RADPAR WP 5

Deliverable D 12

September 2011:

Report:

Radon Risk Communications Strategies

This publication arises from the project Radon Prevention and Remediation (RADPAR) which has received funding from the European Union, in the framework of the Health Programme.

Contents

1 INTRODUCTION

Based on current scientific evidence radon is classified as a Group 1 human carcinogen by IARC. It has been estimated that exposure to radon is implicated in approximately 20000 deaths from lung cancer each year in EU Member States (R). To reduce the EU public health burden from radon an integrated radon policy and strategy is required. An important component of such a strategy should be a radon risk communication strategy directed both at the public and also at decision makers at local and national level. Work Package 5 (WP5) of the RADPAR project gathered and analysed information on existing radon risk communication activities in both EU and in two non-EU European countries. It also was involved in a number of radon awareness surveys. Based on this work WP5 has developed a number of recommendations aimed at improving the effectiveness of radon risk communication (see 5 below). These will be submitted to radiation protection authorities and other relevant public health agencies in both EU and some non-EU countries for their consideration and comments. In this report the work of WP 5 and its recommendations are described.

2 RISK COMMUNICATION PRINCIPLES

In order to place radon risk communication in context a description of some of the key principles of risk communication should be considered. In communicating radon risk information to the general public (or to policy and decision makers) there are in general two main objectives:

(a) to give accurate and comprehensible information in clear and simple messages on both the likelihood and severity of the harm from radon exposure and

(b) to stimulate action to prevent or reduce radon exposures.

Experience gained in the communication of risk to the public from other hazards has led to a development of a number of risk communication principles which could usefully adapted into radon risk communication activities. Good examples of these (based on Covello, V. and F. Allen (1988), *Seven Cardinal Rules of Risk Communication*, Washington, D.C.: U.S. Environmental Protection Agency, Office of Policy Analysis). are as follows:

1. Accept and involve the public as a legitimate partner
2. Plan carefully and evaluate your efforts
3. Listen to the public's specific concerns
4. Be honest, frank and open
5. Coordinate and collaborate with other credible sources
6. Meet the needs of the media
7. Speak clearly and with compassion

Interactive risk communication involving two-way communication pathways have been found to be generally more effective than one-way communication. As recommended in Chapter 3 below, such two-way communication in the case of radon can be achieved by the use of Roadshows, Radon Forums etc. Unlike in the case of many other environmental hazards there exists public apathy towards

radon risks. The reasons for such apathy are many. Indoor radon exposure is usually perceived as completely natural with no one to blame. This perception of indoor radon exposures as natural is erroneous as indoor radon levels are artificial being largely the consequence of the human activities of building design, construction and usage. The sources of radon ultimately are geological and as such are natural but high indoor radon exposures are not. As it is colourless, odourless and does not seem to cause any obvious visible health effects radon is low on the scale of concern for the public. Carbon monoxide is also colourless and odourless but for this gas exposure to high levels can result in almost immediate death. Such deaths are well documented in the media which helps to heighten public awareness and its acceptance that action against this hazard is necessary. In the case of radon there are no obvious "dead bodies" and the lung cancer caused by radon exposure, if it occurs, will be many years in the future. Resulting from these and other related aspects of human perceptions to overcome public apathy towards radon presents considerable challenges to the design of an effective risk communication strategy.

The actual communication strategy chosen in a country will depend on a number of factors such as the extent of the radon problem in that country (if it is known), the present state of public knowledge of radon, the available budget, the existence of a national radon reference level and the national building codes. Because of the variability of these factors it cannot be expected that a single radon risk communication strategy will be equally applicable or effective in all countries. It should also be noted that in many EU Member States radon risk communication activities evolved in a heuristic fashion quite often as a response to the accidental discovery of high radon dwellings. In WP 5 information on these activities in a number of countries was gathered and analysed in order to produce a set of recommendations aimed at improving the effectiveness of existing risk communication activities. It is hoped that these recommendations will be of particular use to Member States who have not yet developed a national radon policy. These WP 5 recommendations together with those from other RADPAR Work Packages will be sent to the relevant authorities in all EU Member States for their consideration and comments.

3 RECOMMENDATIONS TO IMPROVE RADON RISK COMMUNICATION

Based on the work of WP 5 and the responses obtained from radiation protection and public health authorities the following radon risk communication related recommendations should be made to agencies concerned with the reduction of radon exposure and associated risks to the public in EU Member States:

3.1 Radon Awareness Surveys (RAS) should be an essential component of a risk communication strategy

Radon Awareness Surveys (RAS) should be an essential component of a risk communication strategy both at the planning stage of communication campaigns and on a continuous basis. As the report on the comparison of different European Radon Awareness Surveys (see Chapter 5 below) clearly shows there are wide variations throughout Europe in public knowledge of radon. If a radon risk communication campaign is being considered it is therefore almost self-evident that the existing state of awareness in the public or other target audiences should be first determined by means of a RAS. The knowledge and insight gained by such an exercise will be of assistance to the design of the campaign. A RAS should also be carried of the same target audiences after the communication campaign to assess its effectiveness. This will be of assistance in improving any future campaigns.

3.2 Identify target audiences and tailor communication information accordingly

Apart from the general public (especially home owners) elected representatives (politicians) and other decision makers should be key target audiences. In particular this could be important at local government (municipality) level where, in many countries, decisions on planning and house construction could include specifications aimed at prevention of high radon levels in future housing. Where decision makers at local government level have a responsibility for ensuring healthy living conditions in homes under their control they should be a target audience to encourage a programme of radon measurement and remediation where necessary. In some countries targeting radon information at locally elected representative has been shown to be quite effective at stimulating action against radon.

3.3 Keep messages simple but accurate in particular when communicating with the public

A number of simple core messages, preferably non-quantitative, on radon risk and its control should be established and used in all communication campaigns. The following list of radon risk core messages given in the WHO Handbook on Indoor Radon 2009 are good examples of these:

- Radon is a radioactive gas present in homes.
- Radon causes lung cancer

- Radon is easy to measure.
- You can easily protect your family from radon.

Messages (a) and (b) in a simple way inform the public that there is a health risk from radon in their homes. Further non-core messages can elaborate on these by informing the public of such facts that radon is natural, where it comes from, how it may enter and accumulate in indoor spaces, that the risk increases with the radon concentration and duration of exposure, that the combined effects of smoking and radon exposure are much greater than simply adding the individual risks etc etc.

Messages (c) and (d) meant to stimulate action against radon by pointing out it is easy to measure radon in homes and to protect against it. Experience gained by the USEPA shows that putting emphasis on protecting the family from health hazards is much more effective in encouraging action against the hazard than emphasising protecting oneself.

3.4 Appropriate communication channels should be used to communicate information

Within the context of the national radon strategy some or all of the following channels should be considered. For a basic information platform websites and information brochures have to be provided. Most successful to support a campaign are articles in health related magazines. As an general support the mailing of information brochures, advertising in newspapers and magazines, radon phone-in helpline, stands at public and construction trade exhibitions, press releases, radio and TV popular science programmes etc. can be recommended. Trained radon mitigators and other construction professionals can also act as secondary channels of communication.

3.5 Radon Focus Groups and attention to regional chrateristics should be used to assess and improve communication effectiveness

Focus Groups are where discussions with and interviews of a representative selection of the public take place on the effectiveness of a risk communication campaign. This typically would take place in a region where high radon concentrations had been found. All aspects of the campaign can be discussed such as an evaluation of information on radon given in brochures, posters, help lines etc. An important objective of a focus group is to try to determine the barriers that exist in the minds of the public in regard to carrying out a radon measurement and taking remedial action in their homes when it is recommended. In addition possible measures to reduce radon must be adapted to the local circumstances as shown in Chapter 5. RADPAR recommends to national authorities that such strategies to improve the effectiveness of radon risk communication should be included in their National Radon Policy**.** In addition national radon risk communication activities should be a regular topic for discussion in countries where a Radon Expert Group has been established.

Example: Focus Group meeting in a high radon area in Ireland (see National Radon Forum 2010 presentations at www.rpii.ie). This was carried out by the national radiation protection authority (RPII) using a professional marketing company. One of its main findings was that there were complex processes of rationalization and justification used by the public on not to take action on radon (either to measure or to remediate). The reluctance to take action was found to depend on how seriously the risk from radon was perceived. Other factors involved were the perceived cost and practicalities (disruption etc) involved in remediation. Suggestions from the public were given for improved methods

of risk communication such as using respected channels like medical practitioners, pharmacists, schools and local media. Holding annual National Radon Forums and Radon Roadshows are other strategies to help improve radon risk communication either nationally or in a specific community with a radon problem. (As an example both of these approaches have been used for nearly a decade in Ireland and in some other EU Members similar risk communication initiatives are used.)

3.6 Dissemination of radon risk information should be endorsed by well known national and local health and environmental agencies

This recommendation is aimed at improving the credibility of the disseminated information as quite often while the public may know and trust their local health agency they may not have such opinions (or indeed any opinions) regarding the credibility of the central government agency responsible for radiation protection. At its simplest level this endorsement could take the form of having the logos of such agencies on all radon information brochures etc. Stronger forms of such endorsement should be considered such as having speakers from these other agencies at local and national Radon Forums.

