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INTERNATIONAL RADON PROJECT

SURVEY ON RADON GUIDELINES, PROGRAMMES AND ACTIVITIES

FINAL REPORT

Health Security and Environment
Public Health and Environment
Radiation and Environment Health

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Summary

Under the framework of the WHO International Radon Project, WHO conducted a survey on indoor radon among WHO member states in 2005. This report includes the detailed responses of 36 countries that returned the questionnaires.

Among other, information on the mean radon levels in the different countries as well as on radon action/reference levels is provided. The values for action levels show a wide range, but most frequently radon concentrations between 100 and 400 Bq/m^3 are being used as action level. Many countries have opted for lower levels for new buildings as compared to slightly higher levels for existing buildings.

Questions concerning radon measurement as well as mitigation and prevention guidelines were also part of the survey. Many different activities and approaches to radon risk communication were reported by the participating countries, but only some countries have evaluated these activities.

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Introduction and background

A survey on detailed aspects of radon programs was sent to countries and scientists worldwide making use of the network of International Radon Project (IRP)[1] participants and following the responses to a global mini-survey distributed through WHO to its 192 member countries. To this mini-survey 75 countries out of 192 Member States responded (38.5%), and 45 of the responding countries indicated that they have some radon related activities in their country.

The full survey was sent to all 45 countries that had responded positively to the mini-survey. 36 countries provided detailed information to all or some of the questions. One country (Cyprus) indicated that they had no ongoing radon program but had previously assessed the national situation with regard to radon. A short summary on the different sections of the questionnaire is provided below, followed by the detailed data concerning the different sections of the questionnaire.

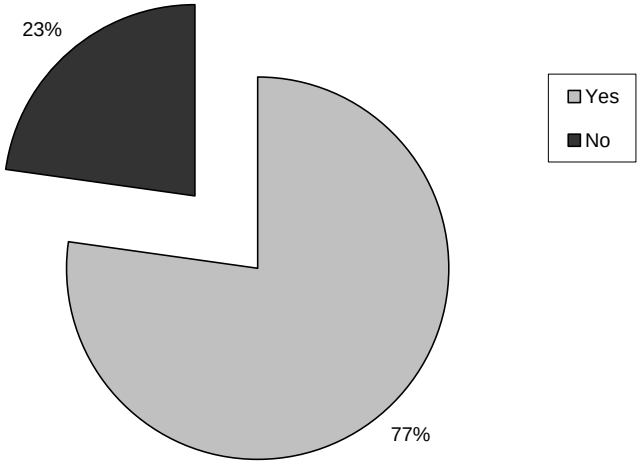
Section 1 Guidelines

Action (Reference) levels for Radon (answers from 35 countries):

The questionnaire was aimed at countries with existing radon activities. In more than three quarter of these countries action levels exist, mostly in the range 200-400 Bq/m^3 for existing homes and, with few exceptions, at 200 Bq/m^3 for new buildings. For existing buildings only a small number of responding countries define the action levels as compulsory. For new buildings this number is slightly larger, as at least 4 countries have compulsory levels for new buildings as against voluntary levels in existing buildings (Denmark, Finland, Norway, UK). Germany and the USA currently have the lowest action level values; at 100 and 148 Bq/m^3 respectively (Data from Ecuador were somewhat contradictory). The German value is, however, not yet legally binding.

[1] Responding to the new evidence from the case-control studies on residential radon and lung cancer risk, WHO launched the International Radon Project in 2005. For detailed description of the project see: http://www.who.int/ionizing_radiation/env/radon/en/.

Figure 1: Existence of action or reference levels for indoor radon



In countries with compulsory action/reference levels, there is a wide spectrum of activities that are considered once the relevant level is found to be exceeded. It appears that only very few countries specify activities to be undertaken, and there are often several public agencies involved in advising the householder and guiding/evaluating mitigation actions.

Specified target levels post mitigation are commonly set to below the reference level in the country concerned, but there are several countries that do not specify such levels, aiming instead at the maximum reduction practically possible without giving target values. Several countries such as Norway and Switzerland define comparatively low target levels (50 and 100 Bq/m^3, respectively) for new buildings post mitigation or installation of preventive measures.

Figure 2a: Radon action (reference) levels in existing buildings (Bq/m^3)

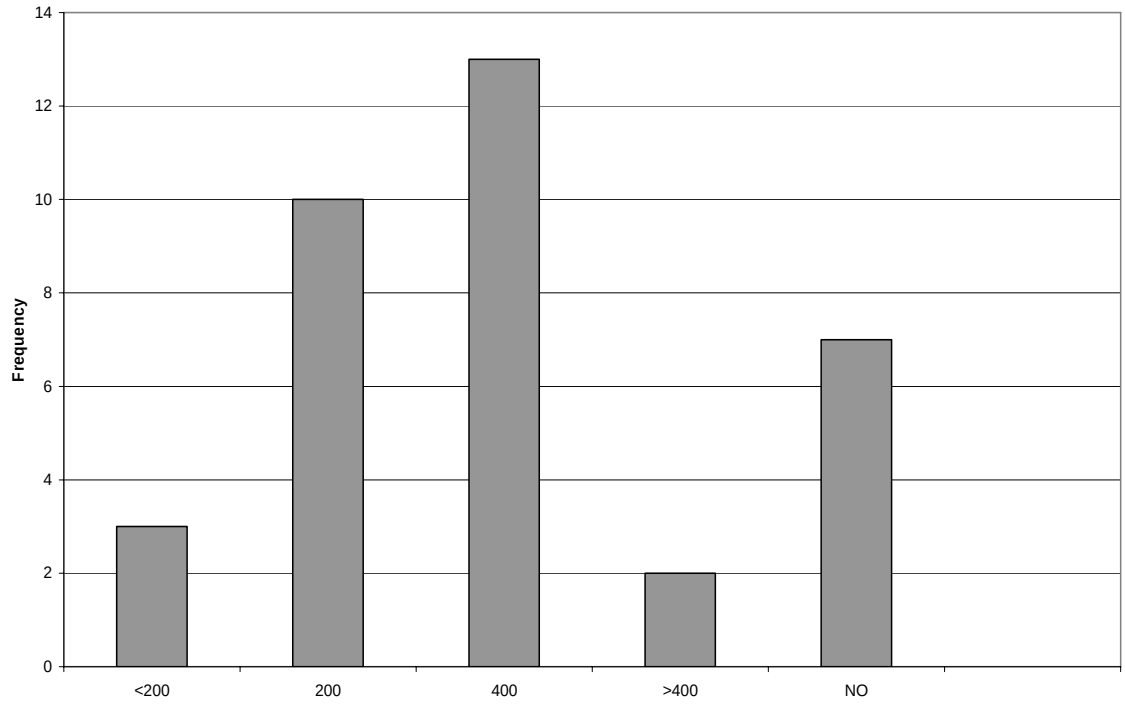
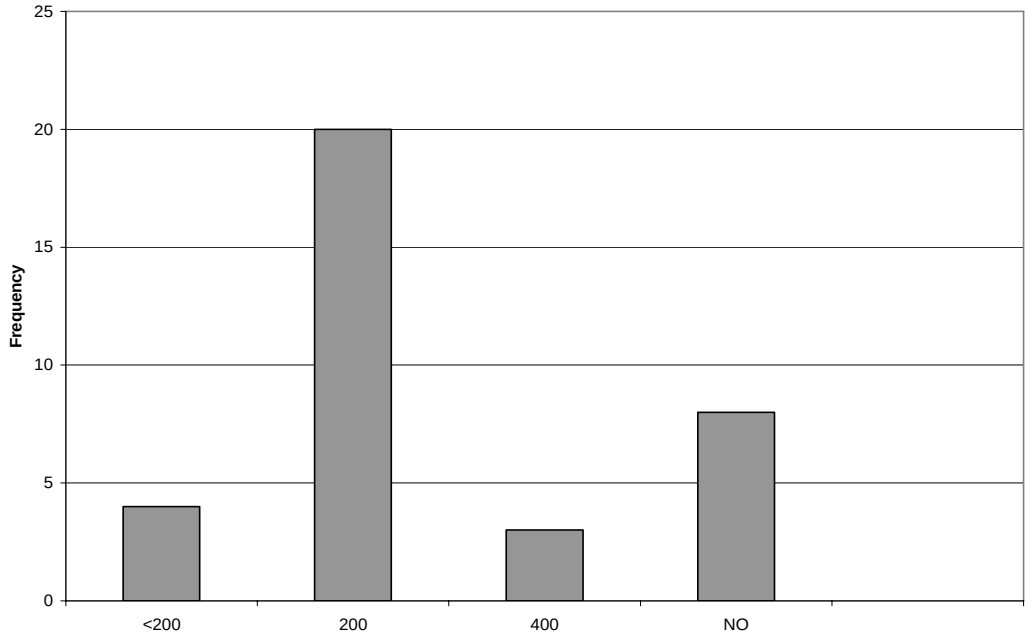


Figure 2b: Radon action (reference) levels for new buildings (Bq/m^3)



