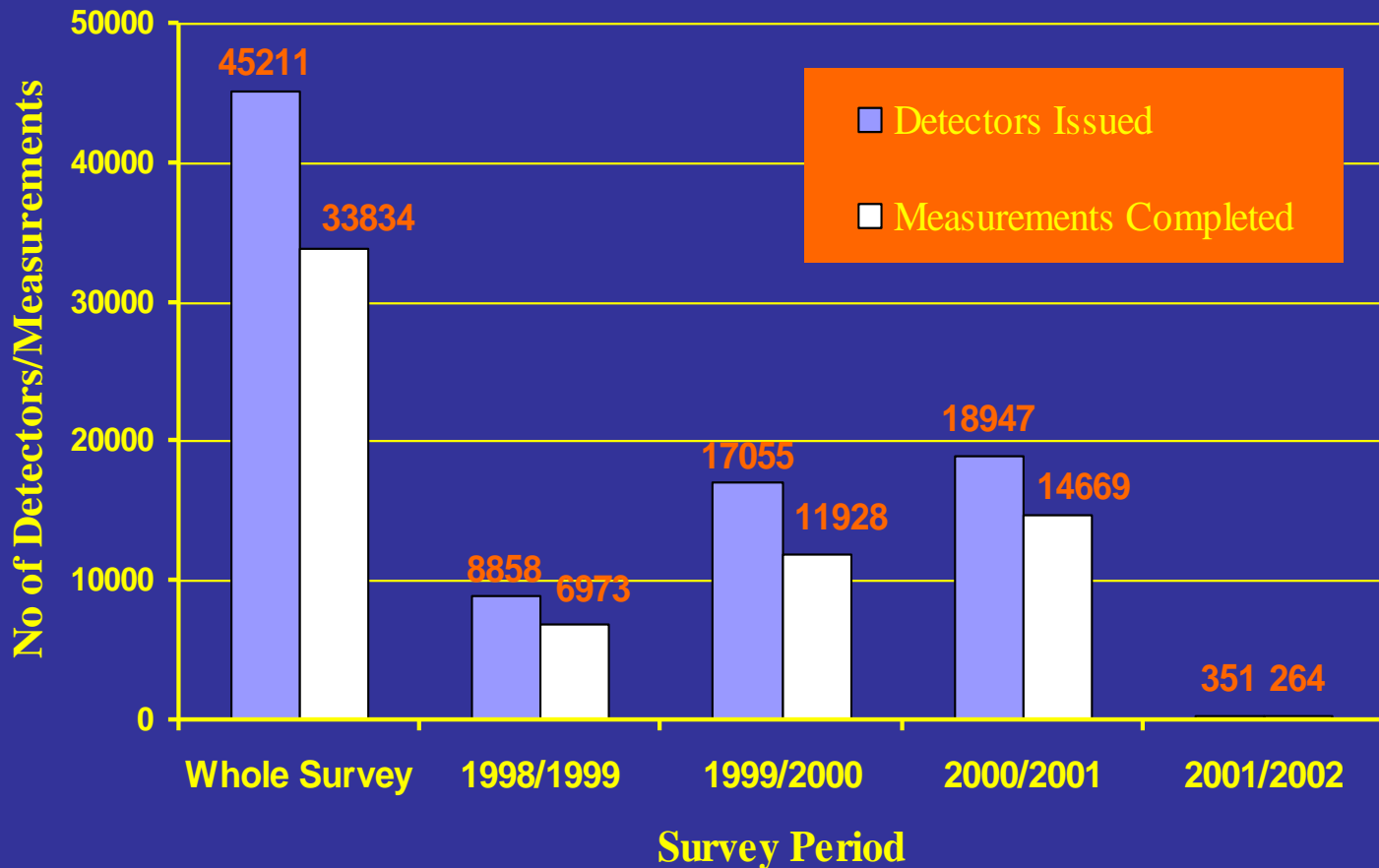
Radon Measurement Protocol

- Passive measurements
- 1 track etch detector per room
- All occupied ground floor rooms were tested
- Duration of measurement was for 1 school year (approximately 9 months)