3.7 If possible radon information campaigns shouldbe linked to other health or environmental campaigns

One possibility are public health information campaigns which are aimed at reducing smoking and in improving indoor air quality. Radon exposure is recognized by the European Commission and international bodies such as the WHO and IAEA as an important public health issue. It would therefore appear sensible for policies and strategies aimed at the control of indoor radon exposure to be linked to other public health initiatives aimed at reducing risks to the public from the inhalation of other indoor airborne pollutants.

As the principal health hazard of radon exposure can be lung cancer and as the epidemiological evidence is convincing that a synergism exists between smoking and radon exposure it seems sensible to link radon control strategies with those aimed at reducing tobacco smoking. A simple explanation of the synergy with smoking is important to include in information disseminated on this aspect of the risk from radon exposure. It may be a useful option to make the actual risk estimates for smokers and non-smokers for various radon concentrations available in a simple table.

Another approach is to link radon to green building labels, as these labels already focus on different indoor air quality and building standards. Radon could so easily be integrated into existing standards.

3.8 The services of a good professional marketing company should be used in the design and execution of radon communication campaigns

The many confusing statements released directly to the public by scientists from official bodies in the aftermath of radiation accidents in the past such as those at Three Mile Island and Chernobyl and more recently at Fukushima show clearly that specialist scientists are not always the best communicators of risk information. In the case of these accidents the public were fearful and the risks involved were often exaggerated in their minds by confusing information both from specialist scientists and the media. In the case of radon it is almost the opposite situation where, for a variety of reasons, it is difficult to persuade the public that exposure to radon can cause a serious risk to health and that

prevention and remedial actions are possible and cost effective. Such attitudes leak to apathy and inertia to take any action. Professional marketing companies are likely to have more success in overcoming public apathy towards the radon problem and in motivating action against it than are professional scientists.

3.9 Educate health officials, professional groups and the media regarding radon, its risks and its control

Establishing links with respected individuals in professional groups (such as medical, teaching and the construction industry representative bodies) and also with the media is important. Keeping these individuals and groups informed and educated on developments in the radon field (epidemiology, preventative and remediation construction technologies, reference and action level recommendations and legislation) should in effect help to form an additional channel of communication and approval for a national radon control strategy.

3.10 Regularly assessment of information campaigns on radon

Information campaigns on radon, whether directed at the public or decision makers, should be regularly assessed and repeated (again and again and again …) over many years.

3.11 Stakeholders

To support a campaign partners (**stakeholder** approach) should be integrated. These are medical doctors, pharmacists, home inspectors and architects. To raise their knowledge special training courses should be developed and offered.

3.12 Additional concepts from a health marketing approach

To change behaviour the classical risk communication approaches of "knowledge and attitude" not only have to be considered but also offers for a appropriate incentives to stimulate the public to take action. Feedback should be an essential component of such measures. . By these means a good **risk communication** lays the basis of a change of the behaviour (see also Chapter 5). Next to basic knowledge about radon central messages on health effects should focused on the health of (own) children. EXISTING RADON RISK COMMUNICATION ACTIVITIES IN SOME EUROPEAN COUNTRIES

In order to assess existing strategies RADPAR Master Questionnaires (MQs) were distributed to agencies with radiation protection responsibilities in all EU Member States, Norway, Switzerland and in a number of other countries. Completed MQs from 29 Countries (20 EU, Norway, Switzerland and from seven other countries) were returned. An overview of the present state of radon risk communication activities in 22 of these countries was obtained from the responses given mainly in Section C of the returned MQs (see Appendix). The following table summarises the information of relevance to radon risk communications in these countries.

Table of information relevant to radon risk communication selected from completed RADPAR Master Questionnaires from EU and RADPAR Partner Countries

Country	National Survey Status	Mean Radon Bq/m^3	Risk Communication Campaigns	Linked to other Public Health Actions	Radon Awareness Surveys	Estimated Percent Aware of Radon and its Effects
Austria	C,PW	102	Y,GP	N	P	0-25%
Belgium	C,GE+GL	52	Y,GP,D,PG	N	Y,NA,R,M	0-25%
Bulgaria	P	--	P for GP,D,PG	--	N	--
Czech Rep	C, GE	118	Y, GP,D,PG	N	Y,NA	50-75%
Denmark	C,GE,PW	77	Y,GP,PG,NA,R,M	N	N	------
Estonia	C,GE	102	Y,GP,D,M	N	Y,M	0-25%
Finland	C,PW	96	Y,GP,D,PG,NA,R,M	N	P	50-75%
France	C	90	Y,GP,D,PG,R	N	---	---
Germany	C,GE,GL,PW	49	Y,GP,D,PG,NA	N	C	25-50%
Greece	IP,GE	80	Y,GP,PG,NA	N	Y,M	25-50 %
Hungary	IP,GE,GL	93	N	---	N	0-25%
Ireland	C, GE	89	Y, NA,R, GP,D	Y	Y, NA, R	75-100%
Lithuania	C,GL,PW	55	Y,GP,D,PG,NA,R,M	N	N	0-25%
Malta	P	---	N	---	N	---
Norway	C,GE,GL,PW	88	Y,GP,D,PG,NA	N	Y,NA	75-100%
Portugal	C,GE	62	IP,GP,R,M	N	N	0-25%
Spain	C,GE	82	Y,GP,D,PG,NA,R,M	N	P	0-25%
Switzerland	C,GE,GL,PW	75	Y,GP,D,PG,NA,R	N	Y,NA	25-50%
United Kingdom	C,R	21	Y,GP,D,PG,NA,M	Y	N	----

Key to table: Y: Yes, N: No | C: Completed, P: Planned, IP: In Progress | GE: Geographical, GL: Geological, PW: Population Weighted | NA: National, R: Regional, M: Municipal | GP: General Public, D: Decision Makers, PG: Professional Groups

It is interesting to note that RAS (radon awareness surveys) have been carried out only in 8 of the countries listed in the table. Many studies and reports (such as that of the WHO International Radon Project 2009) recommend that both to assist in the design of a radon risk communication campaign and to assess its effectiveness a RAS of the target audience(s) should be made both before and after the campaign. **Therefore RADPAR recommends this approach to the relevant authorities in EU Member States (see Section 3).**

4 REPORT ON THE COMPARISON OF DIFFERENT EUROPEAN RADON AWARENESS SURVEYS.

NOTE: This report and the analysis contained therein was made as a WP 5 task by RADPAR partner Dr Dieter Schlesinger, BfS (Federal Office for Radiation Protection, Germany)

References

BfS – Federal Office for Radiation Protection (2011a): German risk awareness survey 2011. Munich.

BfS – Federal Office for Radiation Protection (2011b): Radon in buildings. URL: http://www.bfs.de/en/ion/radon/radon_in_haeusern.html

Bochicchio, Francesco (2011): Health burden from radon to the EU population. Internal Report. Roma.

FOPH – Federal Office of Public Health (2009): Wissensstand der Schweizer Bevölkerung über Radon im Jahr 2008. Bern.

FOPH – Federal Office of Public Health (2011): Radon risk in Switzerland. URL: http://www.bag.admin.ch/themen/strahlung/00046/11952/index.html?lang=en

IBES – International Bureau for Environmental Studies (2011): Survey about radon knowledge in the municipality of Genappe (Belgium). Brussels.

NRPA – Norwegian Radiation Protection Authority (2008): What do people know about radon? Translated into English by Will Standring. Østerås.

RADPAR (2011): Answered Master Questionnaires. URL: http://web.jrc.ec.europa.eu/radpar/

SURO – National Radiation Protection Institute (2011): Radon Awareness Study 2010 in the Czech Republic. Prague.

UOWM (2011): Radon Awareness Survey in Kozani, Greece. UOWM – University of Western Macedonia. Kozani.

WHO – World Health Organization (2009): Violence and Injury Prevention and Disability (VIP).Country profiles. URL: http://www.who.int/violence_injury_prevention/road_safety_status/en/

WHO – World Health Organization (2011): WHO report on the global tobacco epidemic 2011. Warning about the dangers of tobacco. Geneva.

Summary

The aim of this report is to analyze the risk awareness surveys carried out in different European countries (Belgium, Czech, Republic, Germany, Greece, Norway, and Switzerland) to provide relevant recommendations for future radon strategies and to identify useful indicators that have an influence on the radon strategies.

Analysing the **knowledge of radon** it can be stated that the public from countries with an established national radon strategy have a higher knowledge than in countries without such a strategy. Throughout all surveys it is perceived that radon can harm health (**health effects**). It is generally perceived that not only lung cancer but all kinds of cancers are expected to occur through exposure to radon. This is at variance with the scientific consensus which so far has established that radon exposure only increases the risk of lung cancer. Cultural differences in evaluating the radon risk can be attributed to regional smoking behavior. Countries with a higher percentage of smokers tend to rather underestimate the radon risk. In addition to this the harm from radon is rather underestimated in comparison with other risks. In general is seems so that the knowledge of possibilities and the willingness to get into action for **radon measurement and control** are also positively correlated with the existence of established risk communication strategies. To identify the willingness to pay for these measures further survey should be carried out. The cost for a radon-measuring-kit seems to be roughly 0,16% of the national GDP. Relevant **stakeholders** for risk communication campaigns are from a health perspective medical doctors and pharmacists and from a real estate perspective home inspectors and architects.

Central Observations from the RAS results

- Risk communication raises the information level and helps to change behaviour.
- In general the facts about radon have to be continuously communicated and efforts have to be made to put radon in the "right place", as e.g. radon is seen as a "rural" problem.
- The public may know about the severe health effects from radon, but this risk in comparison with other risks is underestimated; Future risk communication strategies could focus on this aspect.
- Possible measures to reduce radon must be adapted to the local circumstances, as it seems that the public in some countries (e.g. in Germany) would rather pay a higher amount for remediation work by experts and in other countries (e.g. in the Czech Republic) they rely more on friends and their own work.
- A Stakeholder approach should focus on medical doctors, pharmacists, home inspectors and architects.