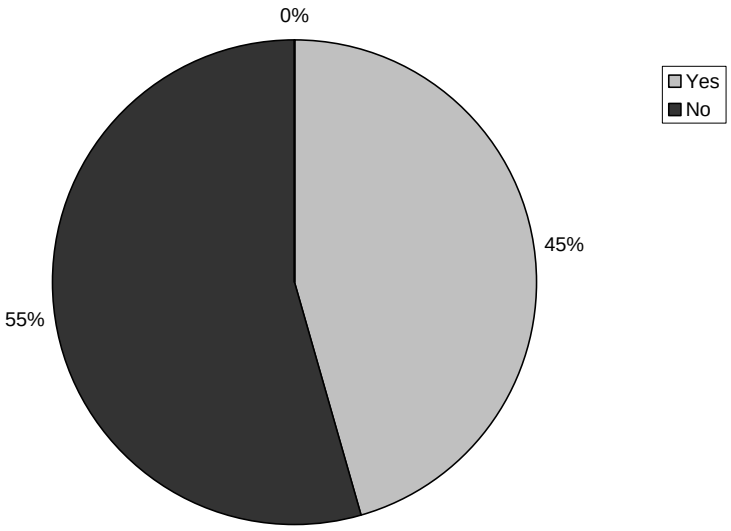
Note: < 200 Bq/m^3 includes Germany (new legislation planned)

Finland, the Czech Republic, Kyrgyzstan Latvia, Norway, Sweden and Switzerland are among the few countries where action levels exist beyond which radon mitigation is judged to be always justified. Rarely, a definite time frame is given for remedial action to be completed. Finland prescribes a time frame depending on the actual radon level found, and houses with high radon levels above 5000 Bq/m^3 to be remediated within a short period after identification of the problem. Switzerland generally allows several years for the remediation to be completed in existing homes with high radon concentrations.

15 out of 33 responding countries indicate that they have building regulations for new buildings in place. Very few countries have conducted scientific assessments of the effect of these codes, with results generally giving an indication of a positive effect towards lowering indoor radon concentrations. There are very few countries (9%) at present where a radon measurement during new building construction is mandatory at least in parts of the country.

The financial burden of mitigation and radon prevention work is almost exclusively carried by the house owner, and very few countries, notably the Czech Republic and Belgium, have state grant schemes (ongoing or in the past).

Figure 3: Building codes for new dwellings



Similarly the inclusion of radon issues in buying or selling of existing and of new homes is currently not widespread, however, the proportion of countries requiring information on radon or radon measurements in transactions concerning new buildings is larger (6 out of 29) than the respective proportion with focus on existing buildings (2/29).

Section 2 Radon levels

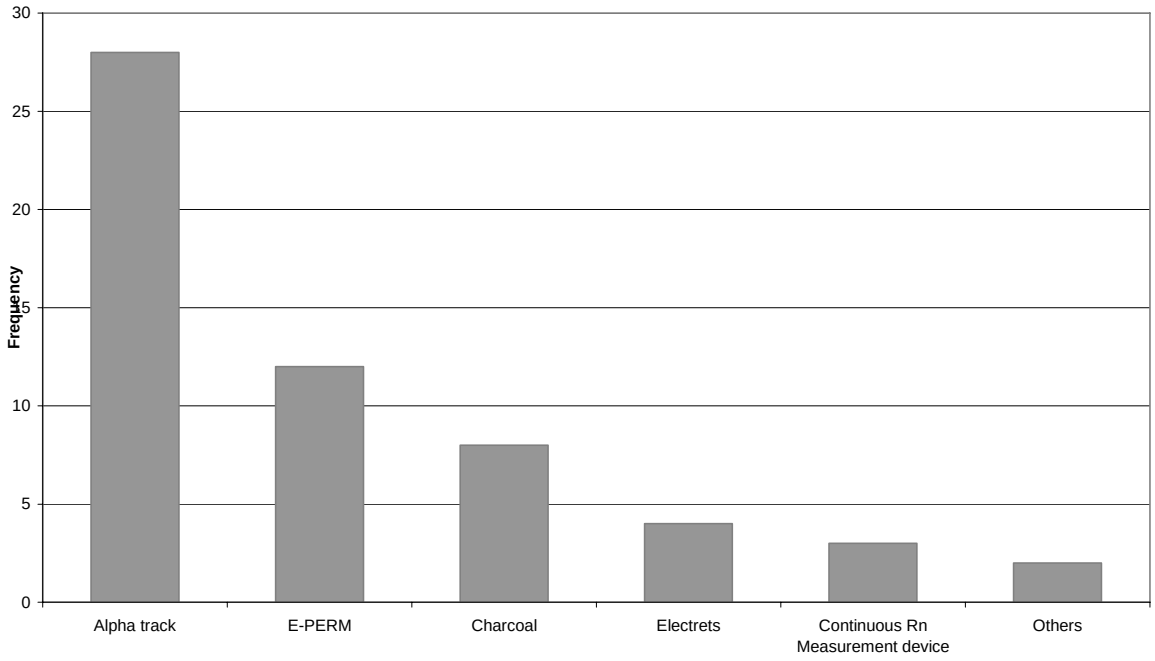
32 countries supplied information on mean radon levels, but for a few countries the given values are probably not representative since they are based on small studies and/or specific areas. The world-wide variation of radon levels is well known, and the survey includes both countries with mean radon concentrations in homes around or above 100 Bq/m^3 (e.g. Czech Republic, Ireland) and countries with low average radon levels (e.g. Japan, UK). It should be noted that there are also major within-country variations that are not well captured by single-value averages. The average indoor radon concentration value of 26 countries with data on a presumably representative basis was 64.3 Bq/m^3.

Section 3 Measurement, mitigation and prevention

For 33 countries, information on the main types of detectors used for radon measurement was available. The majority used more than one type, with the alpha track being the most commonly used by all countries. Less than half of the participants reported having written requirements for accuracy and precision for detectors sold within their countries.

Soil gas was generally weighted as being a more important source of indoor radon than well water, ground emanation or building materials. Thirteen of the 15 countries which answered the question on radon mitigation techniques used in their countries indicated that they used a combination of techniques, with active soil depressurization being the most commonly used method. Two countries, Argentina and the Netherlands reported a 100% use of ventilation.

Figure 4: Types of detectors used in countries

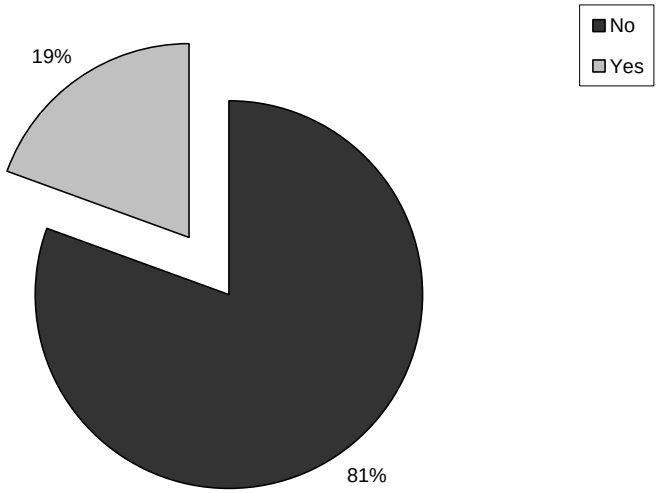


Only 12 countries indicated having standards or guidelines on radon mitigation and prevention, and almost all of these countries have specific guidelines/standards for radon reduction in new buildings. Reports from 13 countries indicated that studies exist that have examined the cost-effectiveness of policies concerning radon in their countries. The results of two countries were not yet published.

Section 4 Radon Risks, Communication and Awareness-Raising

Almost all of the countries which responded to the questionnaire reported various forms of radon risk communication activities aimed at different audiences such as the general public, households in high radon areas, professional groups and government agencies. The methods used vary from leaflets, booklets, magazines, videos, TV-spots to the internet. Only 6 countries, however, reported having evaluated specific radon risk activities.

Figure 5: Evaluation of risk communication activities



In Sweden, local campaigns by local and regional authorities are said to have led to an increase in radon measurements. The 10 countries where the general public's perception of and attitude to radon risks has been assessed reported varying results. In the Czech Republic, only 25% of respondents had never heard of radon, 75% were convinced of its dangers, although 10% of them didn't rightly know why. In Belgium study respondents generally knew about radon and ranked it as a minor risk, but three quarters felt that health risks from radon should be taken seriously. Whereas a lack of radon awareness was reported in Switzerland, in the Netherlands it was a lack of concern. In Norway, letters to house owners and local information through local newspapers were found to be the most important channels. Half of households in the UK on the other hand did not read leaflets about radon. The elderly, retired and higher income groups were more likely to be interested. The cost of remediation was found to be a major deterrent.