June 2002

No of Detectors Issued and Measurements Completed for the Duration of the Survey



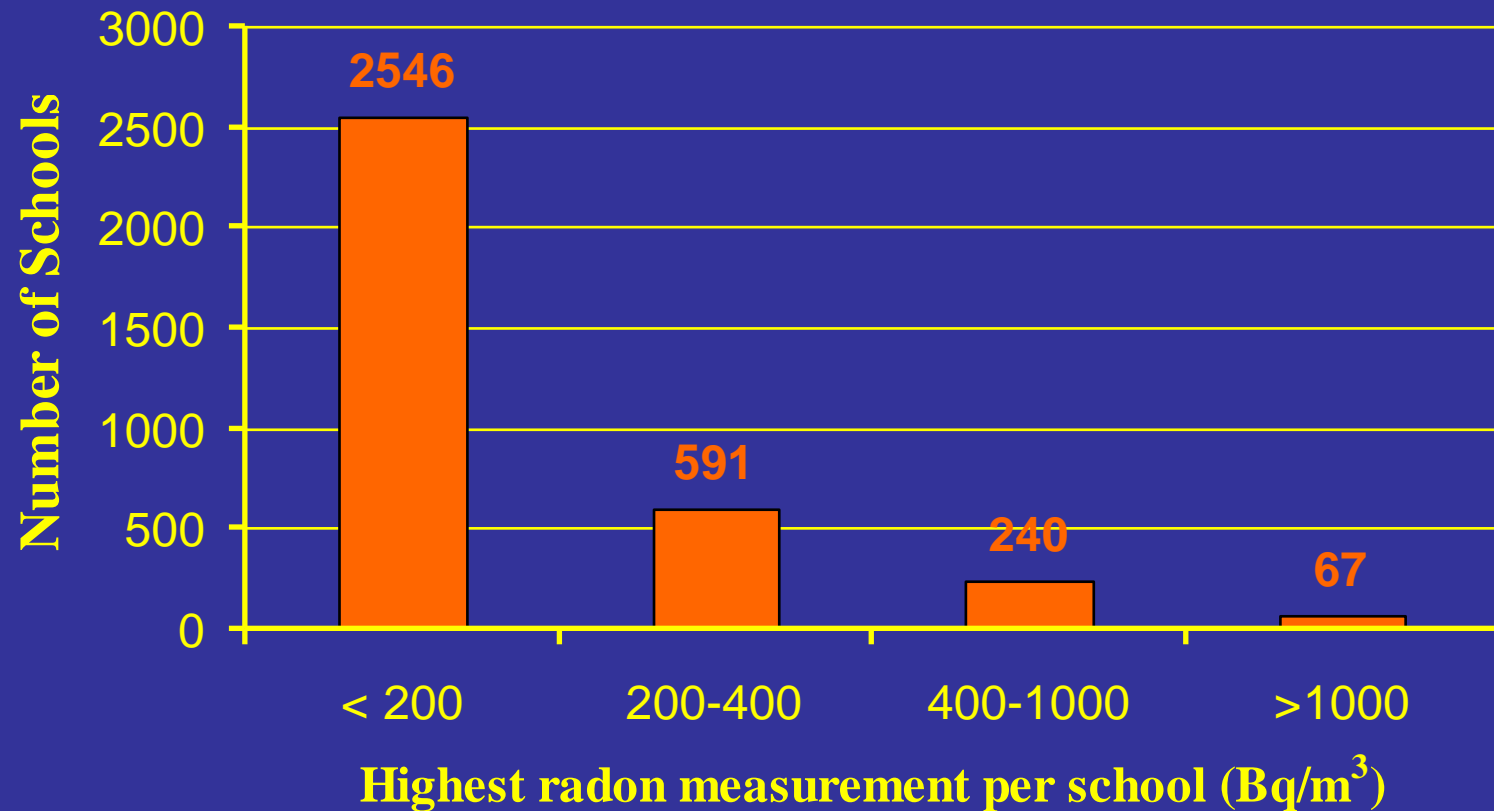
Summary of School Results

June 2002

School Type	No of Schools	Mean Bq/m ³	Standard Deviation	GM	GSD	Max
Primary	2842	96.8	124.6	66.8	2.2	2748
Post Primary	602	86.3	162.0	54.1	2.4	4948
all schools	3444	93.1	139.6	61.8	2.3	4948

