IRPA 13

Glasgow, Scotland

13 - 18.5.2012

Radon prevention and remediation in EU countries, RADPAR questionnaire study

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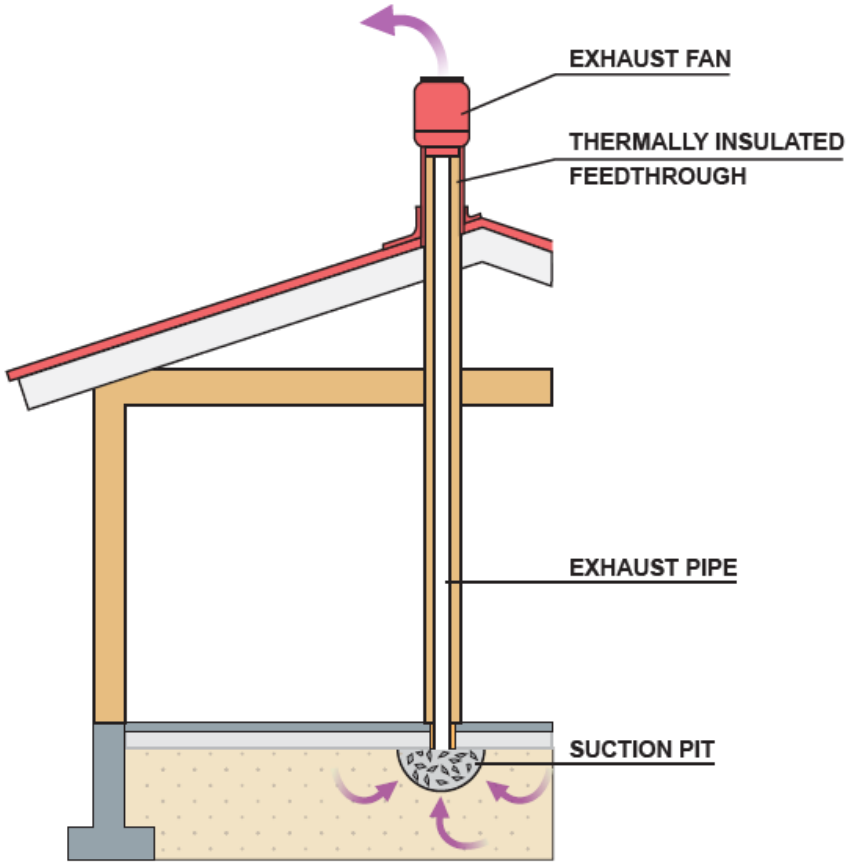
Outline

- Introduction
  - Typical radon remediation and prevention methods used to achieve a reduction of indoor radon concentration (^{222}Rn) in existing houses and in new buildings
  - RADPAR project, Objectives and work packages
- RADPAR Questionnaires
- Results
  - Current radon remediation and prevention status in Europe
    - Number of houses where radon remediation or preventive measures have been applied
  - Reduction efficiency of the remediation and prevention methods