Detailed Data abstracted from the questionnaire:

Section 1 Guidelines

Q1 Programme yes no
Q2 Action level yes no
Q2a for existing dwellings
Q2b for dwellings under construction

NO	Country	Q1	Q2	Q2a	Q2b
1.	Argentina	Y	Y	400 Bq/m³ vol.	200 Bq/m³ vol.
2.	Austria	Y	Y	400 Bq/m³ vol.	200 Bq/m³ vol.
3.	Brazil	Y	N	-	-
4.	Belgium	Y	Y	400 Bq/m³ vol.	200 Bq/m³ vol.
5.	Bulgaria	Y	Y	500 Bq/m³ (250 EEC) vol. existing	200 Bq/m³ (100 EEC) vol
6.	Canada	Y	Y	800 Bq/m³ under revision; new: 200 Bq/m³ vol	800 (200) Bq/m³ vol.
7.	China	Y	Y	400 Bq/m³. for houses; 1000 Bq/m³ for workplace	200 Bq/m³.
8.	Czech Republic	Y	Y	400 Bq/m³ vol.	200 Bq/m³ vol.
9.	Denmark	Y	Y	200 Bq/m³ vol., (differentiated guidance < 400 Bq/m³ vs. > 400 Bq/m³)	200 Bq/m³ vol., compulsory airtight construction;
10.	Ecuador	N	-	100 Bq/m³ (min) comp. 400 Bq/m³ (max)	comp.
11.	Finland	Y	Y	400 Bq/m³ vol.	200 Bq/m³ comp.
12.	France	Y	(N)	400 Bq/m³ comp. for selected public buildings	
13.	Georgia	Y	Y	200 Bq/m³ comp.	100 Bq/m³
14.	Germany	Y	Y	100 Bq/ m³ vol.	100 Bq/ m³ vol.
15.	Greece	Y	Y	400 Bq/m³ vol.	200 Bq/m³ vol.
16.	Ireland	Y	Y	200 Bq/m³ vol.	200 Bq/m³ vol.
17.	Italy	Y	N	-	-
18.	Japan	Y	N	-	-
19.	Korea		N	-	-
20.	Kyrgyzstan	Y	Y	<200 Bq/m³	200 Bq/m³
21.	Latvia	Y	Y	200 Bq/m³ vol, 600 Bq/m³ comp.	200 Bq/m³ comp.
22.	Lithuania	Y	Y	400 Bq/m³ vol.	200 Bq/m³ vol.
23.	Morocco	Y	Y	(Dose limits as in IAEA-BSS) vol.	(no diff. existing – under constr.)
24.	Netherlands	Y	Y	-	30 Bq/m³ (vol.) averaged over all new dwellings built in one year. If level exceeded there will be new regulation
25.	Norway	Y	Y	200 Bq/m³	200 Bq/m³ comp. upper level (bldng. regulations)
26.	Paraguay	N	-	-	-
27.	Peru	N	Y	200-600 Bq/m³ for houses; 1000 Bq/m³ for workplaces	-
28.	Romania	Y	Y	400 Bq/m³ vol.	200 Bq/m³ vol.
29.	Russia	Y	Y	400 Bq/m³ existing, homes comp. 200 Bq/m³ (100 Bq/m³ Rn EEC) new	200 Bq/m³

NO	Country	Q1	Q2	Q2a	Q2b
30.	Slovenia	Y	Y	400 Bq/m³ vol. for houses; 400 Bq/m³ comp. for schools and kindergartens; 1000 Bq/m³ comp. for companies	same as for existing buildings
31.	Spain	Y	N	-	-
32.	Sweden	Y	Y	200 Bq/m³ comp.	200 Bq/m³ comp.
33.	Switzerland	Y	Y	1000 Bq/m³ comp.	400 Bq/m³ comp.
34.	UK	Y	Y	200 Bq/m³ vol.	200 Bq/m³ comp.
35.	USA	Y	Y	148 Bq/m³ vol.	148 Bq/m³ vol.

Q3 Actions to take if compulsory levels exist and are exceeded
Q3a Enforcement

NO	Country	Q3	Q3a
1.	Argentina	-	once dwelling with Rn >Action Level detected, area ventilation suggested and further measurements done
2.	Czech Republic	for dwellings under construction: preventive measures required for medium and high Rn Index of the Ground (RIG). Enforced by Bldng Office during building permission procedure	-
3.	China	Simple and low-cost measures recommended	
4.	Finland	for new bldngs builder to activate precautionary Rn piping or do other remedial measures to reach 200 Bq/m³. In do-it-yourself projects measures may not be implemented until property transactions – depends on houseowner activity	Normally new houseowners require Rn measurements and its builder's responsibility to do measures and take any necessary measures. Alternatively builder checks indoor Rn conc. unprompted and takes measures if needed
5.	France	(public build. - see above): simple actions if Rn conc., < 400 Bq/m³, more sophisticated if above	
6.	Georgia	No actions defined/assigned	No enforcement procedure/enforcer defined/assigned
7.	Germany	-	Info. sheets, publications and special PR campaigns of Federal Office for radiation Protection and the Min. of Environ. Nature Conservation and Reactor Safety.
8.	Greece	Simple measures such as area ventilation are recommended	No enforcement
9.	Ireland	N/A	N/A
10.	Kyrgyzstan	reduce radon level by airing the place	special orgs e.g. Health Service
11.	Latvia	Owner to seek advice from Reg. Body (RDC); no standard action	Responsibility is shared: State, Rad. Safety Centre RSC, local authorities. RSC responsible for measurements etc.
12.	Lithuania	AL comp.in working places, remedial means taken	Rad. Protection Centers
13.	Netherlands	Dutch governt. and building material industry have reached agreement	See 3a
14.	Norway	Simple and low-cost measures recommended in all dwellings. In ‘HRAs'	Nat. Bldng Regulations- Bldng Code: National Office of Building Technology

NO	Country	Q3	Q3a
		more extensive measures sometimes required and recommended	and Administration
15.	Russia	Householder needs to conduct mitig. measures; if reduction impossible, building not to be used for living	Through Ministry of Health and Soc Development documents
16.	Slovenia	If AL exceeded (school, kindergarten, company) Rn and Rn progeny measured for one year (at least winter & summer period), source determined, dose assessment for children and workers done - if >5mSv/year, remediation to follow	Rad. Protection Admin. (MOH)
17.	Sweden	Actions not specified as action necessarily depends on bldng construction and Rn source	-Existing dwellings: LEHA (according to Environmental Code) issues general advice. Priv. house owners usually not forced to remediate radon. Multifamily houses have to remediate. -Bldngs under construction: local bldng auth. according to Planning & Bldng Act & bldng regulations from National Board of Housing Bldng & Planning (see additional comments)
18.	Switzerland	Remediation until 2014; if house rented remediation within 3 years	Cantons. Householder can be fined if no remediation measures taken

Q4a Target levels after remediation - existing buildings
Q4b Target level new buildings

WHO Q4			
NO	**Country**	**Q4a**	**Q4b**
1.	Argentina	only one value AL: 400 Bq/m³	200 Bq/m³
2.	Austria	400 Bq/m³	200 Bq/m³
3.	Belgium	200 Bq/m³	200 Bq/m³
4.	Bulgaria	~500 Bq/m³ (250 Rn EEC)	~200 Bq/m³ (100 Rn EEC)
5.	Canada	As low as practicable	As low as practicable
6.	China	400 Bq/m³	200 Bq/m³
7.	Czech Republic	400 Bq/m³, or reducing level four times (75%)	200 Bq/m³
8.	Denmark	- (?)	200 Bq/m³
9.	Finland	no official target level for remediation. Recommended to reduce Radon conc.as low as possible – if possible below 200 Bq/m³	where contribution fo soil Rn can be prevented, conc. limit comes from bldng mat. contribution. wooden walls 20-40 Bq/m³; concrete walls 40-100 Bq/m³
10.	Georgia	No target levels defined	No target levels defined
11.	Germany	Annual mean value <100 Bq/m³	Annual mean value <100 Bq/m³
12.	Greece	No target levels	No target levels
13.	Ireland	200 Bq/m³	200 Bq/m³
14.	Italy	No target levels	No target levels
15.	Korea	No target levels	No target levels
16.	Kyrgyzstan	<200 Bq/m³	-
17.	Latvia	200 Bq/m³, no legal req.	< 200 Bq/m³
18.	Lithuania	400 Bq/m³	200 Bq/m³
19.	Norway	annual mean conc. in living area (bedrooms, living area etc) should be <200 Bq/m³	target level for future housing stock is 50 Bq/m³
20.	Russia	No target levels specified, but aim is to get below action level	same as in 4a
21.	Slovenia	400 Bq/m³	400 Bq/m³
22.	Sweden	no official target, but 100 Bq/m³ sometimes mentioned	same as in 4a
23.	Switzerland	400 Bq/m³	100 Bq/m³-SFOPH recommendation
24.	UK	As low as reasonably practicable and at least below AL	As low as reasonably practicable and at least below AL
25.	USA	No target levels	No target levels

Q5 Any level where action is always justified
Q5i: Specify level
Q5ii: period of time for reduction
Q5a - if no level for always justified action, any consideration for introduction?