4.1 Radon Awareness Survey (RAS)

The basis for the analysis (= theoretical background) of the RAS was laid by the "**General Radon Awareness Survey Questionnaire**" developed by Dieter Schlesinger (BfS, Germany), Ivana Fojtikova (SURO, Czech Republic), James Mc Laughlin (UCD, Ireland) and Krystallia Kalimeri (UOWM, Greece) and which is attached in the Appendix. **The survey is used as the guide for the analysis and the recommendations, as the questions were designed to address the most relevant factors regarding the public perception of the radon problem.**

The aim of a **RAS-Questionnaire** is to provide information by means of a survey to assist in the development of strategies for the reduction of the health burden from radon. It helps to identify the state of knowledge of the general population (and in addition of the relevant stakeholder groups that should be integrated in a radon strategy) on radon, general risk perception and perceived effectiveness of radon control measures. The survey is divided into sections dealing with "knowledge of radon", "health effects", "radon measurement and control" and "stakeholders".

The data base was provided by the following countries (Table 1). The comparison of the material from the different countries had to be done very carefully. This was because on a country to country basis as on the one hand **different questions** were asked and on the other hand the **regional spread** and the **representativeness** are on **different scales.** As no survey is older than 5 years it is considered that the timescale should be good enough for comparison.

Table 1: RAS data basis; Source: different national RAS and RADPAR 2011

	Organisation **	Survey Year	Number of Participants	Representative	National Average Radon Concentration Bq/m^3	National indoor radon control policy and strategy	National Action/Reference level in Bq/m^3	National Rn risk communication campaign
Belgium	IBES	2011	71	✗	52	✓	400 (rec.)	✓
Czech Republic	SURO	2010	1000	✓	118	✓	400 (rec.)	✓
Germany	BfS	2011	1300	✓	49	✗	/	✓
Greece*	UOWM	2010/ 2011	75 & 80*	✗	80	✗	400 (rec.)	✓
Norway	NRPA	2008	2851	✓	88	✓	100 (rec.)	✓
Switzerland	FOPH	2008	800	✓	75	✓	1000 (man.)	✓

rec. = recommended; man. = Mandatory

* Two surveys with 75 (Greece 1) and 80 (Greece 2) participants from the City of Kozani

** Federal Office for Radiation Protection (**BfS**), Germany; Federal Office of Public Health (**FOPH**), Switzerland; International Bureau for Environmental Studies (**IBES**), Belgium; National Radiation Protection Institute (**SURO**), Czech Republic; Norwegian Radiation Protection Authority (**NRPA**), Norway; University of Western Macedonia (**UOWM**), Greece.

As a reference point the representative German results can be used as Germany has just started building up a radon communication strategy and probably has in terms of the national average indoor level the lowest overall risk of the countries listed in the above table. Thus the results should give an impression for the early phase of a national indoor radon control policy and strategy.

The Czech Republic, Switzerland and Norway provide examples of representative information for countries with a developed national indoor radon control policy and strategy, due to their – on average – higher radon risk. The Belgium and the Greece surveys are not representative for their countries as in Belgium they have been carried out in a radon prone area of the country and in Greece in a small provincial city. The participants of the Belgium survey were in addition well informed, as they had already taken part in an information event. The Greece surveys 1 and 2 show the short time effect of informing the public through the media, as the second survey was carried out after the local media made some reports on a radon survey that had been conducted in schools in the area in the time period between the two surveys .

The detailed results of each of the **different national RAS** is or will be published by the national agencies (BAG 2009; BfS 2011a; IBES 2011; NRPA 2008; SURO 2011; UOWM 2011). The results according to the Master RAS questionnaire are attached in the appendix.

4.2 Results

4.2.1 Knowledge of radon

Comparison of the German and Czech results indicated, that **an established radon strategy raises the awareness of radon** (Table 7). In addition it seems, that the public has with increasing information a better understanding of the characteristics of radon (e.g. natural origin, radioactive, tasteless etc.) and its appearance (in cellars) (Table 8 and Table 9). It is interesting to note, that the participants see radon as a "rural" problem and that they think that city dwellings are not so affected as those in rural areas.

It can also be stated, that the regional (geographical) knowledge is quite good. This result is just slightly affected through the undertaken radon communication efforts as table 2 and figure 1 and 2 show.

Table 2: Geographical knowledge of the radon appearance; Source: different national RAS

	Region	Germany	Switzerland
①	Alps	Karwendel 34%	Graubünden 58%
②	Alpine foothills	Münchner Schotterebene 26%	Tessin 54%
③	Central mountains	Erzgebirge 63%	Juragebiet 55%
④	Rivers and seas	Rheintal 13%	Genfer See 28%
⑤	Plains	Lüneburger Heide 14%	Mitteland 28%
⑥	Coasts	Ostfriesland 6%	/

Figure 1: Map of the geographical distribution of indoor radon in Germany; Source: BfS 2011b

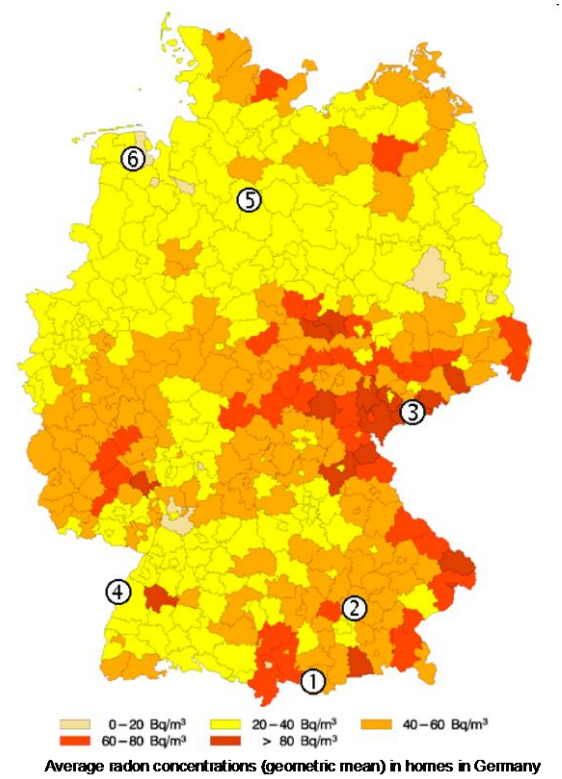
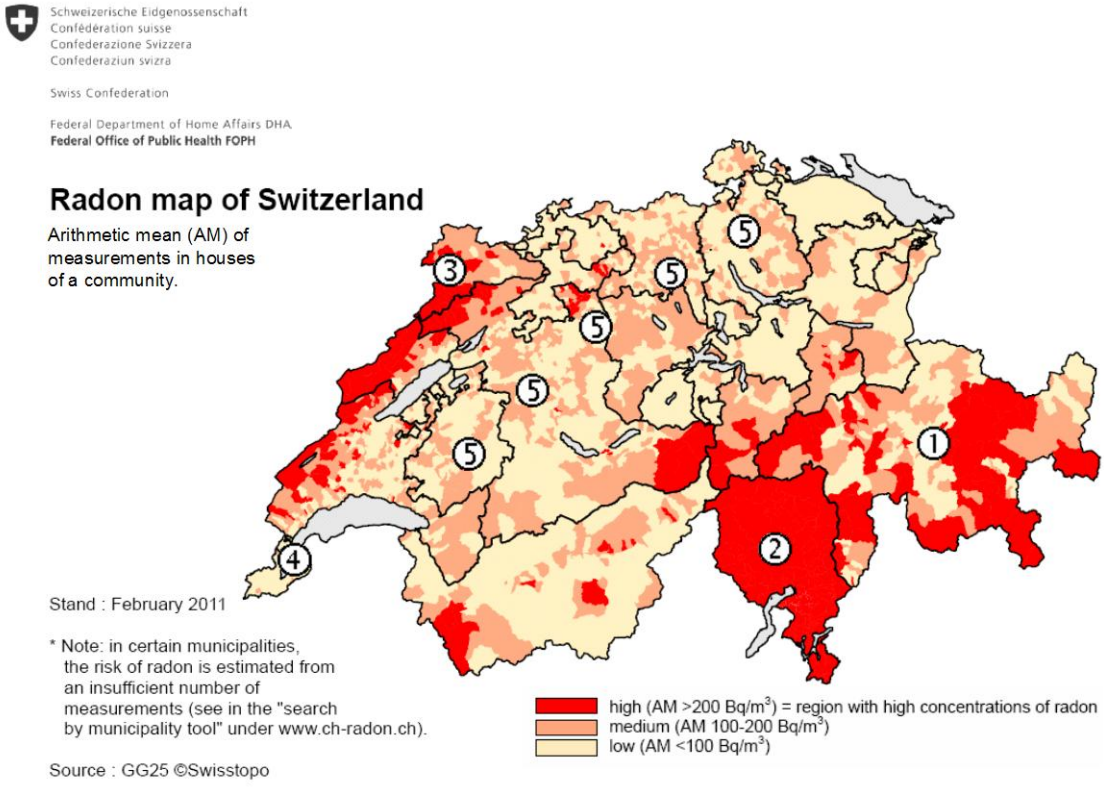


Figure 2: Map of the geographical distribution of indoor radon in Switzerland; Source FOPH 2011



4.2.2 Health effects

Throughout all surveys the majority of participants considered that **radon can harm their health** (72% to 95%), with just slight country differences (Table 11). The expected health problems induced by radon are mostly **lung cancer** followed by migraine. In Germany leukaemia is seen mostly as the main health effect. This is also stated by the Norwegian survey which puts cancers in general at first place (Table 12).