Survey End (June 2002)

Distribution of Maximum radon concentrations in Irish Schools



Remediation of Radon in Schools

- **All remedial work was funded by central Government**
- **200-400 Bq/m³ (591 schools)**
 - *Ventilation in Irish Schools was low (BRE study)*
 - *Wall vents were installed in each affected room*
 - *Reduction in radon concentrations of 50%*
- **> 400 Bq/m³ (307 schools)**
 - *Individual schools were assessed by a remediation expert and active mitigation systems (mainly sumps) were installed*
 - *Reduction in radon concentrations of 90%*
- **Remedial work was completion by end 2003.**
- **All remediated schools will be re-surveyed by RPII**

Reducing radon levels



Better ventilation can reduce levels by up to 50%

Main Findings/Conclusions

- This survey is unique insofar as every primary and post primary school in the country was invited to participate
- 898 of the 3444 schools that completed the survey (June 2002) had radon levels greater than 200 Bq/m³ in one or more rooms
- Highest Radon measurement was 4948 Bq/m³
- The average radon value measured for schools with a measurement period greater than 6 months was 93.1Bq/m³)
- A total of 3,826 schools were finally measured. (984 schools had radon levels greater than 200 Bq/m³ in one or more rooms and 329 greater than 400 Bq/m³).
- All schools with radon levels greater than 200 Bq/m³ were remediated. Remedial work was completed by the end of 2003 for those in the initial survey.

National Strategy

Why is it needed ?

- Low rates of testing resulted in the standby sump not being activated
- Standby Sumps not understood
- Barrier only having a limited effect
- Existing dwellings not being tested
- Existing dwellings with high levels not being remediated



Rate of Remediation survey Summary

- People seem reluctant to remediate even when they know they have high levels
- Only 25% have remediated. Comparable to previous surveys and internationally where 20% to 30% is reported
- Non smokers are most concerned at radon, then ex smokers. Active smokers seem unconcerned. This is also seen internationally.



Issues

- Poor installation or positioning of sumps:
 - Pipe sloping downwards and water accumulating in the pipe resulting in a water trap
 - Outlet positioned under or in front of obstacles or opes



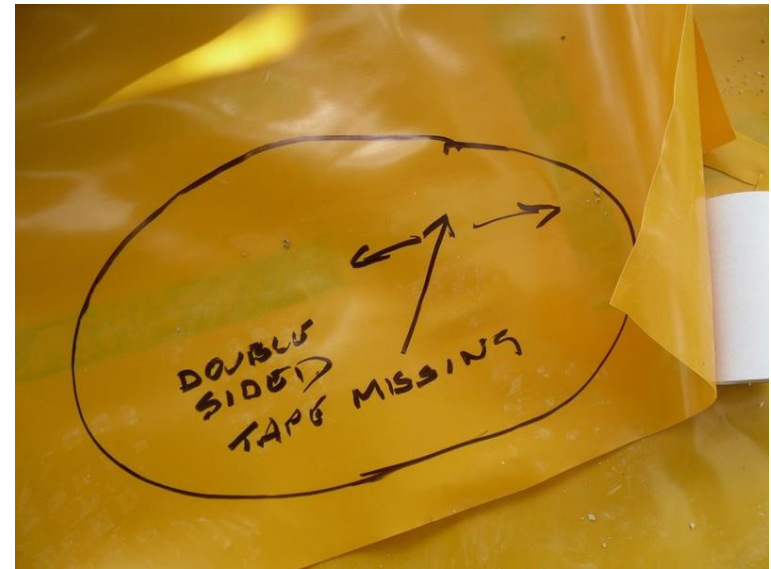
Poor design and positioning

- Designer, Installer or Certifier not aware of its purpose.
- Belief that it had an effect as fitted.
- Blatant lack of knowledge and understanding.



Issues (cont.)

- Barriers poorly installed
 - especially at corners &
 - around penetrations
- Post installation damage
 - By services
 - By power floating
 - By workmen



Post installation damage



Proposed Information & Training

- M.1 Short targeted training courses should be provided for site staff on the correct installation of radon preventive measures and on maintaining the integrity of those measures once installed
- The aim of this would be to:
 - Explain the dangers of Radon
 - The purpose of the standby sump
 - The necessity of maintaining the barrier intactThis course to be done through industry groups.