NO	Country	Q5	Q5i	Q5ii	Q5a
1.	Argentina	N			Y
2.	Austria	N			Y
3.	Belgium	N			Y
4.	Brazil	N			N
5.	Bulgaria	N			Y
6.	Canada	N			Y
7.	China	N		Plan exists, but none given yet	
8.	Czech Republic	Y	4000 Bq/m³	none given	
9.	Denmark	N			N
10.	Finland	Y	no accurate level specified. Housing authorities have power to prohibit residential use of bldng. Not yet used these rights therefore no example available. Even in cases of 10000-30000 Bq/m³ remedial measures have been taken within reasonable time	conc. >5000 Bq/m³ within next months. Concentrations.of 400-500 Bq/m³ reduction before next heating season	
11.	France	N			
12.	Georgia	N			N
13.	Germany	Y	1000 Bq/m³	1 year	-
14.	Greece	N			N
15.	Ireland	N			N
16.	Italy	-			-
17.	Korea	N			N
18.	Kyrgyzstan	Y	200 Bq/m³	-	
19.	Latvia	Y	600 Bq/m³ mean annual; >1000 Bq/m³ acute measurement	Immediate actions recommended, but no time period specified	-
20.	Lithuania	N			N
21.	Morocco	N			N
22.	Netherlands	N	-	-	-
23.	Norway	Y	400 Bq/m³	as soon as possible	
24.	Peru	N			Y
25.	Romania	N			DK
26.	Russia	N			Y
27.	Slovenia	N			Y
28.	Spain	N			-
29.	Sweden	N			-
30.	Switzerland	Y	see Q3	see Q3	
31.	UK	N			Y
32.	USA	N			Y

Q6i Buildings codes for new dwellings
Q6ii Any studies on impact of codes
Q6iia positive effect?
Q6iib no effect
Q6iic other
Q6a radon measurement in new dwelling construction mandatory

WHO Q6							
NO	**Country**	**Q6i**	**Q6ii**	**Q6iia**	**Q6iib**	**Q6iic**	**Q6a**
1.	Argentina	N	-	-	-	-	N
2.	Austria	N	-	-	-	-	N
3.	Belgium	N					N
4.	Brazil	-	-	-	-	-	N
5.	Bulgaria	N					N
6.	Canada	Y	?				N
7.	China	Y	N	Y	-	-	N
8.	Czech Republic	Y	Y	-	-	freq. of failure under study from 2006-2009	N
9.	Denmark	Y	N				N
10.	Ecuador	N					N
11.	Finland	Y	Y	Yes, recommendations given based on studies in test houses or other research knowledge affecting indoor Rn conc. In case of slab-on-ground the sealing measures and Rn piping have tested positive effect – when carried out along guidelines			N
12.	France	N					N
13.	Georgia	N	N				N
14.	Germany	N	-	-	-	-	N
15.	Greece	N					N
16.	Ireland	Y	Y	Y			N
17.	Italy	N	-				N
18.	Japan	N					N
19.	Kyrgyzstan	Y	?				Y
20.	Latvia	Y	?			Some recommendations available	N
21.	Lithuania	N					N
22.	Morocco	N					N
23.	Netherlands	N	-	Studies have been carried out which have shown a general positive effect of codes/regulations on radon levels. Foreseen codes have however not been implemented.	-	-	N
24.	Norway	Y	N				N
25.	Peru	N					N
26.	Romania	N					N
27.	Russia	Y	DK			Requirement to control Rn flux on build.sites, efficiency??	Y

WHO Q6							
NO	**Country**	**Q6i**	**Q6ii**	**Q6iia**	**Q6iib**	**Q6iic**	**Q6a**
28.	Slovenia	Y	N				N
29.	Spain	N					N
30.	Sweden	Y	N				N
31.	Switzerland	Y	N	preliminary results of nationwide study on Rn in dwellings indicate that the Rn conc. is lower than 10 years ago. Bldng. regulations may be contributing factor			N
32.	UK	Y	Y	Y			N
33.	USA	Y	Y	Passive systems reduce up to 50%			Y

Q7 Who finances recommended remedial work?
Q7a Who finances required/compulsory work?

WHO Q7			
NO	**Country**	**Q7**	**Q7a**
1.	Argentina	Householder only	-
2.	Austria	Householder only except in Upper Austria where grant is given (max. 22% of total cost)	-
3.	Belgium	State grant	
4.	Bulgaria	No mitigation so far	No mitigation so far
5.	Canada	Householder only	Householder only
6.	China	In most cases Householder only In some cases both householder and	-
7.	Czech Republic	State grant	state grant
8.	Denmark	Householder	-
9.	Finland	Householder, state grant only in few expensive cases	-
10.	Georgia	issue not defined	same as in Q7
11.	Germany	Householder: until 2005 Federal state of Saxony gave grant if annual mean value in dwellings was >1000 Bq/m³	-
12.	Greece	Householder only	-
13.	Ireland	Householder only	-
14.	Italy	-	-
15.	Kyrgyzstan	In some cases both householder and state	same as in Q7
16.	Latvia	Householder only	Householder only
17.	Lithuania	Householder only	Householder only
18.	Norway	Householder only: 1999-2003, state grant	-
19.	Peru	Householder only	Householder only
20.	Romania	Householder only	-
21.	Russia	Householder, possibly grant	Householder, possibly grant (indiv. decision)
22.	Slovenia	Householder only	Householder only
23.	Sweden	Householder only for RN conc. <200 Bq/m³	Householder: state grant for Rn conc. >200 Bq/m³ (50% of costs, max. 1600Euros). Only valid for single homes, not multi-storey bldgs.
24.	Switzerland	Householder only	Householder + tax reductions
25.	UK	Householder only	-
26.	USA	Householder only, sometimes shared between buyers/sellers	- ; some private org. sometimes require testing and mitigation (if Rn above 148 Bq/m^3) of commercial multi-family properties

Q8 Radon required to be considered in buying/selling (existing buildings)
Q8a Radon required to be considered in buying/selling (new buildings)

NO	Country	Q8	if yes details	if no +details	Q8a	if yes details	if no: any consideration?
1.	Argentina	N		N -	N		N-
2.	Austria	N		N-	N		N-
3.	Belgium	N			N		Y (currently under disc. with regional author.)
4.	Brazil	N		N-	N		N-
5.	Bulgaria	N		Y	N		N
6.	Canada	N		Y, but only as an option	N		See Q8
7.	China	N		N	Y		
8.	Czech Republic	N		N, not officially up to now	N,	only on individual request	N, not actual problem as migration rate in country low
9.	Denmark	N		Y; Denmark has considered this but found not realistic due to absence of valid short term measurements	N		N
10.	Ecuador	N		N	N		N
11.	Finland	N		Y, STUK plans to publish guide for buying & selling in co-op with consumer advice authorities	N		
12.	Georgia	N		N-	N		N-
13.	Germany	N		Y, see deliverables of European Project “ERRICCA 2”	N		Y, see European Project “ERRICCA 2”
14.	Greece	N		N-	N		N-
15.	Ireland	N		Y, RPII have recommended to governt. that feasibility of including radon measurement & remediation during conveyance be investigated	N		Y, see Q8 details
16.	Italy	N			N		
17.	Japan	N		-	N		N-
18.	Kyrgyzstan	N		DK	N		DK
19.	Latvia	N			N		(some regulation in place - see original survey response for answer)
20.	Lithuania	N		N-	N		N-

NO	Country	Q8	if yes details	if no +details	Q8a	if yes details	if no: any consideration?
21.	Morocco	N		N	N		N
22.	Netherlands	N		N-	N		Y, for political reasons agreement instead of legislation chosen
23.	Norway	N		Y, practical problems exist as min. integration time for measure. is 2 mths, however recomm. that Rn be mentioned in contract, also results & any remedial measures undertaken (if avail	Y	Rn level in new dwellings to be <200 Bq/m³ - upper level (comp level-bldng code) (see additional info)	
24.	Peru	N		N	N		N
25.	Romania	N		N	N		N
26.	Russia	N		N	Y		
27.	Slovenia	N		N: some people ask for measurements before buying house, build using fly ash bricks	N		N
28.	Spain	N		N	N		N
29.	Sweden	N		Y, Bldng declarations (spec. on energy, ventil., Rn) to be enforced in Oct.2006. Declaration of house to be established when selling house and mention if Rn measured or not	N		Y, same as for existing buildings
30.	Switzerland	Y	high Rn level = lack of requested quality	depends on cantonal law	Y	depends on cantonal law	
31.	UK	Y	Standard legal questions on house purchase include one on whether property in Rn affected area		Y	as for existing dwellings	
32.	USA	N			Y	Some counties, towns require Rn resistant bldg., RN included in some codes	

SECTION 2 Global radon levels

Q9 average indoor radon level
Q10 coefficient of variation
Q11i op. Proportion above 100 Bq/m3
ii Pop. Proportion above 150 Bq/m3
iii Pop. Proportion above 200 Bq/m3
iv Pop. Proportion above national action level