The scientifically established synergistic **link between health effects of combined exposure to radon and smoking** was also seen by the public, but the perceived strength of this link roughly correlated with national smoking rates as Table 3 shows. Countries, however, with a higher percentage of smokers rather tended to play the risk down.

Table 3: Links between smoking and radon; Source: different national RAS and WHO 2011: 100

	Germany	Czech Republic	Belgium	Greece 1	Greece 2
Yes	78%	72%	61%	16%	38%
No	10%	17%	8%	8%	5%
Maybe	11%	11%	21%	40%	46%
Percentage of daily smokers	25%	27%	21%	49%	
Percentage of smokers (men)	33%	43%	30%	63%	

For risk communication campaigns it can be helpful to compare **information about the unknown risk** (e.g. radon) with known risks (e.g. number of death due to traffic accidents) to show the importance of the topic. As you can see in Table 4 the participants are more or less guessing. Only in Germany the direction of correlation is more or less correct.

Table 4: Risk comparison between traffic fatalities and radon; Source: different national RAS, WHO 2009 and Bochicchio 2011: 26

	Germany	Czech Republic	Greece 2	Greece 1	Belgium
far higher	3%	6%	0%		11%
higher	14%	7%	1%		11%
almost the same	11%	16%	3%	**12%**	**78%**
less	**51%**	24%	**5%**		
far less	21%	**34%**	1%		
road traffic fatalities (2006/2007)	4.949	1.222	1.657		1.067
Additional lung cancer cases	2.904	878	495		469

*Shaded columns show the correct direction of the correlation. Bold values show the most chosen answer.

Next to the general comparison of risks, also the risks of a certain field of interest (e.g. radiation) can be compared. In this case the **risks for public health by radiation** from radon were compared with that from regular nuclear power generation (Table 15). Mostly the risk from nuclear power generation

is overestimated. With higher efforts in risk communication the knowledge in this field should get better.

4.2.3 Radon Measurement and Control

These radon risk awareness surveys show that over 90% of the participants know (or guess) that it is **possible to measure radon in homes** (Table 16). Besides this a far lower percentage also knows **how to get a radon test done** (Table 17). Again it can be stated that an established risk communication raises the knowledge (e.g. Germany 8% to Czech Republic 25%).

Asked for **organizations that can help with** a radon test, regional differences appear (Table 18). In Germany government agencies (e.g. BfS) are put in first place and in Greece the research centers. Unfortunately these results could depend on the surveys itself, as the German survey was carried out by the BfS and the Greece survey by the University of Western Macedonia. Despite this in both cases private companies are voted as a good partner by roughly 25% of the participants.

Depending on the undertaken national risk communication efforts the participants appeared more likely to **get a radon test done** and to **reduce a high radon level** in their homes. These results state the importance of the communication strategy, as this field is very important to achieve measurable effects in reducing the health burden through radon (Table 20 and Table 21).

To establish an economically viable radon measurement service it is necessary to know the sum the participants are **willing to pay**. Comparing Germany and the Czech Republic the acceptable price for a test kit is roughly 0.16% of the national Gross Domestic Product (GDP) (Table 5). The costs to **reduce radon** to an acceptable level in a typical home are provided in

Table 6. Unfortunately the spread of values is far higher than those of the "Willingness to pay for radon-measuring-kit". This appears to be due to different cultural effects. It seems that e.g. the people in Germany are rather prepared to pay a higher amount for a remediation through experts and e.g. in the Czech Republic the people rely more on friends and their own work. Above this the calculated values can help to design the categories for the RAS question "How much do you think it might cost to reduce radon to an acceptable level in a typical home?". E.g. the Greek surveys show, that the calculated median and quartiles are clearly lower as the given categories in the survey. Therefore the categories could be changed to "<50€", "50€-100€" ">100€".

Table 5: Amounts willing to pay for radon-measuring-kit; Source: different national RAS and WHO 2009

	Germany	Czech Republic	Greece 2
Mean	103 €	35 €	*≈ 65 €**
Median	50 €	20 €	*≈ 33 €**
GDP	28.635 €	13.000 €	20.761 €
% of GDP (Mean)	0,36%	0,27%	*≈ 0,31%**
% of GDP (Median)	0,17%	0,15%	*≈ 0,16%**
Willing to pay?	68%	79%	84%

** calculation see Appendix. GDP = Gross Domestic Product.*

Table 6: Willingness to pay for radon remediation measures; Source: different national RAS and WHO 2009

	Germany	Czech Republic	Switzerland	Greece 2	Belgium
Mean	6.174 €	481 €	≈ 2.743 €*	≈ 688 €*	≈ 1.311 €*
Quartile 25%	500 €	5 €	≈ 422 €*	≈ 8 €*	≈ 271 €*
Median	2.000 €	46 €	≈ 1.737 €*	≈ 73 €*	≈ 1.119 €*
Quartile 75%	6.000 €	460 €	≈ 5.793 €*	≈ 735 €*	≈ 3.733 €*
GDP	28.635 €	13.000 €	47.330 €	20.761 €	30.498 €
% of GDP Q 25	1,75%	0,04%	≈ 0,89%*	≈ 0,89%*	≈ 0,89%+
% of GDP Q 50	6,98%	0,35%	≈ 3,67%*	≈ 3,67%*	≈ 3,67%*
% of GDP Q 75	20,95%	3,54%	≈ 12,24%*	≈ 12,24%*	≈ 12,24%*
Further Information; Evaluation of remediation costs			16% low ... 51% normal ... 29% high ... ... costs	27% < 100€ 59% 100-500€ 5% > 500€	50% < 500€ 27% 500-2000€ 22% > 2000€

** calculation see Appendix. GDP = Gross Domestic Product.*

4.2.4 Stakeholder

Relevant stakeholders to support risk communication campaigns are from a health perspective medical doctors and pharmacists and from a real estate view home inspectors and architects as they are trusted most (Table 23 and Table 24).

4.3 Appendix

4.3.1 Master RAS

RADPAR
Radon Prevention and Remediation

RADPAR is a project funded by the
European Commission Directorate-General for Health and Consumers (DG SANCO)
http://web.jrc.ec.europa.eu/radpar

October 2010

TO WHOM IT MAY CONCERN

General Radon Awareness Survey (RAS) Questionnaire

The aim of a RAS is to provide information by means of a survey to assist in the development of strategies for the reduction of the health burden from radon. This **RAS-Questionnaire** helps to identify the state of knowledge of the general population (and in addition of the relevant stakeholder groups that should be integrated in a radon strategy) on radon, general risk perception and perceived effectiveness of radon control measures.

The primary target groups for the results of these surveys are national agencies which wish to gather substantiated information concerning radon, to assist them develop their radon strategy. Therefore in addition to the questionnaire we will also establish a **database**, which will provide the results from already completed surveys.

Please feel free to adjust the questionnaire, e.g. to put additional questions into the questionnaire. Some existing questions will need to be **adapted to the local conditions**. The parts needing adaptation to local conditions are marked with XXX and as a guide show examples for Germany in brackets. Additional questions could point out incentives to increase the willingness of householders to measure and remediate radon as well as possible offers and ways (e.g. media) to support radon measures. *When you translate and adapt the RAS to your own local conditions it is quite important that the questions remain close to the original so that we can compare the different results afterwards.*

When you do carry out a RAS we would be pleased if you could provide us with your results and send them to radpar@jrc.ec.europa.eu. Also feel free to contact us by e-mail in case you have any queries or need advice on conducting a RAS.

On behalf of my colleagues Dieter Schlesinger (BfS, Germany), Ivana Fojtikova (SURO, Czech Rep) and Krystallia Kalimeri (UOWM, Greece).

Best regards

James Mc Laughlin
Leader RADPAR Work Package 5 (Radon Risk Communication)
School of Physics
University College Dublin
Ireland

RADPAR is a project funded by the
European Commission Directorate-General for Health and Consumers (DG SANCO)
http://web.jrc.ec.europa.eu/radpar

General Radon Awareness Survey (RAS)

Questionnaire

The aim of this survey is to provide information to develop strategies for the reduction of the health burden from radon. The questionnaire helps to identify the knowledge on radon, general risk perception and assessment, perceived effectiveness of measures of the population and – in addition – the relevant stakeholder groups that should be integrated in a radon strategy.

Knowledge of radon

- Have you heard about the radioactive gas radon? O Yes or O No.
- In your opinion, is radon O **natural** or O artificial?

Radon is a natural occurring radioactive gas that comes from the soil!

- Where might you expect to find radon at high concentrations?
  O Outdoors in cities; O Outdoors in the nature; Indoors at the O **ground floor**; O Upper floors; O **In cellars**.
- In which of the following areas do you think radon is a problem? O *XXX >>> list different regional areas <<< (O alps, O alpine foothills, O central mountains, O rivers, O coasts or O North German Plains)*

Health Effects

- Do you think radon may harm your health? O Yes, strongly; O Yes, a little bit; O Maybe; O No, rather not; O No, not at all; O I have no idea.
- What health problems do you expect to be induced by radon? Does radon cause O skin problems, O heart disease, O diarrhoea, O **lung cancer**, O migraine, O other_____ or O none?
- In your opinion, is there a link between health effects of radon and smoking? O **Yes**; O No; O Maybe; O Don't know.