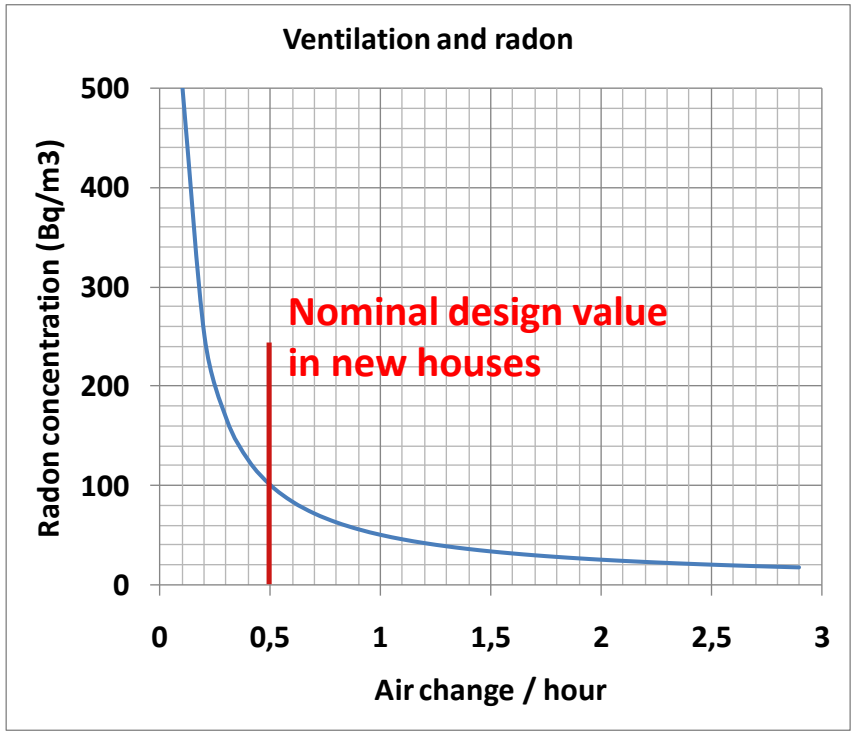
Sub-slab depressurization (SSD)

- Common radon remediation and prevention method
  - Passive SSD: natural ventilation due to stack and wind effects
  - Active SSD: forced ventilation using an exhaust fan
- SSD creates under-pressure under the floor slab and lowers the soil air radon concentration
- In new construction: suction pit replaced by radon piping
  (network of flexible perforated pipes)



Improving ventilation

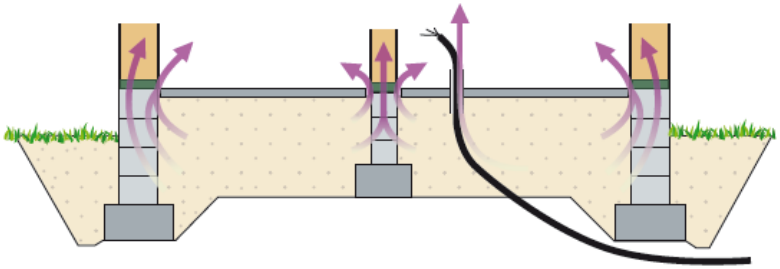
- Can be effective if the initial state of the house ventilation is poor
- Possible actions in living spaces
  - Opening or adding supply air vents
  - Increasing air change of the mechanical ventilation system
- Under-pressure in the house should be small
- Improving ventilation in cellar or in crawl space also common



Sealing entry routes

- Typical entry routes from the ground
  - cracks, gaps, holes and pipe penetrations in the floor slab and in the walls in contact with soil
  - For slab-on-ground foundation, most important: gap in the joint of floor slab and foundation wall due to drying shrinkage of the concrete
- Complete sealing often very demanding
- Easier in new construction than in old houses

Typical entry routes for slab-on-ground foundation



RADPAR project

- Radon prevention and remediation (RADPAR), 2009-2012
- Partners from 14 countries
  - 11 Associate Partners and 7 Collaborative Partners
- Website: http://web.jrc.ec.europa.eu/radpar/index.cfm (or google RADPAR)
- Funding from the EU in the framework of the Health Programme
  - Executive Agency for Health and Consumers (EAHC or DG SANCO)

- **General objective**: to assist in reducing the significant public health burden of radon related lung cancers in EU Member States

RADPAR Work packages

WP 1: Coordination of the project

WP 2: Dissemination of the results

WP 3: Evaluation of the project

WP 4: Developing **policies and strategies** to promote effective radon prevention and remediation

WP 5: Establishment of an EU radon **risk communication** network

WP 6: Assessment and harmonization of **radon control technologies** in Member States

WP 7: Analyses of **cost-effectiveness** and health benefits of radon control strategies