Proposed Information & Training

- M.2 Basic information on radon should be included on undergraduate courses related to the construction industry:
 - Currently the 3rd level training appears to deal with barriers as part of the DPM (Damp Proof Membrane) for buildings without any emphasises on the dangers or reasoning behind the requirements.
 - Little knowledge of National reference levels, etc



Proposed Information & Training

- M.3 In cooperation with the relevant professional bodies education on radon should be integrated into the existing system of continuous professional development (CPD) for building professionals.
 - The aim here to increase the expertise of the construction professional both for prevention and resultant remediation using the sump
 - Explain other remediation methods
 - Design methods to reduce the risk of damage to barriers



Proposed Information & Training

- M.4 A web based knowledge resource on radon should be developed for the building industry
- The aim is to have available:
 - Information on the dangers
 - methods of prevention and remediation
 - FAQ's for the homeowner and the professional.



Proposed TGD Changes

- M.5 The relevant Technical Guidance document should be amended to require that a passive sump be installed in all new dwellings
 - There is increased evidence that a passive sump reduces radon by 50% or more
 - Little added cost to the current sump requirements
 - Aids the proper positioning and installation.
- M.6 The relevant Technical Guidance should be amended to include provisions, which would allow radon preventive measures to be more easily identified on site



Passive Radon Sump

Pipe continues from Radon Sump to external air.

Pipe vents above the roof to:

- Give passive extraction
- Disperse gas to air.

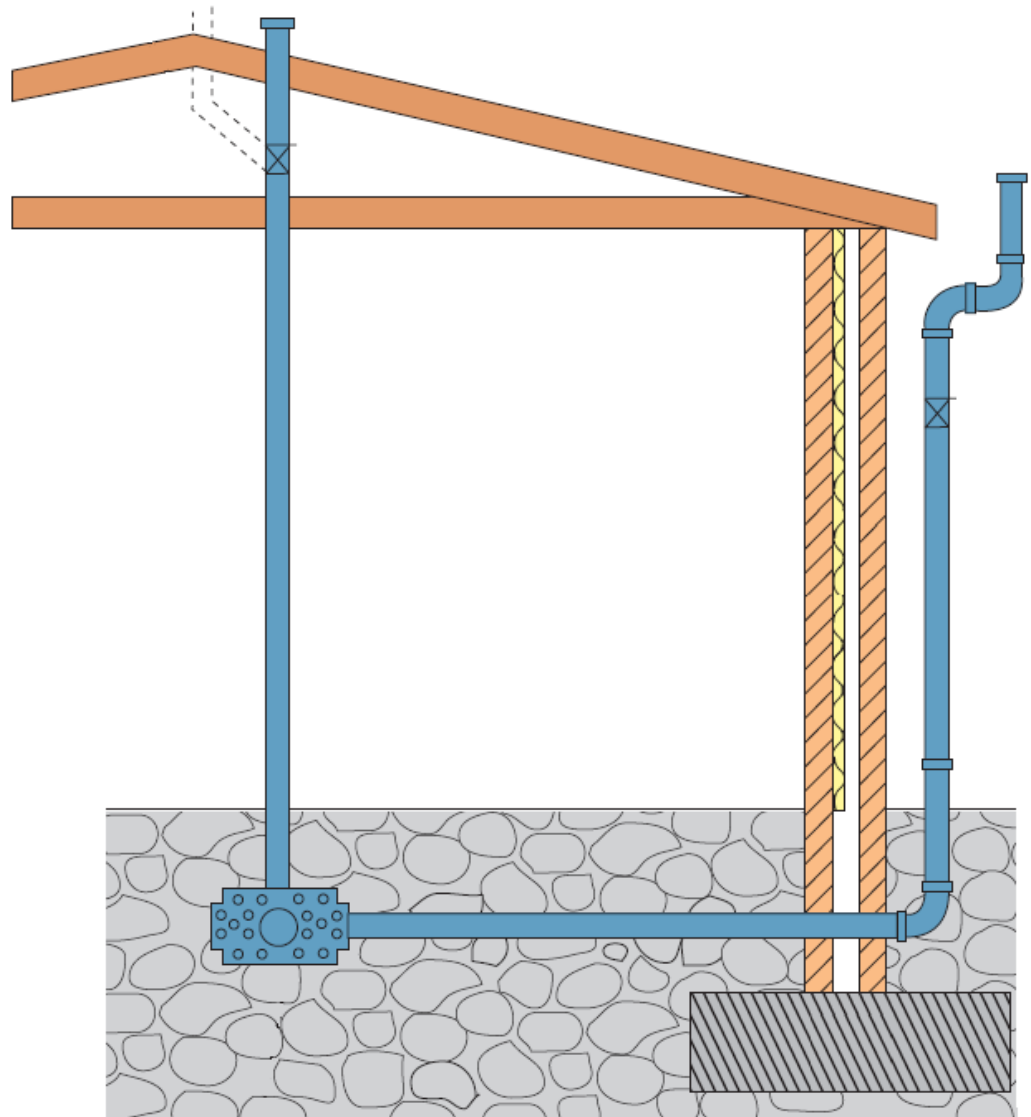
Pipe readily identifiable to prevent errors and misuse.