In Europe it is estimated that exposure to radon is responsible for about 10% of all lung cancer deaths each year.

Excessive radon inhalation in homes enhances the probability of lung cancer. Due to lung cancer every year XXX (1.900) person die in XXX (Germany).

- Please compare the number of deaths due to radon with the number of death due to traffic accidents. The number of deaths in the country due to radon compared with traffic accidents is O far higher, O higher, O almost the same, O less, O far less or O I have no idea.
- Comparing the radiation from radon with that from regular nuclear power generation – do you think that the harm to public health from radon is O **far higher**, O higher, O almost the same, O less or O far less or O I have no idea?

Radon Measurement and Control

- Do you know whether it is possible to measure radon in homes? O Yes; O No; O Don´t know.
- Do you know how to get a radon test done? O Yes or O No.
- Who do you think can do such a test? O Government agency; O Local authority; O Private companies; O Physics teacher; O Research centers.
- Wow much would you be willing to pay for a radon-measuring-kit? _____

In general it is easy and inexpensive to measure Radon in homes. You just have to order a radon kit which typically costs around XXX Euros (50 Euros) and put the detector at a suitable place in your home.

- Would you now like to get a radon test done? O Yes, sure; O Yes, sometime; O Maybe; O No, rather not; O No, not at all.

Excessive radon concentration in homes can be reduced quite well.

- If your home had a high radon level would you wish to reduce it? O Yes, definitely; O Yes, sometime; O Maybe; O No, rather not; O no, not at all.
- How much do you think it might cost to reduce radon to an acceptable level in a typical home? _____

Stakeholder

- Whom do you trust on health issues most? O Media; O NGOs, O Authorities; O Independent experts; O Health insurance; O Doctors; O Pharmacists; O (pharmaceutical)-Companies; O Nobody. *(please tick up to 3 answers)*
- Whom do you trust on real estate issues most? O Bank; O Building Society; O Building & Construction Company; O Developers; O Architects; O Home inspectors; O Municipalities; O Notary; O Real estate agent ; O Nobody. *(please tick up to 3 answers)*

Responder Information

- Postal code: _____
- Gender: O Male or O Female.
- Age: O up to 25, O 26-45, O 46-65 or O older than 66.
- How many people live in your home (including you) _____? Please give the number of your children under the age of 18 _____
- What type of house do you live in O detached house, O undetached/ terrace house, O an apartment (Apartment level ____) or Other _____?
- Are you the O owner or O tenant?
- Are you O a smoker, O an ex- smoker or O a never-smoker (less than 100 Cigarettes in the entire life)?
- Are you a passive smoker at O home, O at work or O other _____?
- What is your highest level of education? O Primary school, O High school, O Apprenticeship, O University or Other _____.
- How high is your household net-monthly income in Euros? O *XXX per month (O Up to 1000 €, O 1001€ to 2000€, O 2001€ to 3000€ or O > 3000€.)*

4.3.2 Knowledge of radon

Table 7: Knowledge of the physical properties of radon

	Germany	Switzerland	Czech Republic	Greece 1	Greece 2	Norway
Yes, heard about it	49% (nobel gas Rn)	40%	88%	24%	40%	73%
Radon is …						
… radioactive	56%	66%				39%
… tasteless	43%	75%				
… fluorescent	15%	24%				
… colourless	46%	88%				
… odourless	61%	78%				
… caustic	3%					
Further information		54% gas				58% soil gas; 20% poisonous, 16% carcinogenic and 11%noble gas

Table 8: In your opinion, is radon …

	Germany	Czech Republic	Greece 2	Greece 1	Belgium
natural?	66%	74%	84%	72%	96%
artificial?	27%	13%	16%	28%	

Table 9: Where might you expect to find radon at high concentrations?

	Germany	Czech Republic	Switzerland	Greece 2	Greece 1	Belgium
Outdoors in cities	14%	63%	34%[1]	5%	64%	
Outdoors in the nature	55%	73%		30%		
Indoors...			66%[2]			
... at the ground floor	15%	83%		33%		
... at the upper floors	7%	31%	19%	1%	11%	34%
... in cellars	41%	85%	81%	31%	25%	66%

[1]outdoors in general and the people who don't know; [2]indoors in general

Table 10: In which of the following areas do you think radon is a problem?

	Region	Germany	Switzerland	Greece 2
①	Alps	Karwendel 34%	Graubünden 58%	
②	Alpine foothills	Münchner Schotterebene 26%	Tessin 54%	
③	Central mountains	Erzgebirge 63%	Juragebiet 55%	6% (volcanic areas 48%)
④	Rivers and seas	Rheintal 13%	Genfer See 28%	
⑤	Plains	Lüneburger Heide 14%	Mitteland 28%	44%
⑥	Coasts	Ostfriesland 6%	/	2%

4.3.3 Health Effects

Table 11: Do you think radon may harm your health?

	Germany	Czech Republic	Greece 2	Greece 1	Switzerland	Belgium
Yes, strongly	49%	72%	64%	25%	85%	90%
Yes, a little bit	38%	23%	8%			
Maybe	6%		20%			
No, rather not	5%	3%	1%	11%		
I have no idea		1,7%	6%	64%		

Table 12: What health problems do you expect to be induced by radon?

Does radon cause …	Germany	Czech Republic	Switzerland	Greece 2	Greece 1	Norway	Belgium
lung cancer	57%	79%	79%	90%	38%	17%	90%
skin problems	28%	52%	59%	6%	4%	2% (Allergies)	0%
heart disease	17%	37%	38%	0%	28%		0%
diarrhoea	14%	43%	30%	0%	2%		0%
migraine	29%	65%	72%	0%	4%	4%	1%
other	63% Leukaemia			1%	24%	73% general cancer 3% lung problems 4%; Radiation injury	9% cancers

Table 13: In your opinion, is there a link between health effects of radon and smoking?

	Germany	Czech Republic	Belgium	Greece 1	Greece 2
Yes	78%	72%	61%	16%	38%
No	10%	17%	8%	8%	5%
Maybe	11%		21%	40%	46%

Table 14: Please compare the number of deaths due to radon with the number of death due to traffic accidents. The number of deaths in the country due to radon compared with traffic accidents is …

	Germany	Czech Republic	Greece 2	Greece 1	Belgium
far higher	3%	6%	0%		11%
higher	14%	7%	1%		11%
almost the same	11%	16%	3%	12%	78%
less	51%	24%	5%		
far less	21%	34%	1%		

Table 15: Comparing the radiation from radon with that from regular nuclear power generation – do you think that the harm to public health from radon is …

	Germany	Czech Republic	Greece 2	Greece 1	Belgium
far higher	6%	17%	0%	Greater harm to health is ... Rn = 11% NPG = 62%	Greater harm to health is ... Rn = 18% NPG = 22%
higher	21%	20%	1%		
almost the same,	30%	24%	1%		
less	34%	14%	15%		
far less	8%	10%	3%		

4.3.4 Radon Measurement and Control

Table 16: Do you know whether it is possible to measure radon in homes?

	Germany	Switzerland	Greece 2	Greece 1	Czech Republic
Yes	97%	92%	29%	7%	

Table 17: Do you know how to get a radon test done?

	Germany	Czech Republic	Norway	Belgium	Greece 2
Yes	8%	25%	26%	24%	15%
Further information			Measures to reduce radon in general	Techniques for remediation	Greece 1 = 0%-15%

Table 18: Who do you think can do such a test?

	Germany	Greece 2
Government agency	74%	11%
Local authority	23%	6%
Private companies	29%	24%
Research centers	20%	58%

Table 19: How much would you be willing to pay for a radon-measuring-kit?

	Germany	Czech Republic	Greece 2
Mean	103 €	35 €	
Median	50 €	20 €	
Willing to pay?	68%	79%	84%

Table 20: Would you now like to get a radon test done?

	Germany	Czech Republic	Switzerland	Greece 2	Greece 1	Norway
Yes, sure	3%	16%	26%	42%	52%	36%
Yes, sometime	13%	23%		49%		
Maybe	18%			6%	8%	45%
No, rather not	30%	38%		1%	40%	19%
No, not at all	35%	23%		0%		
made a test		18%	5%			8%

Table 21: If your home had a high radon level would you wish to reduce it?

	Germany	Czech Republic	Greece 2	Greece 1	Belgium
Yes, definitely;	55%	61%	54%	59%	58%
Yes, sometime;	28%	23%	44%		
Maybe;	9%		1%	34%	
No, rather not;	4%	7%	1%	7%	
no, not at all.	4%	2%	0%		

Table 22: How much do you think it might cost to reduce radon to an acceptable level in a typical home?

	Germany	Czech Republic	Switzerland	Greece 2	Belgium
Mean	6.174 €	481 €			
Quartile 25%	500 €	5 €			
Median	2.000 €	46 €			
Quartile 75%	6.000 €	460 €			
Further information			16% low ... 51% normal ... 29% high ... ... costs	27% < 100€ 59% 100-500€ 5% > 500€	50% < 500€ 27% 500-2000€ 22% > 2000€

4.3.5 Stakeholder

Table 23: Whom do you trust on health issues most?