RAPDAR WP 6 Objectives

- Assessment of potential conflicts between energy conservation in buildings and radon exposure reduction
  - Analyses and assessment of current techniques/technologies
    - reduction efficiency ⟵ **Topic of this presentation**
    - potential impact on energy consumption (qualitative)
  - Examination of the potential for conflict or links between radon control technologies and energy conservation in standard, climatic/passive and low energy consumption house technologies
- Establishment of measurement protocols for radon control technologies
- Design of training courses for radon measurement, prevention, remediation, and cost effectiveness analysis

Questionnaire

- A questionnaire was prepared in order to gather national information about the current remediation and prevention techniques
- Sent to all RADPAR partners
- Responses with varying amount of information

- Summary report of the questionnaire study "*Assessment of current techniques used for reduction of indoor radon concentration in existing and new houses*"
  - publication 2011

Questionnaire

- Status of radon control in each country
  - Action and target levels of radon concentrations
  - Number of dwellings exceeding the action level
  - Number of dwellings already remediated
  - Estimated number of houses with preventive measures
- **Remediation and Prevention methods**
  - radon reduction factor
  - potential impact on energy consumption (qualitative information)
- References to guides, brochures, research reports, website links, other relevant documents

Status of the radon remediation

Country	Action level (Bq/m³)	No. of dwellings (in low rise residential and apartment buildings)		
		Total	Exceeding	Remediated
Austria	400	3 700 000	89 000 (2.4 %)	25 (0 %)
Belgium	400	5 040 000	20 000 (0.4 %)	1 000 (5 %)
Czech Republic	400	3 840 000	76 000 (1.9 %)	4 000 (5.3 %)
Finland	400	2 450 000	59 000 (2.4 %)	4 500 (7.6 %)
Greece	400	5 630 000		
Portugal	400		2.6 %	
France	300*	32 760 000	969 000 (3 %)	
Ireland	200	1 930 000	91 000 (4.7 %)	low number
Italy	200**	22 000 000	902 000 (4.1 %)	450 (0 %)
Norway	200	2 270 000	162 500 (7.1 %)***	
UK	200	23 000 000	100 000 (0.4 %)	15 000 (15 %)
Germany	100	39 900 000	1 930 000 (4.8 %)	1 000 (0.1 %)
Switzerland	1 000	4 000 000	7 500 (0.2 %)****	500 (6.7 %)

* FR: regulations only for public buildings, regulations for existing dwellings in preparation.

** IT: no official value, recommendation 200 Bq/m^3.

*** NO: 427 000 (18.8%) exceeding the target level of 100 Bq/m^3.

**** CH: 75 000 (1.9%) of dwellings exceeds 400 Bq/m^3.

Radon reduction factors, remediation

Remediation method	Reduction factor (%), Typ. range									
	Summary	AT	BE	CZ	FI	FR	IT	NO	CH	UK
Sub-slab depressurization	**60-95**	80	90	85-95	65-95	89	60-95	50-95	90	89
Improving natural ventilation in living spaces	**10-50**			< 30	15-55	49		10-50		33
Improving mechanical ventilation in living spaces	**10-60**				5-55	61	20-95	10-20		
Replacing the existing natural room air ventilation by a mech. exhaust ventilation	**10-40**				15-45			10-20		
Installation of a new mech. supply and exhaust ventilation with heat recovery system	**30-60**	60		30-60	30-65			10-80		
Improving ventilation in cellar	**20-60**	50		25-50	20-55	47	60-90	10-50	75	
Decreasing under-pressure	**20-70**	50						10-50	25	60
Sealing entry routes	**10-60**	10		10-40	10-55	55		10-60	25	41
Improving crawl space ventilation	**40-60**	50			40-65	47	60-90	10-80	75	47

In addition: other methods + typical combinations: 8 + 9 responses.