Very small capital cost.

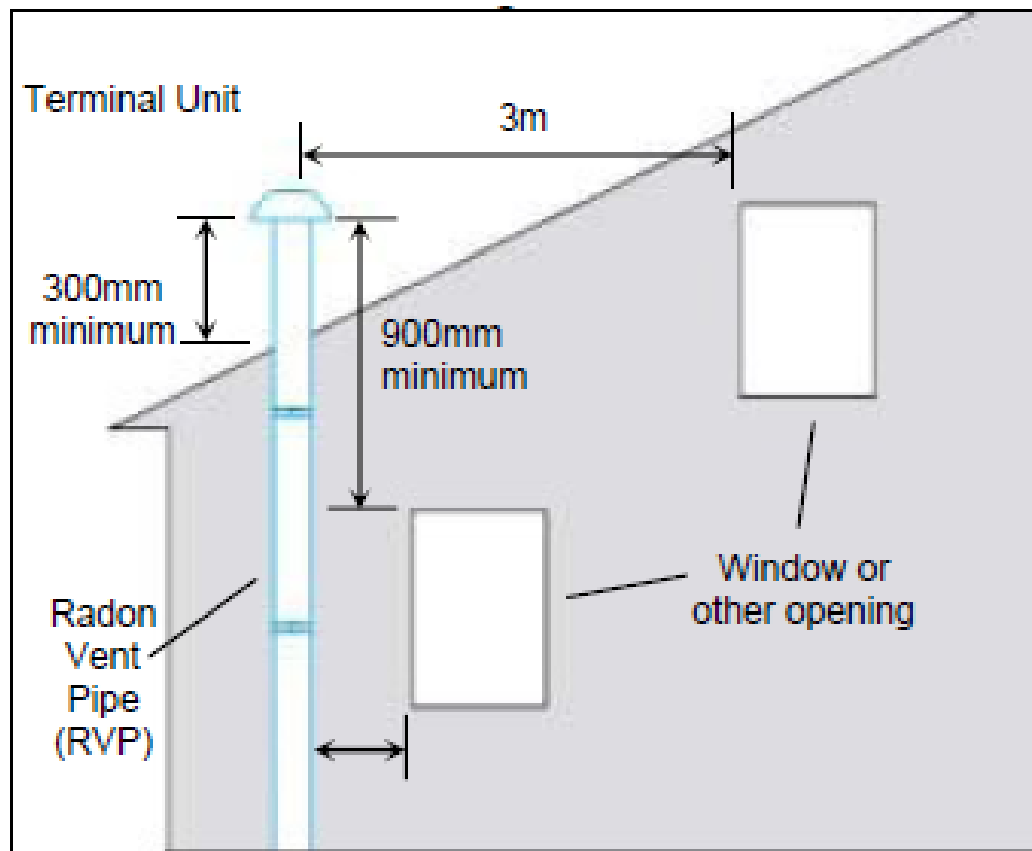
Large reduction in Radon infiltration

Easy connection of Fan for future remediation.

Potential to attach a rotating cowl for added effect.