	Germany	Greece 2	Czech Republic
Media	12%	4%	3,66
NGOs	15%	47%	
Authorities	11%	55%	
Independent experts	27%	42%	
Health insurance	20%	25%	3,18
Doctors	72%	89%	2,12
Pharmacists	41%	17%	2,46
(pharmaceutical)-Companies	2%	0%	3,39
Other		Nobody: 6%	Friends: 2,56
Further information			Average value; Rating from 1 = ++ to 5 = --

Table 24: Whom do you trust on real estate issues most?

	Germany	Greece 2	Czech Republic
Bank	8%	1%	3,32
Building Society	8%	20%	
Building & Construction Company	6%	44%	3,62
Developers	9%	51%	
Architects	35%	66%	3,22
Home inspectors	56%	74%	
Municipalities	18%	5%	3,64
Notary	16%	2%	
Real estate agent	6%	4%	4,34
Other		Nobody: 6%	Friends: 2,57
Further information			Average value; Rating from 1 = ++ to 5 = --

4.3.6 Notes to the calculations in Table 5 and Table 6

In **Table 5** the Gross Domestic Product (GDP) from the different countries was taken as the basic figure to compare the costs. Then the percentage of the willingness to pay for a radon-measuring-kit could be set in comparison to the GDP for Germany and Czech Republic. So you can see, that the median is in average 0.16% of the GDP. This number can now be taken to evaluate the acceptable costs for a radon-measuring-kit in other countries, e.g. Greece (33€), Belgium (49€), Switzerland (75€) or Norway (85€). Of course the evaluated cost should be used carefully, as the calculated median is just based on two countries. Hopefully through forthcoming RAS the values can be specified.

The calculation in **Table 6** is based on the German and Czech average 25%, 50% and 75% quartiles. These – so the idea – can represent the categories low, medium and high remediation costs, as asked in the surveys from Switzerland, Greece and Belgium. As these surveys provide the dispersion to the three categories, also the mean can be calculated. Unfortunately the deviation of the 25%, 50% and 75% quartiles between Germany and the Czech Republic is very high and so it must be quoted, that concept is just a first approach to transfer categories into costs and that further data is needed to get authoritative values.

5 APPENDICES

5.1 APPENDIX 1. Contributions from German (BfS), Czech (SURO) and Belgian Partners (IBES and FANC).

5.1.1 CONTRIBUTION FROM DIETER SCHLESINGER (BfS) / Germany

Critical assessment of the present radon risk communication strategy In Germany, there are different organizations and responsibilities with respect to radon risk communication. At the federal level the BfS (Federal Radiation Protection Agency) is in charge. At the moment BfS' strategy is under revision and a new concept is being developed. Further, the German Handbook on Radon is currently updated. On a regional level nine of the 16 Bundeslaender have information about radon on the web. Almost all Bundeslaender have responsible departments for radiation protection in the national ministries and local state offices. In addition the Bundeslaender have developed their additional strategies, mainly those with high risk areas. Namely, Saxony has a good interactive concept to inform the different stakeholders (http://www.smul.sachsen.de/umwelt/strahlenschutz/5222.htm). This concept is to a large extend based on information provided by BfS.

Review and assess the radon risk communication information (brochures, leaflets, web site pages etc) The main **printed brochure** edited in the series "radiation themes" contains four pages with a lot of figures and maps and is up to date concerning content and layout. In addition there are also three leaflets and the German Handbook on Radon. The information go beyond the basics and also refer to topics as quality management in measurements (e.g. calibration). In addition, we also published research and technical reports (BfS-documents). Also the Federal Environmental Protection Ministry has an own brochure concerning radon, and many Bundeslaeder provide their own booklets (e.g. Saxony, Bavaria). The data is technically correct but in some cases the information is slightly politically biased (e.g. neither the results from Darby et al. 2006, the WHO Handbook on Indoor Radon, 2009 or reference values are mentioned) and in general these brochures mostly provide basic data. In 2010, the BfS **questionnaire** submitted in conjunction with radon measurement devices was revised and updated. The **internet** provides additional information on radon (incl. most of the printed informations as download files) and is continually revised

Core messages (scientifically accurate, concise and written in simple and easy to understand language?): Sure!

Are target groups (1) the general public, (2) the decision makers, (3) the building professionals or (4) opinion leaders neglected? For 1 and 2 general information is provided. For the construction industry an own brochure (German Handbook on Radon) with roughly 80 pages was published. On top the BfS risk communication handbook contains a chapter about radon. For opinion leaders we have no special information, but e.g. the German Medical Association informed her members about radon this year as well as a well known pharmacist journal. For school teachers we are developing a project that will start next year. For universities we are developing a curriculum for an additional certificate for architects.

Has a **representative** national indoor survey to determine the **exposure situation** in a country been carried out? Yes, for family houses but not for general workplaces and public buildings.

Are radon risk communication campaigns linked with national anti-smoking campaigns? No! But we are linked with the German Risk Communication agency and with the Environmental Protection Agency (UBA). With the UBA the focus lies on indoor pollutants in general and in the context of thermal remediation and passive houses in particular. From our point of view, this is a better risk communication strategy than focusing on the relationship with smoking.

5.1.2 CONTRIBUTION FROM IVANA FOJTIKOVA (SURO) / Czech Republic

The assessment of the Czech radon risk communication activities and the future plans

I. Critical assessment of the Communication strategy

Activities

- The main tool of enhancing the awareness in the Czech Republic nowadays is the free-of-charge measurement campaign organized by local authorities, which seems to be most effective. The measurements are offered in private houses mostly in the affected areas (indentified using the geological and the gamma dose rate map of the Czech Republic), at schools and kindergartens, in old people's homes, children's homes. The campaign is managed centrally, in fact provided locally in 14 counties. The results of measurement are being stored in a central database.
- The second very effective tool is the State Grant provided to homeowners to realize the remediation in houses with concentrations above 1000 Bq/m^3. The project is managed locally.
- Web pages - general information is posted on web of the State office of Nuclear Safety and National Radiation Protection Institute. There has been prepared a new common web page "Czech Radon Programme" summarizing all important links and the relevant information provided in a more "health marketing" manner.
- The periodically published magazine "Radon Bulletin" has been sent to the municipalities on high radon area (> 2000), all building authorities (> 700) and regional authorities (>14) since 1999. Its content covers practical topics - how to order the measurement, how to get the state subsidy, how to protect new buildings etc. The magazine is not addressed personally and is maybe too scholarly to read for laypeople, which seems to be main disadvantages of this magazine. The format should be changed to be more inviting.

Planned activities

- To sustain the high level of risk awareness and to enhance the overall knowledge, there is necessary to educate the young generation. There has been started the project of collaboration with high schools in 2010, which will be further developed and extended.
- In affected areas, people are overloaded with information about radon seriousness. They underestimate the risk. There is necessary to enhance the radon perception, which requires to address with our core messages the physicians and the opinion makers (above all in the villages) - teachers, majors, pastors. The doctors are universally informed about radon in the frame of their professional education, but some more activities are needed. The impact of opinion makers in the affected areas has been underestimated so far.

II Available information sources

- The main source of information for both the public and the decision makers is expected to be our new radon web site pages.
- Twice a year, Radon bulletin is distributed to all municipalities in the affected area, collaborating state officers, all building offices. Individual issues cover all the radon topics - building code, epidemiology, relevant legislation, news etc.
- Leaflets "Why to measure radon?" are distributed by local officers
- Handbook "Radon remediation" includes information about the possibilities of simple remediation measures in the house, which the owners can execute themselves. It is distributed to all home owners having radon concentration higher than 400 Bq/m^3.
- Handbook "Radon insulation" includes information for the building professionals
- Teaching material for the students of the Faculty of Civil Engineering of the Czech Technical University in Prague.
- Articles in professional journals (medical and building) are being published.

III Target groups

The decision makers collaborating on the radon programme are continuously informed, once a year there takes place a tutorial in the State office for the Nuclear Safety. Some officers organize local tutorials for the majors on the local level.

There exists a building professional education system: first level at the University, then the special training courses are organized

The project for teachers of the primary and secondary schools is being prepared.

The physicians obtain the general information at the University; some of them get further details in the frame of their professional education. The content of the course should be revised and extended.

5.1.3 CONTRIBUTION FROM JAN KLERKX (IBES) AND ANDRE POFFIJN (FANC) / Belgium

1. Communication strategy about radon risk and achievements

- **Communication targeted at the general public**

The most efficient communication to the general public operates through the organization of indoor measurement campaigns by the Federal Agency for Nuclear Control (FANC). A first general measurement campaigns has been organized more than 10 years ago (1995-2000) in the entire Wallony region (Southern part of Belgium). A new campaign was organized during the last 5 years in the radon prone area of the Ardennes (32 municipalities). The campaign has been organized by FANC in collaboration with the municipalities. The administration of the municipalities has invited the population to perform indoor radon measurements.

Presently, radon measurement campaigns are organized in a similar way in other radon prone areas of the country, namely central and south-western Belgium.

Other approaches for radon risk communication to the general public operate through websites: FANC and IBES (ngo), as well as through brochures edited by FANC and by the health services of certain provinces..

Articles about radon risk are regularly published by various magazines. Radio and TV programmes also attract the attention of the public on the radon risk.

Evaluation

FANC has attracted the attention of the general public on radon risk for health since several years. It has organized successfully different campaigns for indoor radon measurements. It also has attracted the attention of the media.