No	Country	Q9	Q10	Q11i	Q11ii	Q11iii	Q11iv
1.	Argentina	40.5 Bq/m³ (2631 dwellings till today) (literature ref.)	N/A	5%	2%	0.5%	0.2%
2.	Austria	99 Bq/m³ (literature ref.)	N/A	30%	18%	12%	4,4%
3.	Belgium	53 Bq/m³	N/A	11%		4%	1%
4.	Bulgaria	- ; for high radon areas 250 Bq/m³	N/A	-	-	-	-
5.	Brazil	Est. not avail..: (2 papers concerning preliminary Rn estimates in Rio de Janeiro and Pocos de Caldas provided)	N/A	-	-	-	-
6.	Canada	45 Bq/m³	N/A	7.6%	4.4%	2.7%	0.12%
7.	China	43.8 Bq/m³ (3098 dwellings, survey 1999-2005)	(sampling rate) $0.09/10^4$	6.4%	-	0.7 %	0.7 %
8.	Czech Republic	118 Bq/m³ (literature ref.)	36%(effect under research)	40%	20%	12%	2%
9.	Ecuador	(value needs confirmation)	-	-	-	-	-
10.	Finland	120 Bq/m³ (literature ref.)	36 & 62% (ref given)	-	-	12%	-
11.	France	90 Bq/m³ (literature ref.)	N/A				
12.	Georgia	Est. not avail. (see additional info)	N/A	-	-	-	-
13.	Germany	49 Bq/m³ (literature ref.)	~30% (no ref.)	6.67%	2.88%	1.63%	-
14.	Greece	55 Bq/m³ (literature ref.)	N/A	-	-	3.1%	-
15.	Ireland	91 Bq/m³ (literature ref.)	N/A	~26%	~14%	~7%	-
16.	Italy	70 Bq/m³	17% (from case-control study)	17.5%	7.9%	4.1%	-
17.	Japan	15.5 Bq/m³ (literature ref.)	N/A	-	-	-	-
18.	Korea	54.3 Bq/m³ (literature ref.)					
19.	Kyrgyzstan	Est. not avail.	N/A	-	-	-	-
20.	Latvia	70 Bq/m³ (not an annual mean; 1993-94 survey of 300 dwellings, literature ref.)	N/A	-	-	4% (200-<400)	4%
21.	Lithuania	32 Bq/m^3 (55 in detached houses & 19 in multifamily houses)	8%	3%	-	-	-
22.	Netherlands	25 Bq/m3, no ref. given	Est. not available	5%	2%	0%	-
23.	Norway	89 Bq/m³	N/A	-	-	9%	-
24.	Peru	Est. not avail	N/A	-	-	-	-
25.	Romania	-50 Bq/m³ (literature ref.) -Transylvania ~80-90 Bq/m³, measurements with track detectors:~200 houses; Stei area (~24000 inhabitants):	winter/summer = 2 (ref given)	-	-	-	-

No	Country	Q9	Q10	Q11i	Q11ii	Q11iii	Q11iv
		~280 Bq/m³					
26.	Russia	50-60 Bq/m³; more detailed data for areas including Moscow, Sverdlovsk, Chelyabinsk	N/A	-		5%	1-1.5% (action level indicated here as 400)
27.	Slovenia	87 Bq/m³ (literature ref.)	N/A	-	-	5,7%	2%
28.	Spain	45 Bq/m³ (literature ref.)	30% (article in prep.)	-	-	4%	-
29.	Sweden	108 Bq/m³ (literature ref.)	N/A	29%	19%	10-13%	-
30.	Switzerland	75 Bq/m³	N/A but will be analysed in future	14%	-	6%	0,25%
31.	UK	20 Bq/m³ (literature ref.)	41%	23%	0,9%	0,4%	-
32.	USA	1.3 pCi/L = 48 Bq/m³	-	-	-	-	-

SECTION 3 Measurement, mitigation and prevention

Q12 Types of detectors used
Q13 Written quality requirements exist
Q14 Relative contribution of sources:
i soil gas
ii well water
iii emanation from ground
iv other, buildings materials etc.

No	Country	Q12	Q13	Q14i	Q14ii	Q14iii	Q14iv
1.	Argentina	Alpha track, Charcoal detectors with liquid scintillation measurement, E-Perm	N	30%	5%	30%	30% (bldng.mat)
2.	Austria	E-Perm, alpha track, Alpha Guard	N	95%	1%	-	3% (exhalation from bldng mat.)
3.	Belgium	Alpha track, Charcoal	Y (not publ.)	40%	2%	53%	5%
4.	Brazil	Alpha track	N	5%	5%	90%	-
5.	Bulgaria	Alpha-track	N	45%	5%	50%	
6.	Canada	Charcoal, alpha-track, E-PERM	N	100%	0	0	0
7.	China	Alpha track, Charcoal detectors		>30%rural			>30% urban
8.	Czech Republic	Alpha track, KODAK LR115 and electrets (similar to E-Perm)	Y:also meteorological assurance	60%	1%	38%	1% (bldng mat.)
9.	Ecuador	Alpha track, E-Perm	N				
10.	Finland	Alpha track for passive measurements: LAs have few charcoal instruments; STUK & some companies use active instruments for research & remediation checking	Y	72%	3%	-	25% (bldng mat.)
11.	France	Alpha track	Y				
12.	Georgia	E-Perm	N	-	-	-	-
13.	Germany	Alpha track	Y	50%	-	20%	30%
14.	Greece	Alpha track (CR 39) & E-Perm	N	70%	5%	20%	5% (bldng mat.)
15.	Ireland	Alpha track (CR 39)	N	95%	<5%	-	-
16.	Italy	E-PERM	N	-	-	-	-
17.	Japan	Alpha track	N	20%	10%	50%	10% (bldng mat.)
18.	Korea	Alpha track, E-PERM	N				
19.	Kyrgyzstan	Alpha track & special Rn measurement device	Y	-	-	-	-
20.	Latvia	Electret, continuous Rn gas instruments	Y	20%	40%	40%	-
21.	Lithuania	E-Perm	N	80%	<1%	15%	5% (bldng mat.)
22.	Morocco	CAPP1 (alpha counter), MEAPIII					
23.	Netherlands	Alpha track	N			-	70% Bldng

No	Country	Q12	Q13	Q14i	Q14ii	Q14iii	Q14iv
							mat.; 15% open air – used for ventilation
24.	Norway	Alpha track	Y	85%	5%	10%	-
25.	Peru	Alpha track only for research	N	25%	15%	20%	40% uranium mining, undergrou nd mining
26.	Romania	Alpha track, grab sample	N	5%	5%	70%	20% (bldng mat.)
27.	Russia	Electrostatic chambers, alpha track and charcoal	Y	80%	1%		19% (building mat.
28.	Slovenia	Alpha track, charcoal, rarely E-Perm	Y	90%	-	-	10% (bldng mat)
29.	Spain	Alpha track	N	80%	5%	5%	10% (bldng mat.)
30.	Sweden	Alpha track, E-Perm, continuous Rn gas instruments	Y	73%	2%	2%	25% (bldng mat.)
31.	Switzerland	Alpha track, E-Perm	Y	100%	-	-	-
32.	UK	Alpha track, some charcoal and electret.	Y	70%	-	-	20% (bldng mat.)
33.	USA	Charcoal, electret., cont. monitors	Y (voluntary protocols)	90%	-	5%	-

Q15 Relative prevalence of mitigation techniques
i active soil depressurization.
ii passive soil depressurization.
iii building pressurization
iv water treatment
v source isolation
vi other (e.g. passive ventilation)

No	Country	Q15i	Q15ii	Q15iii	Q15iv	Q15v	Q15vi
1.	Argentina	-	-	-	-	-	100%: passive ventilation of area
2.	Austria	75%	0%	10%	0%	0%	15%: active bldng ventilation, subslab ventilation
3.	Belgium	60%				10%	30%: ventilation
4.	China				few	few	Most increasing indoor ventilation
5.	Czech Republic	45%	5%	0,1%	0.1%	-	49,8%: Rn-proof membrane (mainly for new houses)
6.	Finland	50%	-	-	-	10%	40%: ventilation improvement or depressure reduction or crawl space ventilation
7.	Germany	50%	-	30%	-	20%	-
8.	Ireland	35%	-	7%	-	8%	50%: increasing indoor ventilation (40%), increasing under-floor ventilation (10%) (see additional info)
9.	Netherlands	-	-	-	-	-	100%, Extra ventilation + using other bldng mats.
10.	Norway	50%	15%	10%	5%	20%	combination of techniques
11.	Russia						Main techniques: sealing, basement ventilation
12.	Slovenia	50%	20%	-	-	30%	-
13.	Sweden	39%	1%	(see add. info)	2%	14%	44%: ventilation 36%, combination of techs. 8%. Applies to single-family houses. Multi-storey bldngs. commonly use improved ventilation since Rn from building material is common. Combs. of soil depressurization, sealing & ventilation common.
14.	UK	45%	-	10%	-	-	45%: Sealing, ventilation under suspended floor
15.	USA	60%	40%				

Q16 Variation of techniques by building
16ai residential most common
16aii residential second most common
16bi schools most common
16bii schools second most common
16ci commercial and institutional buildings most common
16cii commercial and institutional buildings second most common

No	Country	Q16	Q16ai	Q16aii	Q16bi	Q16bii	Q16ci	Q16cii
1.	Belgium	Y	Active soil depress.	ventilation	ventilation	Active soil depress.		
2.	China	N	ventilation					
3.	Czech Republic	N	-	-	-	-	-	-
4.	Finland	Y	active soil ventilation	ventilation based measures, limited efficiency	Active soil ventilation	ventilation improvement & pressure reduction	ventilation control & improvement	active soil ventilation
5.	Ireland		ventilation	sub-slap depress.	ventilation	sub-slap depress.	DK	DK
6.	Netherlands	Y	ventilation	Other bldng. mats.	ventilation	-	ventilation	-
7.	Norway	Y	sub-slap depress. (active) in combination with sealing of cracks and openings in foundation, walls and floor	Bldng depress.	ventilation	sub-slap depress. (active) in comb. with sealing of cracks and openings in the foundation walls & floor	ventilation	-
8.	Sweden	Y	soil depressurization & sealing if soil Rn source	improved ventilation if bldng. mat. Rn source	as for residential	as for residential	as for residential	as for residential
9.	UK	Y	soil depress.	ventilation under suspended floor	soil depress.	-	soil depress.	-
10.	USA	N			Act. soil depress.	Act. soil depress.		