Typical Radon vent pipe



Pipe marking

- Identifies the purpose
- Prevents inappropriate connections ie waste pipes or soil pipes.



Proposed Research

- M.7 The current requirement that barriers are required in High Radon Areas should remain. Research should be carried out to assess the combined effectiveness of passive sumps and barriers compared to the effectiveness of barriers alone.
- M.8 Research on better barrier systems and the appropriate placing of barriers to improve barrier success rate and decrease post-installation damage should be undertaken.



Certification

- M.9 The installation of radon preventive measures should be “signed off” by a competent person.
- The new Building Control (Amendment) Regulations 2013, will result in new building certification procedures requiring sign off by competent persons on a wide range of measures.



Other strategy proposals

- The development of a recognised list of competent remediation companies/contractors to give confidence to the home owner.
- A validation or registration scheme for Radon measurement services.
- Questions regarding Radon to be asked during Conveyancing. (Sale, re sale or transfer of property)
- Housing standards for rented private houses should address Radon.
- Testing of social housing should continue.

Research themes

Baseline values

What is the best approach to produce

- A new national average radon concentration (current and future)
- A better radon map, bearing in mind
 - no postcodes,
 - bias in the existing data (excl.the NRS),
 - should take account of new geological information (TELLUS)
 - is there a need to redefine HRA