It may be considered that the general public in the southern part of the country is well informed about the radon risk and that it reacts positively on the measurement campaigns. The recent actions complete the general public awareness strategy in other areas.

Individual radon measurements can be obtained through different public and private organizations.

Suggestions

Almost all what could be done, has been done. It is only necessary to continue to keep the attention of the public for this problem.

- **Communication targeted at decision makers**

Through the organization of the indoor radon measurement campaigns, the local administrations have been informed about the radon risk.

FANC keeps regular contacts with the decision makers at the level of the regions and the provinces, and communicates with the concerned health organizations. Several provinces have their own radon unit.

FANC also discusses radon regulations with the authorities of the Regions that are responsible for this application of the legislation.

Evaluation

Decision makers at the regional and local level are well aware about the radon risk. There exists good communication between FANC, responsible for the radon problem at the federal level, and the regional authorities.

Suggestion

What has to be done in the future is to keep the decision makers informed about the scientific/technical evolutions about radon risk assessment.

- Communication targeted at building professionals

Since a few years, FANC is organizing training courses for architects and building constructors concerning radon risk and remediation and prevention methods. These courses have a limited success. What concerns the radon risk awareness aspect, the invitation for the courses reaches all building professionals and represents in a certain way a radon risk communication action for this type of audience.

Evaluation

From contacts with architects and building companies, it appears that many of them are not aware of the radon risk, or at least do not want to take it into account in the building procedures.

Suggestion

Further actions are required to inform the building professionals about radon risk and to familiarize them with the problem. A "Radon Newsletter" distributed to the building professionals at regular intervals, informing them about aspects of the radon problem in building, could help to make them more attentive for the problem.

2. Communication strategy about radon risk remediation and achievements

- Communication targeted at the general public

From previous actions for radon risk awareness it has been concluded that making the population measuring indoor radon is not sufficient, it is also necessary to inform the public about radon remediation. In the frame of the recent radon measurement campaigns, FANC has taken several initiatives for informing the public about radon risk remediation:

- during the information meetings introducing the measurement campaigns, general information about radon remediation has been provided;
- after obtaining the results of the measurements, the public was invited for a second meeting where the measurements techniques were explained in details;
- FANC experts have visited homes with high radon concentration in order to suggest concrete solutions for remediation. In certain provinces, this task has been performed by specialists of the radon unit of this province.
- FANC has attempted to assist for the creation of private remediation companies.

Radon remediation techniques are explained in websites (FANC, IBES) and in brochures (FANC).

Evaluation

Intense efforts have been undertaken by FANC for informing the public about radon remediation procedures and techniques. All measured houses with radon concentrations above 800 Bq have been visited for diagnosis of remediation. Nevertheless, it appears that the results are quite disappointing. A very limited number of houses with high radon have been remediated despite all the information that the owners received.

The reasons for this rather unsuccessful approach are unclear:

- Was the message not precise enough? Have the techniques not been explained in sufficient details?
- Has not enough information been given about the adequate material (equipment) to use?
- Has the information been considered as not interesting because given without payment?
- The starting remediation companies have almost not been approached for remediation.

Suggestion

The communication strategy about remediation for the general public has to be reconsidered for obtaining more successful results in remediation. A questionnaire distributed among the public that already received the remediation information could given hints for an improved strategy.

For sure, it is necessary 1) to try to better introduce the remediation companies to the general public; 2) to consider to introduce regulations that force the owners to remediate their dwellings when necessary.

The information given in brochures and websites has to be as concrete as possible.

- Communication targeted at decision makers

The local authorities have been adequately informed about remediation procedures and techniques during the radon measurement campaigns.

Contacts exist between FANC and the regional authorities for introducing or simplifying the administrative procedure for obtaining a financial incentive for radon remediation.

Evaluation

Decision makers are sufficiently informed about the techniques for radon remediation.

Suggestion

It is necessary to actualize for them the information.

- Communication targeted at building professionals

Training courses are organized by FANC for building professionals (architects, building constructors) on radon remediation. These courses are relatively well attended.

Evaluation

Only the building professionals that attend the training courses obtain the technical information about radon remediation. As suggested earlier, a "Radon Newsletter" distributed to the building professionals at regular intervals, could help in better distributing the information to the professionals.

The professionals that attend the training courses are at present mentioned as "radon expert", although they have not shown practical expertise. This disadvantages the starting remediation companies.

Suggestion

The training courses on radon remediation for professionals are an important component in a radon remediation strategy. They have to be consolidated and extended.

The starting remediation companies have to get a better support from promoting their expertise and growing experience.

3. Communication about radon risk prevention and achievements

- Communication targeted at the general public

The general public is mainly informed about radon risk prevention in new dwellings by the existing websites (FANC, IBES) and by radon brochures (FANC). No specific action is undertaken up to now for informing directly the general public about this aspect.

Evaluation

Building radon proof dwellings by applying the appropriate prevention techniques is at present not a common procedure in Belgium.

New builders are often insufficiently informed about the procedures and about the techniques. Often they complain that they do not receive the appropriate information from the municipality nor from the architect.

Suggestion

Direct information to the general public through websites and brochures has to be as concrete and detailed as possible as well for the procedures to follow as for the materials and the techniques to apply.

New builders have to receive the adequate information from the municipality and from the architects.

- Communication targeted at decision makers

Limited actions have been undertaken towards the municipalities for informing them about radon prevention in new dwellings, and for inviting them to distribute information about radon prevention to new builders within their municipality.

Discussions are going on between FANC and the regional authorities, as well as the local authorities, for introducing the obligation for prevention measures when building in radon prone areas.

Evaluation

The limited actions that have been taken to promote prevention with the local administrations (municipalities) appear positive: the message is well accepted, several municipalities already invite the new builders to apply prevention. Moreover, in 4 cases recently, municipalities have imposed prevention measures in new public buildings (school, old people's home, administrative building).

In some cases, the administration of the municipality is considering the possibility to impose the obligation for prevention at the local level.

Suggestion

Actions have to be reinforced to inform the local administrations about radon prevention in new dwellings, and to propose them to correctly instruct builders of new dwellings in radon prone areas to apply prevention.

Detailed information has to be provided about the procedures to apply, the techniques and the material to use as well as the correct application.

- Communication targeted at building professionals

The training courses that are organized by FANC for building professionals (architects, building constructors) also consider the aspect radon prevention. These courses are relatively well attended.

Evaluation

The building professionals that attend these courses are consequently informed about the prevention procedures and techniques. However, the information that is provided is apparently rather general and the information about the technical requirements of prevention techniques, such as the technical specifications of radon membranes, is limited.

Moreover, it appears that a large majority of architects are not proposing prevention for new dwellings in radon prone areas and that building constructors are often reluctant to apply prevention.

It also appears that when individuals are convinced to apply prevention for a new dwelling, they have problems to find the correct instructions about the techniques to apply, the necessary information about the products to apply and where to find them, as well as the detailed information about the procedures for application of the prevention.

The communication is consequently insufficient for several aspects:

- only a limited number of architects is informed about radon prevention
- architects and building constructors are reluctant for prevention
- detailed information about prevention techniques is not given, and the technical characteristics of the prevention material (radon membranes) are not specified
- individuals face the same problems, and moreover have difficulties in finding the correct products.
- As there exists at present no "market" for radon prevention, the products for prevention are not always easy to find.

Suggestion

Strong actions have to be taken for promoting prevention among building professionals:

- the radon training courses have to be reinforced and in the courses strong emphasis has to be given to radon prevention
- in these courses the procedures and techniques for radon prevention have to be clearly defined, as well as the technical specifications of the material.
- actions have to be taken to inform architects and building constructors about the techniques to apply for prevention in order to demystify the problem. This can be done through a "Radon Newsletter" as suggested earlier.

Once a "market" for radon prevention will exist, material for prevention will become easily available as well for building professionals as for individuals.

Also, it has to be more clearly specified what are the techniques and materials that are appropriate for prevention, and at least their general technical specifications have to be defined.

5.1.4 CONTRIBUTION FROM VASILIKI TAFILI (GAEC) / Greece

The Greek Atomic Energy Commission (GAEC), as the competent authority for radiation protection issues, provides services and scientific advice for radon.

In order to increase radon awareness, GAEC has implemented in the recent past the following actions:

- **Production and distribution of printed information material**. GAEC produced a leaflet, structured in the format of questions and answers related to radon concentration in buildings. This leaflet has been distributed to local authorities all over Greece. It is available at the GAEC's website: (http://www.eeae.gr/gr/docs/president/_radonio_2009.pdf)
- **Information dissemination through GAEC's website**. GAEC has a special part of its website dedicated to radon. Visitors of the address http://www.eeae.gr/gr/index.php?fvar=html/president/_info_radon find basic information regarding radon and its properties, the radon measurements performed by GAEC, as well as links to relevant information sources. This web-page is available only in Greek language.
- **Scientific papers**. GAEC has published in the past several articles about radon measurements. Relevant announcements have been made in international and European conferences.

Currently, GAEC, in cooperation with local authorities across the country, implements a large-scale radon measurements project. The outcome of this initiative will be the creation of the National Radon Map with radon concentrations, and the dissemination to the public of basic information related to radon.

Furthermore, GAEC plans to launch in the future a national survey in order to depict the level of knowledge regarding the radon.

In a few words, GAEC's communication strategy about radon gives due consideration to the public information.

5.2 APPENDIX 2: Compilation of Section C Answers

(Radon Risk Communication Strategies) from MQ

1. Have you carried out radon risk communication campaigns, for example producing brochures, conducting road shows, creating internet forums, etc?