Q17 Standards on mitigation and prevention available
Q18 Guidelines new buildings
Q19 Cost effectiveness studies

No	Country	Q17	Q18	Q19
1.	Argentina	N	N	N
2.	Austria	Y:ICS 13.280 Rn.-Part 2: Technical precautionary measures in the case of bldngs. ICS 13.280 Rn-Part 3: Remedial measures on bldngs	N	Y: ref given
3.	Belgium	Y	Y	Y: (ref given)
4.	Bulgaria	N	N	N
5.	Brazil	N	-	N
6.	Canada	N	N	Y (details missing)
7.	China	N	Y commercial building	N
8.	Czech Republic	Y: Std. CSN 73 0601 Protection of bldngs. Against Rn from the soil. CSN 730602 Protection of bldngs. Against Rn and gamma radiation from bldng mats.	Y:given standards are for old and new bldngs.	Y: ref given
9.	Ecuador	N	N	N
10.	Finland	Y:- Environ. Guide. Min of Environ, 1996 Helsinki. -STUK-A127. Radiation & nuclear safety Authority. 1995	Y:Rn prevention, Bldng information file RT 81-10791. Bldng info Ltd. Helsinki 2003	Y: pub. list enclosed
11.	France	Y (separate for new and for existing buildings		N
12.	Georgia	N	N	N
13.	Germany	N	N	Y: not published
14.	Greece	N	N	N
15.	Ireland	Y: Rn in bldngs-Corrective options, Dept. Of Environ. & local Governt. 2002. Building regulations 1997, Tech. guide. document C-site prep. & resistance to moisture Sept`04	Y: see Q17 and Understand Radiation remediation - a householder's guide	N
16.	Italy	N	N	N
17.	Japan	N	N	N
18.	Korea	N	N	N
19.	Kyrgyzstan	N	N	Y: ref given
20.	Latvia	Y	N	N
21.	Lithuania	N	N	N
22.	Morocco	N	N	N
23.	Netherlands	N	N	Y, in Dutch
24.	Norway	Y: Tech. guide. published by Norw. Bdlng. Research Inst.	Y: see Q17 and Guide. based on experiments over 20 years.	Y: ref given
25.	Peru	N	N	N
26.	Romania	N	N	N
27.	Russia	Y (official only for Moscow)	Y, see Q17	N
28.	Slovenia	N	N	N
29.	Spain	N	N	N
30.	Sweden	N	N	Y: ref given

No	Country	Q17	Q18	Q19
31.	Switzerland	Y: see www.ch-radon.ch	Y: see www.ch-radon.ch	Y: not yet published
32.	UK	Y:various publications by Bldng Research Establishment	Y: BR211-Bldng Research Estab.	Y: ref given
33.	USA	Y: EPA mitigation standards	Y (ref given)	Y: ref given

SECTION 4 Risk communication

Q20 Target audiences for risk communication
Q21 Main objectives of risk communication

No	Country	Q20	Q21
1.	Argentina	1.Governt. Agencies with health protection responsibilities & houses in high Rn areas 2.associations of professional groups & national policy makers 3.schools 4. General public 5. Building industry & home finance agencies 6.all households	raise gen. public awareness in order to reduce Rn health; inform health orgs in order to improve Rn massive measurements & once high Rn conc. detected introduce mitigation & also preventive actions
2.	Austria	Information (CD, leaflet) distributed to general public, policy makers, professionals & some schools without any order of importance	raise awareness in all the target audiences listed in Q20
3.	Belgium	1. Households in high radon areas (HRA) 2. Architects 3. Building industry 4.General public	Stimulate prevention/remediation activities, raise awareness
4.	Brazil	1. Governt. agencies with health protection responsibilities 2. national policy 3 General public	-
5.	Bulgaria	1.Governt. agencies with health protection responsibilities. 2.householders, high radon areas 3.Professional groups 4.General public 5.Building industry	raise awareness; reduce Rn health risks to demonstrate that Rn is a real problem to influence policy makers
6.	Canada	1.General public 2.Governt. agencies with health protection respons. 3.Households in high radon areas 4.Building industry 5.Professional groups	Raise public awareness and reduce population risk
7.	China	1.householders, high radon areas 2.Miners 3.Governt. Agencies 4.nat. policy makers	Raise awareness, motivate preventive action & remediation
8.	Czech Republic	1.national policy makers, governt. Parliam. 2.regional policy makers 3.house owners with higher Rn conc. 4.Building engineers, designers 5.General public	to reduce higher (highest) levels of Rn health risks; to stimulate Rn prevention & remediation practices; to raise general public awareness
9.	Ecuador	1.Governt. agencies with HPRs 2.NGOs 3. Building industry 4.universities 5.General public	influence policy makers with responsibility for public health
10.	Finland	1.Local Health Authorities 2.General public 3.Governt. agencies 4. Building industry	raise gen public awareness, stimulate Rn measurement activity, promotion of Rn mitigation activity, promotion of preventive practices of local authorities & bldng

No	Country	Q20	Q21
		5.professional groups	industry
11.	France	1. Local and central government agencies 2. builders	
12.	Georgia	1.nat. policy makers 2. households in HRAs 3.schools 4. Building industry 5.Associations of prof. groups 6.Home finance agencies 7.General public	No Rn risk communication activities are carried out in Georgia by local officials. Effort is made to communicate such info to target groups but effect is insufficient
13.	Germany	1.General public 2.households in HRAs 3.Associations of prof. groups such as med. doctors and teachers 4.Architects	To raise public awareness and reduce radon health risks
14.	Greece	1.General public 2.Nation. Policy Makers 3.Governt. agencies 4.Associations of prof groups 5.Households in HRAs	At present main concern is to raise general public awareness & to emphasise importance of testing for Rn especially in areas with higher indoor Rn conc.
15.	Ireland	1.General public 2.Governt agencies/Local Authorities 3.Media 4.employer groups 5.Medical groups 6.TUs 7.Schools	main objective of RPII's risk communication activities is to provide main objevtive of RPII's risk communication is to provide information to public, governt. & employers about risks from Rn (see attach for more details)
16.	Italy	1.General public 2.teachers and students 3.personnel of health authorities 4.Professional groups, associations	Raise awareness in gen. public and disseminate correct info on health risks
17.	Japan	1.General public 2.NPMs 3.Governt agencies with HPRs 4.Bldng industry	to raise gen public awareness; to avoid needless or excessive worry & panic of gen public
18.	Korea	1.Government agencies 2.Korea subway cooperation 3.academic circles 4.General public	to raise general public awareness to influence policy makers with a responsibility for public health to reduce radon health risk
19.	Kyrgyzstan	1.Households in HRAs 2.Schools 3.Doctors 4.Governt agencies with HPRs 5.General public	to raise gen public awareness; to stimulate Rn prevention & remediation activities
20.	Latvia	1.General public 2.All households 3.Building industry/home finance agen. 4.Professional groups, associations 5.Governt. agencies with health responsibilities	Raise awareness, motivate preventive action & remediation
21.	Lithuania	1.General public 2.Governt agencies with HPRs 3.Schools 4. Building industry	to raise general awareness
22.	Netherlands	1.General public 2.Prof groups	Stimulation of sound ventilation

No	Country	Q20	Q21
23.	Norway	1.General public /all households 2.Local Authorities (municip., counties) 3.Households in HRAs (by letters & local newspaper) 4.Medical doctors & Local Health Author. 5. Building industry	to raise public awareness & stimulate house owners to perform measurements, do remedial measures on existing bldngs & prevention measures in bldngs under construction
24.	Romania	1.Prof. groups such as medical doctors & teachers 2.National policy makers 3.Governt. agencies with HPRs 4. General public 5. Building industry	influence policy makers with a responsibility for health
25.	Russia	1.Governt. agencies with health protection respons. 2.national policy makers 3.Building industry 4.medical doctors, teachers	Raise public awareness
26.	Slovenia	1.national policy makers. 2.building industry 3.General public 4.households in high Rn areas 5.households in high Rn areas 6.medical doctors and teachers,	Raise general public awareness and reduce Rn health risks
27.	Spain	1.General public 2.Households in HRAs 3.Schools 4.Teachers 5.Governt. agencies	to raise gen awareness; to stimulate Rn prevention/remediation through the participation of local & national authorities
28.	Sweden	1.all households 2.policy makers 3. Local Authorities 4.bldng industry 5.real estate agents 6.politicians 7.measurement & remediation companies	to stimulate Rn measurements & remedial actions; to raise awareness of risks associated with Rn & smoking
29.	Switzerland	1.householders 2.architects & engineers 3.cantonal authorities 4.Local Authorities	to stimulate Rn measurement; to stimulate Rn prevention & remediation
30.	USA	1.consumers 2.homeowners, buyers, sellers 3.health-orient. non profit org & EPA partners 4.builders 5.state and local governt. Officials 6.Schools 7.Fed governt. agencies	To educate, make aware, motivate to test and fix/mitigate To reduce radon health risks
31.	UK	1.public 2.Enviviromental Health Offices 3.Governt. agencies 4.employers 5. Building /housing profs	raise awareness; reduce Rn levels