Radon prevention, status

Country	Target level (Bq/m³)	Number of dwellings***	
		In total	With prevention
Austria	200	3 700 000	15 (0 %)
Belgium	200	5 040 000	
Czech Republic	200	3 900 000	210 000 (5,5 %)
Finland	200	2 450 000	60 000 (2,4 %)
Greece	200	5 630 000	
Ireland	200	1 900 000	699 000 (36,1 %)*
UK	200	23 000 000	Not known **
Portugal	400		a few
Switzerland	400	4 000 000	5 000 (0,1 %)
Germany	100	39 900 000	1 000 (0 %)
Norway	100	2 270 000	
France	-	32 800 000	
Italy	-	22 000 000	

* This is the number of dwellings built since 1998 when the law was enacted
** UK: guidelines for radon prevention since 1991
*** In low rise residential and apartment buildings

Radon reduction factors, prevention

Prevention method	Reduction factor (%), Typ. range						
	Summary	CZ	FI	NO	PT	CH	UK
Passive sub-slab depressurization	**20-50**		30-50	0-20	20-50	50	
Active sub-slab depressurization	**70-95**		70-90	70-95	40-70	95	
Radon proof insulation, membrane below floor slab	**30-70**					50	
Radon proof insulation, membrane above floor slab	**30-70**	30-70		0-90	30-60	50	50
Sealing the joint of floor slab and foundation wall using membranes	**30**			0-90		30	
Sealing the lead-throughs in structures with soil contact	**50**			0-90		50	

In addition: Other methods + typical combinations: 5 + 4 responses.

Conclusion

- Active sub-slab depressurization most efficient remediation and prevention method
  - reduction of radon concentration by 60 - 95 %
  - passive system: up to 50 % reduction
- Other methods less efficient, typically < 60 %
  - improving ventilation and sealing

- Particularly research data on current situation of radon prevention is currently still quite inadequate (i.e., the number of houses with preventive measures and the efficiency of the prevention measures)
- Assessment of the techniques and also the surveys aiming at exploring the impact of remedial and preventive measures is greatly needed in order to promote the work at national level in Europe

Reference

HOLMGREN Olli, ARVELA Hannu. Assessment of current techniques used for reduction of indoor radon concentration in existing and new houses in European countries. STUK-A251. Helsinki 2012, 82 pp. + Appendices 20 pp.

Report available at:

- www.stuk.fi , Publications
- RADPAR website

Acknowledgements

- This presentation arises from the project “Radon prevention and remediation” (RADPAR) which has received funding from the European Union, in the framework of the Health Programme

  – Executive Agency for Health and Consumers , EAHC, DG SANCO

Remember RADPAR website (type RADPAR in Google):
http://web.jrc.ec.europa.eu/radpar/index.cfm

Acknowledgements, Questionnaire responses

- Wolfgang Ringer, Austrian Agency for Health and Food Safety (AGES), Austria
- Jean Klerkx, International Bureau for Environmental Studies (IBES),
  André Poffijn, Federal Agency for Nuclear Control, Belgium
- M. Jiránek, K. Rovenská, I. Fojtíková, CTU Prague +
  NRPI (SURO) Prague, Czech Republic
- Olli Holmgren and Hannu Arvela, STUK, Finland
- Bernard Collignan, CSTB, France
- Bernd Hoffmann, Federal Office for Radiation Protection (BfS), Germany
- John Bartzis, University of Western Macedonia (UOWM), Greece
- Radon Advice Section, Radiological Protection Institute of Ireland (RPII), Ireland
- Francesco Bochicchio, Italian National Institute of Health (ISS), Italy
- Will Standring, Norwegian Radiation Protection Authority, Norway
- Eduardo de Oliveira Fernandes, University of Porto, Portugal
- Luis Santiago Quindos Poncela, University of Cantabria, Spain
- Martha Gruson, Federal office of public health (FOPH),
  Claudio Valsangiacomo, Radon competence centre SUPSI, Switzerland
- Jon Miles, Health Protection Agency (HPA), UK