Country	Yes	No	In progress	Planned
Austria	■			
Belgium	■			
Bulgaria				■
Czech Republic	■			
Denmark	■			
Estonia	■			
Finland	■			
France	■			
Germany	■			
Greece	■			
Hungary		■		
Ireland	■			
Italy	■			
Lithuania	■			
Malta		■		
Norway	■			
Poland	■			
Portugal			■	
Spain	■			
Switzerland	■			
The Netherlands	■			
United Kingdom	■			
Non – EU Countries				
Armenia		■		
Canada	■			
FYROM		■		
Georgia				■
Moldova				■
Serbia				
Tajikistan		■		

1.1. What are your target audiences for radon risk communication campaigns (please tick appropriate boxes, even if your present position is “in progress” or “planned”)?

Country	General Public	Decision makers	Professional bodies	Others
Austria	■			
Belgium	■	■	■	
Bulgaria	■	■	■	
Czech Republic	■	■	■	
Denmark	■		■	
Estonia	■	■		
Finland	■	■	■	
France	■	■	■	
Germany	■	■	■	
Greece	■		■	
Hungary				
Ireland	■	■		■ Local Authorities, Public Representatives (local and national). Local media
Italy	■		■	
Lithuania	■	■	■	
Malta	■	■		
Norway	■	■	■	
Poland	■	■		■ Habitants at radon prone areas (South part of Poland)
Portugal	■			
Spain	■	■	■	
Switzerland	■	■	■	
The Netherlands	■			
United Kingdom	■	■	■	
Non – EU Countries				
Armenia	■		■	
Canada	■	■	■	
FYROM	■		■	
Georgia			■	
Moldova	■			
Serbia				
Tajikistan	■			

1.2. Please specify any special groups you have contacted within the public (such as women, mothers, teachers, DIY handymen, smokers, non-smokers)

Country	**Special groups**
Austria	
Belgium	
Bulgaria	
Czech Republic	Teachers and physicians – in progress
Denmark	Brochure for general public/house owners and for professional bodies
Estonia	Awareness campaigns targeted to the residents of the estimated high Radon risk areas
Finland	Pupils, comprehensive school, upper level
France	
Germany	
Greece	
Hungary	
Ireland	
Italy	Smokers (planned)
Lithuania	Teachers, smokers, public healthcare specialists, builders, students
Malta	
Norway	
Poland	
Portugal	
Spain	
Switzerland	Regional authorities for radon, construction autorisation and energy mitigation, architects and engineers (incl. education centers), actors in the property market.
The Netherlands	Campaign was low key and mostly ventilation oriented.
United Kingdom	Some materials targeted at smokers
Non – EU Countries	
Armenia	
Canada	Smokers, health professionals
FYROM	
Georgia	
Moldova	General public
Serbia	
Tajikistan	Population living close to uranium tailing dumps in the north of Tajikistan

1.3. At what level was the radon risk communication campaign carried out (please tick appropriate box)?

Country	National	Regional	Municipal
Austria	■	■	■
Belgium	■	■	■
Bulgaria			
Czech Republic	■		
Denmark	■	■	■
Estonia			■
Finland	■	■	■
France		■	
Germany	■		
Greece	■		
Hungary			
Ireland	■	■	
Italy	■	■	■
Lithuania	■	■	■
Malta			
Norway	■		
Poland		■	
Portugal		■	■
Spain	■	■	■
Switzerland	■	■	
The Netherlands	■		
United Kingdom	■	■	■
Non – EU Countries			
Armenia			
Canada	■	■	
FYROM			
Georgia	■		
Moldova	■		
Serbia			
Tajikistan			■

1.4. If you have carried out radon risk communication campaigns have you linked these with other public health programmes such as smoking campaigns?

Country	Yes	No
Austria		
Belgium		
Bulgaria		
Czech Republic		
Denmark		
Estonia		
Finland		
France		
Germany		
Greece		
Hungary		
Ireland		
Italy		
Lithuania		
Malta		
Norway		
Poland		
Portugal		
Spain		
Switzerland		
The Netherlands		
United Kingdom		
Non – EU Countries		
Armenia		
Canada		
FYROM		
Georgia		
Moldova		
Serbia		
Tajikistan		

2. Have you carried out a public radon awareness survey?

Country	Yes	No	In progress	Planned
Austria				■
Belgium	■			
Bulgaria		■		
Czech Republic	■			
Denmark		■		
Estonia	■			
Finland				■
France				
Germany	■		■	
Greece		■		
Hungary		■		
Ireland	■		■	
Italy		■		
Lithuania		■		
Malta		■		
Norway	■			
Poland				■
Portugal		■		
Spain				■
Switzerland	■			
The Netherlands		■		
United Kingdom		■		
Non – EU Countries				
Armenia				■
Canada	■			
FYROM		■		■
Georgia			■	
Moldova				■
Serbia				
Tajikistan		■		

2.1. If you have carried out a public radon awareness survey, at what level did you do so?

Country	National	Regional	Municipal
Austria			
Belgium	■	■	■
Bulgaria			
Czech Republic	■		
Denmark			
Estonia			■
Finland			
France			
Germany	■	■	
Greece			
Hungary			
Ireland	■	■	
Italy			
Lithuania			
Malta			
Norway	■		
Poland			
Portugal			
Spain			
Switzerland	■		
The Netherlands			
United Kingdom			
Non – EU Countries			
Armenia			
Canada	■		
FYROM			
Georgia	■		
Moldova	■		
Serbia			
Tajikistan			

2.2. If you have carried out a public radon awareness survey have you done so,

Country	Before risk communication campaigns	After risk communication campaigns
Austria		
Belgium		
Bulgaria		
Czech Republic		
Denmark		
Estonia		
Finland		
France		
Germany		
Greece		
Hungary		
Ireland		
Italy		
Lithuania		
Malta		
Norway		
Poland		
Portugal		
Spain		
Switzerland		
The Netherlands		
United Kingdom		
Non – EU Countries		
Armenia		
Canada		
FYROM		
Georgia		
Moldova		
Serbia		
Tajikistan		

3. What percentage of the general population is estimated to be aware of radon and its health implications?

Country	0 – 25 %	25 – 50 %	50 – 75 %	75 – 100 %
Austria	■			
Belgium	■			
Bulgaria				
Czech Republic			■	
Denmark				
Estonia	■			
Finland			■	
France				
Germany		■		
Greece		■		
Hungary		■		
Ireland				■
Italy				
Lithuania	■			
Malta				
Norway				■
Poland	■			
Portugal	■			
Spain	■			
Switzerland		■	■	
The Netherlands				
United Kingdom	■			
Non – EU Countries				
Armenia	■			
Canada		■		
FYROM				
Georgia		■		
Moldova	■			
Serbia				
Tajikistan	■			

4. Are there established communication links between the radon programme and policy and decision makers in your country?

Country	Yes	No
Austria		
Belgium		
Bulgaria		
Czech Republic		
Denmark		
Estonia		
Finland		
France		
Germany		
Greece		
Hungary		
Ireland		
Italy		
Lithuania		
Malta		
Norway		
Poland		
Portugal		
Spain		
Switzerland		
The Netherlands		
United Kingdom		
Non – EU Countries		
Armenia		
Canada		
FYROM		
Georgia		
Moldova		
Serbia		
Tajikistan		

5. Please provide a list or examples of decision makers or other high impact groups that are involved in or contacted with regard to radon activities

Country	
Austria	Minister of Environment, Mayors in certain high level radon communities, members of provincial governments
Belgium	Ministry of Housing and Environment
Bulgaria	Experts from Ministry of Health and experts from Ministry of Regional Development and Public Works
Czech Republic	Local government officers, physicians, civil engineers in progress - secondary schools, real estate agencies
Denmark	Danish Enterprise and Construction Authority and National Institute of Radiation Protection
Estonia	
Finland	Ministry of Health and Social Affairs, Ministry of Environment, Provincial authorities, Local health and building authorities
France	National policy/Decision makers, Radiation protection agencies, Housing construction companies, Radon remediation companies, Environmental protection NGOs, Relevant general public groups
Germany	
Greece	Ministry of interior, Ministry of education, Prefectures
Hungary	
Ireland	Elected Public representatives, Officials in Government ministries, Government agencies who deal with public health and occupational safety. International bodies. Local and national media
Italy	Ministry of Health, Regional Agencies for Environmental Protection
Lithuania	Public healthcare centers, municipalities
Malta	
Norway	
Poland	
Portugal	University of Coimbra (www.dct.uc.pt/lrn); Instituto Tecnológico e Nuclear (www.itn.pt)
Spain	
Switzerland	Measuring laboratories, regional radon authorities, radon consultants (buildings professionals), Radon competence centers: SUPSI in the Italien part and HES Fribourg in the French part of Switzerland.
The Netherlands	RIVM (research) and Ministry EL&I/ DG ET&M – Energie en Duurzaamheid (policy)
United Kingdom	Government officials, local and national, Health officials, local and national, Environmental health officials, local and national, Building inspectors, local and national
Non – EU Countries	
Armenia	
Canada	Treasury Board Secretariat of Canada, senior management at Health Canada, provincial health departments, Canadian Cancer Society, Canadian Lung Association, Canadian Medical Association, Canadian Home Builders Association, National Research Council, Canadian Mortgage and Housing Corporation
FYROM	
Georgia	
Moldova	
Serbia	
Tajikistan	