Q22 Type of material produced
Q23 Means used for dissemination

No	Country	Q22	Q23
1.	Argentina	leaflets, booklets	go to schools, PHOs & give lectures, co-ordinate measurements: when Rn measurement performed info leaflet with results given to house owner
2.	Austria	leaflets, CD	postal mail, internet
3.	Belgium	Leafleats, Brochures, Radon fact sheets, Website	Local information sessions, local authorities, internet
4.	Bulgaria	Overviews in newspapers, some technical journals; booklets	-
5.	Canada	Radon booklet for homeowners, Health Canada web publication	Governt. Website, radon displays at science events
6.	China	book, DVD, leaflets, posters	internet, newspapers, TV, radio, symposium or report
7.	Czech Republic	Rn bulletin issued 1/2 yearly for offices & gen public, booklets, leaflets, internet	by mail, phone & word of mouth, regional authority officers & radiation (Rn) protection inspectors & experts
8.	Finland	STUK info leaflets, internet, posters, Rn chapter in book on environmental radioactivity (available free on internet)	Rn campaigns, newspapers, press releases for radio, TV & newspapers, Bldng & housing fairs, indoor air info stands (~100 round the country)
9.	France	Information meetings for professionals	
10.	Georgia	no such material known	newspapers, internet
11.	Germany	Leaflets, booklets, internet	Leaflets, booklets, internet
12.	Greece	booklets, DVD, internet	newspapers, internet, seminars organised by architect associations
13.	Ireland	internet, info pamphlets & booklets aimed at public & employers, specific guidance on Rn in homes, schools & , workplace, radio, adverts in local media, regional public meetings in HRAs, nat. Rn forum, statutory/corporate reports, scientific publications	media news stories, TV& radio reports & interviews, internet, Rn roadshows in designated HRAs, mail shots in response to indiidual queries
14.	Italy	-	Newspapers, letters to families, public meetings
15.	Japan	-	internet, newspapers, symposium & public lectures for gen public
16.	Korea	booklets	newspapers & TV
17.	Kyrgyzstan	leaflets, posters, calendars	newspapers & TV
18.	Latvia	Radon book	Mass media, few radon and TV events
19.	Lithuania	book, booklets, DVD, leaflets	newspapers, TV, radio
20.	Netherlands	Internet, brochures	TV - spots, internet
21.	Norway	leaflets/booklets (gen info mat to members of public, specific info to home owners in HRAs & the bldng industry)	mail to houseowners in HRAs & to local authorities, press releases for local newspapers & TV - sometimes by presenting results of surveys by exclusive rights
22.	Romania	booklet with very poor dissemination	some newspaper appearance
23.	Spain	CDs, DVDs, leaflets & booklets	internet, TV, newspapers
24.	Russia	Practically nothing; popular lectures to	Newspapers

No	Country	Q22	Q23
		students, doctors; newspaper articles - usually from non-professionals simply to scare the public	TV channels very infrequently
25.	Sweden	booklets (found on internet as pdf files), books, posters, refrigerator magnets	info meetings; nat authorities invite local authorities, local/regional authorities invite to public meetings; articles in magazines; results in Rn articles in local newspapers, internet
26.	Switzerland	see questionnaire of May 2005	all depending on target groups
27.	UK	leaflets, booklets, posters, videos, newsletters, promotional products	mail, internet, Rn road shows, radio & TV interviews
28.	USA	Leaflets, books, posters, videos, magazines, Public Service campaigns (TV, radio, print media)	TV/radio public service directors, partnerships with health/consumer org., trade shows, consumer shows, health fairs, housing fairs

Q24 Evaluation of risk communication activities
Q25 Assessment of risk perception in population available

No	Country	Q24	Q25
1.	Argentina	N	-
2.	Austria	N	N
3.	Belgium	Y: Demand for more information on health effects, limits and technical advice at a local level	Y: Radon ranked as minor risk, Quite high knowledge about radon, Health is prior element of concern, followed by children For 70% of interviewed “something “ needs to be done about radon
4.	Brazil	N	N
5.	Bulgaria	N	-
6.	Canada	N	N
7.	China	N	N
8.	Czech Republic	N: communication system exists but has not been evaluated, is however been continuously adapted & touched up	Y: Rn well known among population, only 25% of respondents never heard of it. 75% of respondents convinced of dangers of Rn & 10% of them do not rightly know why (see additional info)
9.	Finland	Y: STUK has interviewed some LAs. Main finding: more Rn info through the channels they use & direct to authorities	will check some university publications
10.	France	N	N
11.	Georgia	N	N
12.	Germany	N	-
13.	Greece	N	N
14.	Ireland	N	Y: in Nov 2004 RPII commissioned survey of 1000 people to assess awareness of RPII & public concern of radiation/radioactivity in environment incl. Rn.(see additional info)
15.	Italy	N	N
16.	Japan	N	N
17.	Korea	N	N
18.	Kyrgyzstan	N	Y:population interested in this aspect, though people don't have enough info about Rn risks
19.	Latvia	N	-
20.	Lithuania	N	Y: much more interest including wishes to perform measurements is expressed
21.	Morocco	N	N
22.	Netherlands	Y, about ventilation. No findings given	Y, people not very concerned
23.	Norway	N	Y:letters to house owners & local info through local newspapers are the most important channels
24.	Romania	N	N
25.	Russia	N	-
26.	Slovenia	N	N
27.	Spain	N	-
28.	Sweden	Y: nat campaign in progress. First step with info meetings to LAs has proved successful. Local campaigns organized by LAs & RAs have resulted in increase in Rn measurements	N

No	Country	Q24	Q25
29.	Switzerland	Y-	Y: no Rn awareness
30.	UK	N	Y: half of households did not read leaflets about Rn; elderly, retired & higher income groups were more likely to be interested & the cost of remediation was a major deterrent
31.	USA	Y: focus group: people need to understand the connection between radon, health risk and simplicity/cost of mitigation	Y: Awareness fairly high, perception that "if it is dangerous, it should be regulated"; lack of understanding that main risk is from lung cancer

Annex: Original detailed questionnaire

World Health Organization

WHO International Radon Project
Questionnaire on RADON distributed to all WHO member states
SECTION 1
Guidelines for residential radon exposure

Organisation:
Country:
Contact Person:
Address
Phone number **Fax number** **Email**

(Tick relevant boxes with an X)

If additional space is required then forward additional A4 pages indicating which question your answer refers to.

Question 1: Is there any radon-related activity and/or any regulations or guidance material in your country that deals with radon gas in dwellings? (Radon activity may include measurement programmes, studies or surveys. Advice may be issued by your national or regional Regulatory Authority or Government Advisory Body on radiological protection).

Yes: ☐ No: ☐

if yes, please continue with the rest of this questionnaire

if no, there is no need to continue with the other questions. Please return the questionnaire and thank you taking the time to answer this question.

Comment [d1]: WHO recognises that, for a variety of reasons, many member states will not have policies dealing with radon gas in dwellings. If this is the case in your country it is still important to WHO that this is reported.

Question 2: Does your country have an Action Level for radon gas concentrations in dwellings? (An Action Level is a radon gas concentration above which your national or local Regulatory Authority or Government Advisory Body on radiological protection recommends that work to reduce radon concentration should be considered).

Comment [d2]: This question seeks information on the Action Levels in different countries. WHO need this to try reach a consensus on what an appropriate guideline might be for radon in dwellings.

Yes: ☐ No: ☐

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if yes, what is the recommended national Action Level(s) for radon in **existing** dwellings in your country: **(please indicate if this level is voluntary or compulsory)**

_____

Comment [d3]: There may be more than one Action Level in your country. For example Action Levels may exist at a regional or provincial basis. In this case give the range of Action Levels that are applicable in your country.

if yes, what is the recommended national Action Level(s) for radon in **dwellings under construction** (commonly called new dwellings) in your country: **(please indicate if this level is voluntary or compulsory)**

_____

Question 3 If the national Action Level in your country is compulsory please indicate the actions the householder is required to take when the Action Level is exceeded

_____

_____

Comment [d4]: This question seeks information on exactly what is required of the householder in those countries where there are enforceable Action Levels. This could be useful in deciding if it is worthwhile pursuing the idea of a maximum radon concentration above which remedial work is always necessary.

Question 3 a) How is this Action Level enforced and by whom?

_____

Please give details

_____

_____

Question 4: When action is taken to reduce radon levels in existing dwellings and in dwellings under construction (commonly called new dwellings), what target level is required or recommended? (A target level may be different from the Action Level. It is a radon gas concentration that should be met following remedial work to reduce the radon levels. Some countries have a target level for new dwellings. In these cases the target level is the radon gas concentration that should not be exceeded in new dwellings).

Comment [d5]: We know radon is a risk at levels below the Action Level. This question seeks information on how countries deal with this fact. This will help WHO decide if it needs to refer to target levels in its final document.

Existing dwellings

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Guidelines for residential radon exposure

Dwellings under construction (also referred to as new dwellings)

Question 5: Has your national, regional or local Regulatory Authority or Government Advis Body on radiological protection specified a radon concentration above which it **always justified** to take immediate action reduce radon levels in a dwelling. (This is different from the Action Level).