Research themes

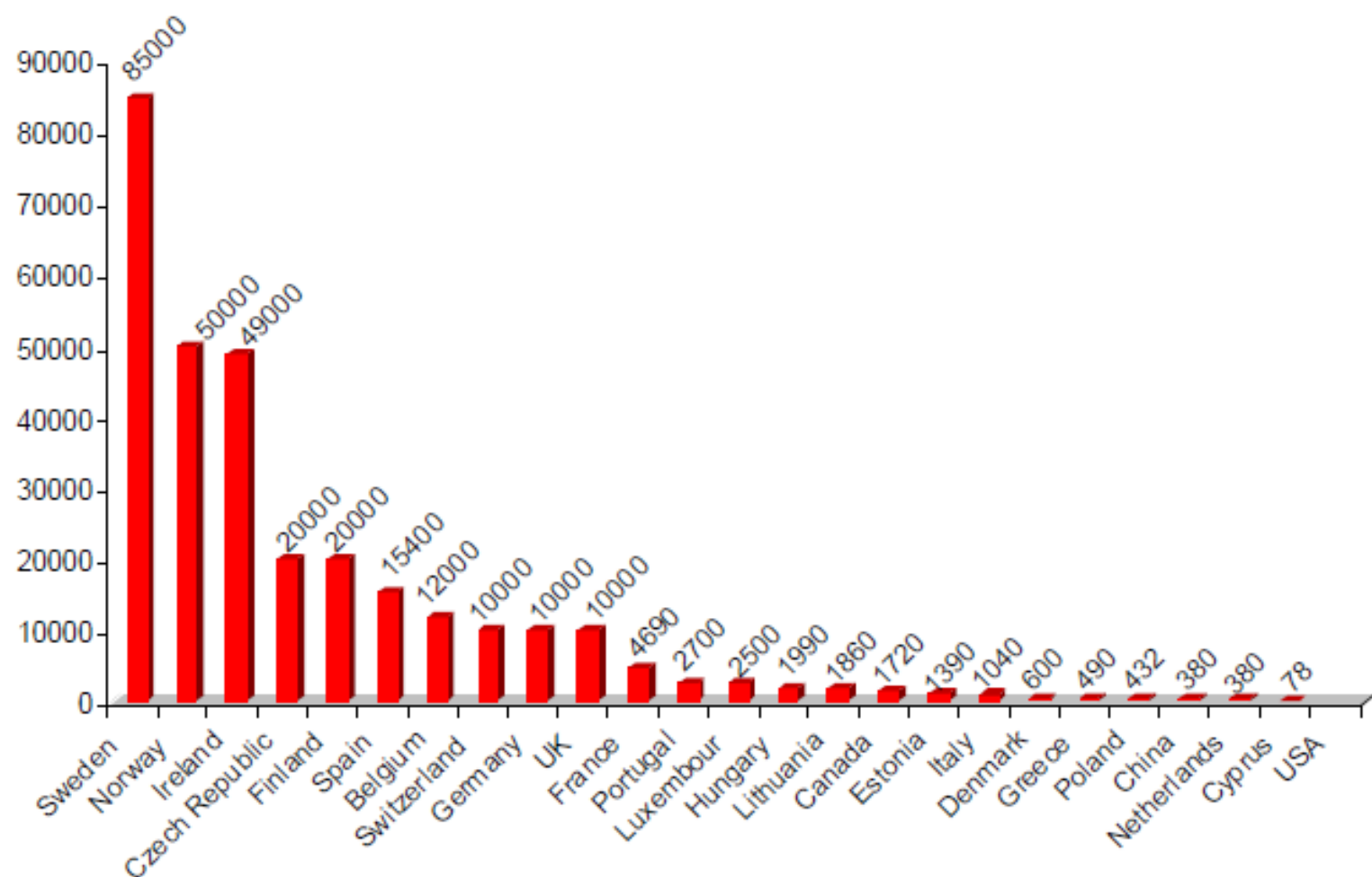
Better targeting of resources

- Better mapping to enable
 - improved predictors for localised anomalies

Eg Airborne radiometric surveys, 'Radon potential' mapping?

 - easy identification of HRA
- Knowledge gaps in
 - Impact of awareness campaigns on attitudes and behaviour
 - long term effectiveness of remediation solution
 - insulation retrofit –increased air-tightness & its effect on Radon if any

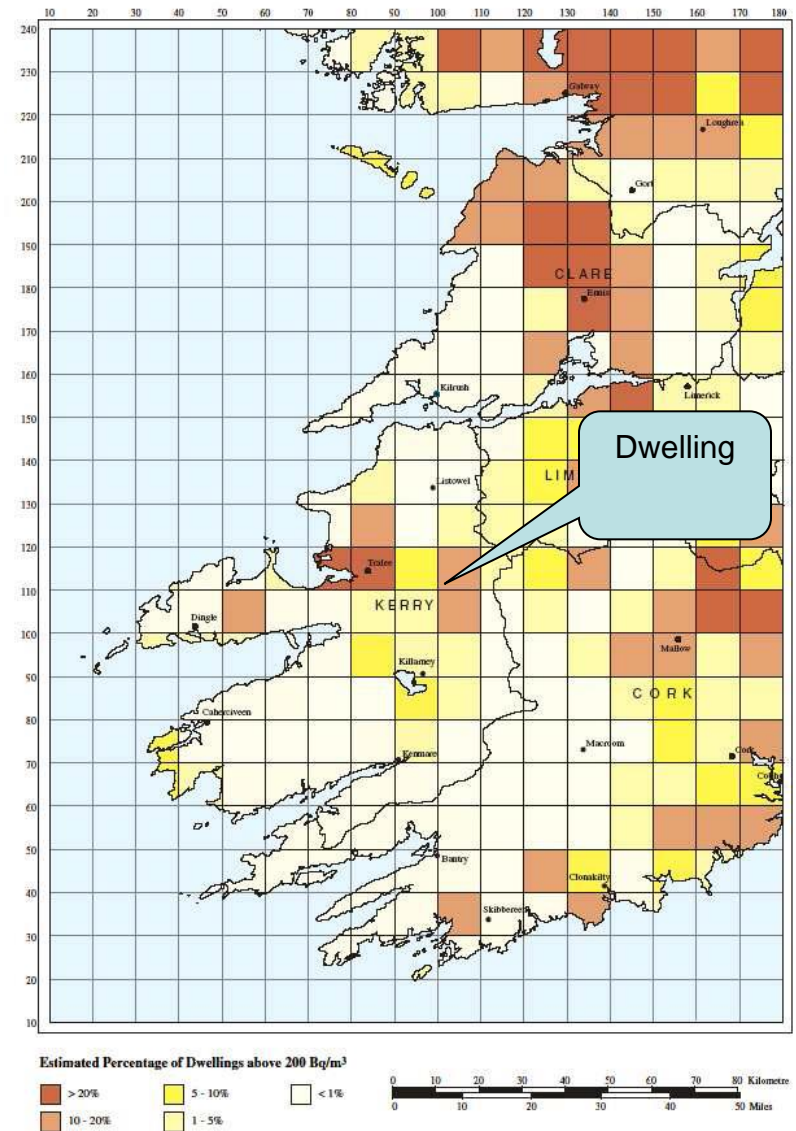
Maximum Reported Radon Concentrations in Selected Countries