Comment [d6]: There may be a need to identify a radon concentration at which immediate action should be taken to reduce the levels. This question seeks the views of countries on whether they think it could be useful to have such a value.

Yes: ☐ No: ☐

if yes, (i) what is this level and

(ii) state the period of time within which it is required to reduce the levels

if no, has the introduction of a radon concentration above which it is always justified to take remedial action ever been considered in your country

Yes: ☐ No: ☐ Don't know ☐

Question 6: Are there building codes or regulations in your country, either applicable to th whole country or to local states, regions or municipalities, dealing with protec of radon in dwellings under construction? (also referred to as new dwellings)

Comment [d7]: Studies indicate that inclusion of radon preventive measures in dwellings under construction (also referred to as new dwellings) is the most cost effective way of dealing with radon into the future. These measures can also help reduce the average radon levels which should in turn help reduce the number of people exposed at radon levels below the Action Level.

Yes: ☐ No: ☐

if yes, have studies been carried out showing the impact of these building codes or regulations on the radon levels.

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Yes: ☐ No: ☐ Don't know ☐

if yes, is there evidence to show

a) the building codes or regulations are generally having a positive effect on the radon levels

b) the building codes or regulations are having no effect on the radon levels.

c) other please give details

Question 6 a) Is a radon measurement in dwellings under construction (also referred to as new dwellings) a mandatory requirement of your national or regional authority?

Yes: ☐ No: ☐

Question 7: When remedial work is **recommended** in a dwelling is the remedial work finance by:

Comment [d8]: Money is always an issue therefore it is important have some idea of how different countries address the funding of radon remediation

a) the householder only ☐

b) a state grant ☐

c) tax reductions ☐

d) other, please give details

Question 7a: When remedial work is **required or compulsory** in a dwelling is the remedial w financed:

Comment [d9]: See comment above.

a) the householder only ☐

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b) a state grant ☐

c) tax reductions ☐

d) other, please give details

_____

_____

Question 8: Is radon **required** to be considered in the buying and selling of **existing dwellings?**

Comment [d10]: If radon was considered during the buying and selling of dwellings then it is possible that at some future time all existing dwellings would be measured and remediated which could be a step toward reducing the radon risk to the population..

Yes: ☐ No: ☐

if yes: please give details

_____

_____

if no, has the introduction of a scheme which requires radon to be considered during the buying and selling of houses been considered?

Yes: ☐ No: ☐ Don't know ☐

Please give details

_____

Question 8 a):Is radon **required** to be considered in the buying and selling of **dwellings under construction** (commonly referred to as new dwellings)?

Comment [d11]: If radon was considered during the buying and selling of dwellings then it is possible that at some future time all existing dwellings would be measured and remediated which could be a step toward reducing the radon risk to the population.

Yes: ☐ No: ☐

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if yes: please give details

_____

_____

if no, has the introduction of a scheme which requires radon to be considered during the buying and selling of houses been considered?

Yes: ☐ No: ☐ Don't know ☐

Please give details

_____

_____

End of section 1

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SECTION 2
Overview of global Radon levels

Question 9):Based on available data, please give an estimate of the average indoor radon concentration across the entire population of your country (and not only for those in specific areas with higher radon levels?

Comment [h12]: To assess the overall burden from radon, it is important to get valid information about radon levels in as many countries as possible

a) Estimate is …….. (please supply report, reference etc.)

b) Estimate not available ☐

c) Estimate available only for specific areas* (= ……..)
* please describe and give an estimate of the population in these areas
……
……
……

Question 10): Is there an estimate of the coefficient of variation for repeat measurements made in the same home in different years?

Comment [h13]: The CEV is a measure of precision of an estimated average value. It is calculated by dividing the standard deviation calculated for repeat measurements by the mean of all measurements.
In some countries, this value will not be easily available but is most useful for the radon risk assessment. Please consult with radon measurement experts in your country.

Estimate is ……..% (please supply report, reference etc.)

Estimate not available ☐

Question 11): Which proportion of the population lives in houses with measured radon concentrations

Comment [h14]: In most countries only small populations live in houses with high radon levels. This information will help WHO to better quantify this proportion of the population.

above 100 Bq/m3 (or respective unit used in your country):……..%

above 150 Bq/m3 (or respective unit used in your country);……..%

above 200 Bq/m3 (or respective unit used in your country):……..%

above the National Action level (if different from above): ……..%

End of section 2

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SECTION 3
Measurement, mitigation and prevention

Question 12): What are the main types of detectors (charcoal, alpha track, E-PERM, etc.) used in your country for measurement of radon?

……
……
……

Comment [h15]: Different detectors may give different results, and therefore it is important to know what is most widely used at present

Question 13) Does your country have any written requirements for accuracy and precision for detectors sold within the country?

Yes: ☐ No: ☐

Comment [h16]: Such requirements help to assure quality of measurements, especially when there are many institutions and companies involved in radon testing.

Question 14): How would you weight the approximate relative importance of the following sources of indoor radon in your country (the total should equal 100%)?

- _____% Soil gas
- _____% Well water
- _____% Emanation from the ground
- _____% Other (please specify)

Comment [h17]: Radon in houses may come from different sources, and mi

Question 15): What is the relative prevalence of the following radon mitigation techniques i your country (the total should equal 100%)?

- _____% Active soil depressurization
- _____% Passive soil depressurization
- _____% Building pressurization
- _____% Water treatment
- _____% Source isolation
- _____% Other (please specify)

Comment [h18]: Several different techniques are available. WHO would like to know which are the most frequently used techniques, and if approaches vary in and across countries.

Question 16): Do these techniques vary by building type? If yes, please specify the two most common techniques.

- Residential
  - Most common: _____
  - Second most common: _____

Comment [h19]: See above

Question 16) continued

- Schools
  - Most common: _____

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_____

- Second most common: _____
- Other commercial and institutional buildings
  - Most common: _____
  - Second most common: _____

Question 17): Do you have standards or guidelines on radon mitigation and prevention in your country?

Yes: ☐ No: ☐

if yes: please give details or attach a copy of the guidelines

_____

_____

Comment [h20]: Existing guidelines will help WHO to draft recommendations based on current practices. Guidelines can be issued by e.g. the federal or regional government, by building authorities or radiation protection institutions.

Question 18) Are there specific guidelines or standards to reduce radon in new buildings?

Comment [h21]: See above

Yes: ☐ No: ☐

if yes: please give details or attach a copy of the guidelines

_____

_____

Question 19) Are you aware of any studies in your country that have examined the cost-effectiveness of policies concerning radon, such as home remediation?

Comment [h22]: Radon prevention and mitigation actions vary in effectiveness and in cost. To adequately inform e.g. home owners and authorities, knowledge on cost-effectiveness of different action is required.

Yes: ☐ No: ☐

If yes, please give references for any publications or reports

_____

_____

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SECTION 3
Measurement, mitigation and prevention

End of section 3

Question 20): Please list the target audiences for radon risk communication messages in your country in order of perceived importance
(i.e. the general public, government agencies with health protection responsibilities, national polic makers, all households, only households in high radon areas, schools, associations of professional groups such as medical doctors and teachers, home finance agencies, building industry etc)

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……

Comment [h23]: One of the main aspects of radon action is appropriate risk communication that takes into account the major target groups

Question 21): Please list the main objectives of the radon risk communication activities in your country
(i.e. to raise general public awareness and/or to reduce radon health risks and/or to stimulate ra preventative/remediation practices and/or influence policy makers with a responsibility for publi health etc.)

……
……
……

Comment [h24]: For a practical WHO recommendation it will be helpful to know which objectives are most important for national risk communication strategies.

Question 22) Please give a list of the type of material produced in your country to communicate radon risk messages
(i.e. leaflets/booklets, posters, videos, CDs, DVDs , promotional products such as stickers etc) .

……
……
……

Comment [h25]: A large variety of materials has been used in the past. For countries considering to start new programmes an overview of available material is essential.

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Question 23): Please indicate the means used to disseminate radon risk messages.
(i.e. by mail, newspapers, TV channels, radon roadshows etc.).

Comment [h26]: See Q 19

.....
.....
.....

Question 24): Have specific radon risk communication activities carried out in your count been evaluated?

Comment [h27]: We would like to learn which are the best ways to communicate radon risks and propagate actions. Evaluations can yield such information.

Yes: ☐ No: ☐

if yes: What were the main findings?

.....
.....
.....

Question 25):Has the existing perception of and attitude to radon risks of the general population in your country been assessed?

Comment [h28]: Often radon seems not to rank high on the agenda of perceived health threats: it is invisible, causes long-term health consequences etc. Is there specific information available in your country.

Yes: ☐ No: ☐

if yes: What were the main findings?

.....
.....
.....
.....

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Measurement, mitigation and prevention

Finally we would like to ask you for some further contact information. Please use a separate page if required.

a) Please name and give contact details of the official organisation(s) in your country with primary responsibility for radiological protection aspects of radon exposure of the public.

……
……
……
……
……
……

b) Please provide contact information for the laboratories, as well as the contact person, in your country that are responsible for calibration of radon detectors.

……
……
……
……
……
……

Many thanks for taking the time to complete this questionnaire.
Please tick the box if you would be interested in a feedback on the survey results

☐

Please return it to the WHO address given below, with a copy to the WHO country or regional office from where you initially received the questionnaire

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