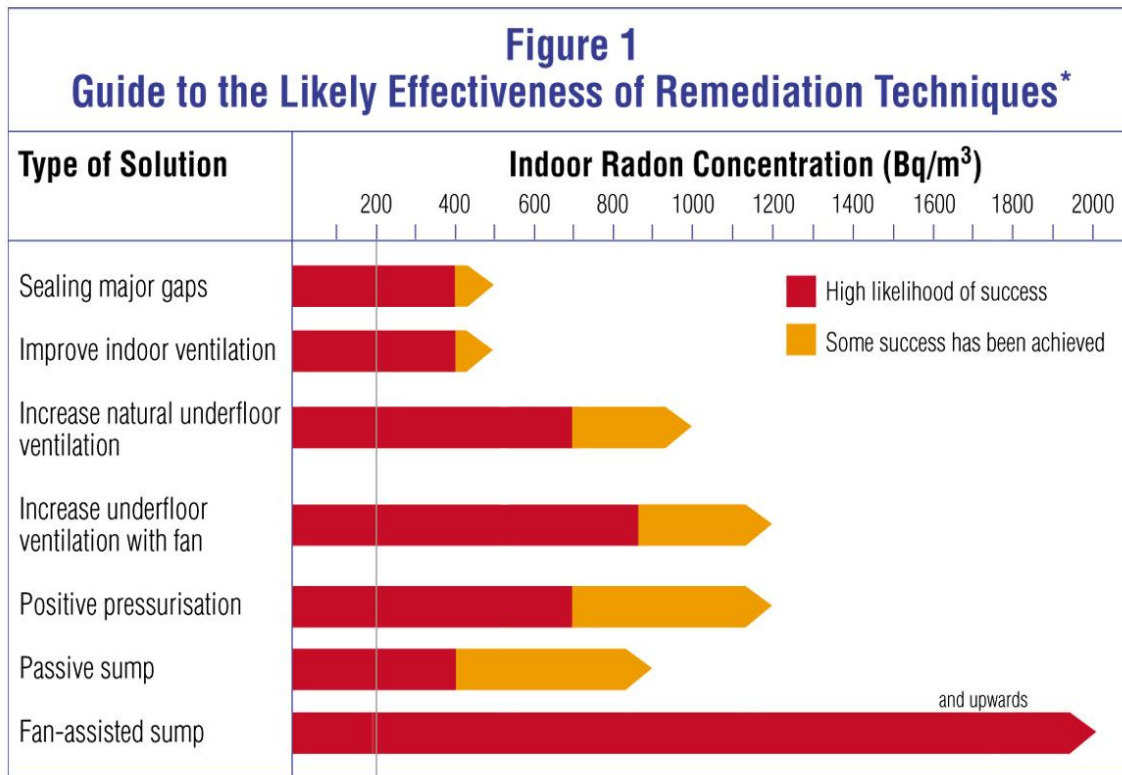
Anomalies

Castleisland Dwelling.

1. Dwelling on border between High Radon area (HRA) and normal.
2. 49,000 Bq/m³ (highest level ever measured in a house in the country)
3. Both occupants, non smokers, died of Cancer.
4. Why in this house?
Investigation not possible,
5. priority had to be given to remediation
6. Geology (Karst limestone)
+ house features?




Remediation methods



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RADON IN EXISTING BUILDINGS

Corrective Options



Printed on recycled paper containing a minimum of 75% post-consumer waste.



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Positive pressure systems

- Roof and wall mounted pressure systems
- Are they still appropriate under the Energy Performance of Buildings Directive (EPBD).
- Could they be combined with MVHR systems?



Radon in Ireland and the New National Radon Strategy

Thank You for your attention.



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- The mechanical components of active remediation systems were found to be still operating effectively three years after installation; and
- The performance of radon sumps improves with time and measurements made immediately after installation may overestimate long-term radon concentrations by up to a factor of two.

