IAEA TECDOC SERIES

IAEA-TECDOC-1810

Status of Radon Related Activities in Member States Participating in Technical Cooperation Projects in Europe

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International Atomic Energy Agency

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STATUS OF RADON RELATED ACTIVITIES IN MEMBER STATES PARTICIPATING IN TECHNICAL COOPERATION PROJECTS IN EUROPE

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INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2017

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FOREWORD

Radon is a naturally occurring radioactive gas found in all rocks and soils. Long term exposure to it has been shown to increase the risk of lung cancer. As a gas, it travels through the soil and enters buildings through cracks in the floor. This can result in the buildup of unacceptably high concentrations in buildings. IAEA Safety Standards Series No. GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, published in 2014, includes requirements for protection of the public against exposure due to radon indoors. It requires governments to provide information on radon levels indoors and the associated health risks, and if appropriate, to establish and implement an action plan for controlling public exposure due to radon indoors. The World Health Organization (WHO) and the European Commission — two of the eight co-sponsors of GSR Part 3 — have issued information and standards on exposure to radon.

The WHO Handbook on Indoor Radon: A Public Health Perspective was published in 2009. It provides information on the procedures for the reliable measurement of radon levels, the control options for radon in new dwellings and radon reduction in existing dwellings, radon risk communication strategies and the organization of national radon programmes.

The European Commission published a revised directive in 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionizing radiation. When radon levels in an EU Member State are a public health concern, these standards require governments to ensure that a national action plan be established that addresses the long term risks from exposure due to radon in dwellings, buildings with public access and workplaces for any source of radon ingress, whether from soil, building materials or water.

Protection of the public is an integral part of many IAEA activities. The Technical Cooperation Project (TCP) on Establishing Enhanced Approaches to the Control of Public Exposure to Radon assists Member States to establish and implement national radon action plans. One of the first activities in the project was to determine the current status of radon programmes in the Member States participating. A questionnaire was developed and sent to a representative in each Member State requesting feedback on various elements of a national radon action plan, including: radon policies and strategies; measuring radon levels; radon awareness activities; radon surveys; educating and training professionals; and radon in civil engineering.

This publication reports on the feedback from the questionnaire and summarizes the status of radon programmes in the participating Member States in 2014. This publication will assist in the design of activities for the TCP, and it will also form the basis for determining future progress made in Member States in establishing and implementing a national radon action plan.

The IAEA gratefully acknowledges the contribution of K. Navratilova Rovenska (Czech Republic) to the preparation of this publication. The IAEA officer responsible for this publication was T. Boal of the Division of Radiation, Transport and Waste Safety.

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CONTENTS

1. INTRODUCTION

1.1. BACKGROUND

IAEA Safety Standards Series No. GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards [1] sets out requirements on governments for control of existing exposure situations, including exposure due to radon (^{222}Rn) indoors. The types of situation that are included in the scope of existing exposure situations include the exposure of the public in dwellings and in other buildings with high occupancy factors for members of the public, and exposure in workplaces for which the exposure due to radon is not required by or directly related to the work and for which annual average activity concentrations due to ^{222}Rn are less than the reference level that does not exceed 1000 Bq/m^3.

The requirements on governments for protecting the public against exposure due to radon in dwellings include: to collect data on the activity concentrations of radon in dwellings and other buildings with high occupancy by the public; to provide information on exposure of the public due to radon and the associated health risks; and if the levels of radon are of concern for public health, to develop an action plan for controlling public exposure to radon.

In addition, the World Health Organization (WHO) published its Handbook on Indoor Radon - A Public Health Perspective [2] in September 2009. The Handbook provides information on procedures for the reliable measurement of radon levels, control options for radon in new dwellings and radon reduction in existing dwellings, radon risk communication strategies, and the organization of national radon programmes. The International Commission on Radiological Protection (ICRP) released a statement on radon in 2009 [3]. The statement recommended a revised upper value for the reference level for radon gas in dwellings from The 2007 Recommendations of the ICRP [4] value of 600 Bq/m^3 to 300 Bq/m^3.

The radiation dose to the public and to workers from radon and its progeny can be relatively high; however, in most cases radon is the most controllable source of radiation in dwellings and in most workplaces when compared to other sources of natural radiation. Proven and cost-effective corrective actions have been developed that can reduce the radon activity concentration in existing buildings [2, 5]. The application of preventive measures in the design and construction of new buildings accompanied with the verification measurement at the end of construction is the most cost-efficient approach to ensure the long-term sustainability of acceptable radon activity concentration indoors.

The IAEA established the Technical Cooperation (TC) Project RER9127 in the TC Europe Region, *Establishing Enhanced Approaches to the Control of Public Exposure to Radon* (hereinafter the project) to assist Member States in Europe to develop and implement national radon action plans. To determine the current status of radon programmes in the Member States participating in project RER9127, a questionnaire was developed by the Radiation Protection Unit of the Division of Radiation Transport and Waste Safety in February to March 2014. The questionnaire was reviewed and finalised at a consultancy meeting from 31 March to 1 April 2014. It was provided to the participants in the first meeting of project that was held in Vienna from 22−25 April 2014 and was circulated electronically to those Member States participating in the project; responses were received by October 2014.

1.2. OBJECTIVE

The purpose of this TECDOC is to summarize the status as of 2014 of national radon policies and strategies, along with national radon action plans that include measurement techniques

and results of local and national surveys of radon in dwellings, from the information obtained in Project RER9127.

1.3. SCOPE

This TECDOC provides a summary of the current status of national radon policies and strategies, and national radon action plans in Member States participating in the project.

The TECDOC does not provide a critical evaluation of the policies, strategies, action plans and other radon related activities in the Member States, or how effectively they are implemented in the Member States.

The development of a national radon action plan is a multidisciplinary issue, which is includes the development of regulatory framework, communication with interested parties, the development of national measurement protocols, carrying out national radon surveys, the development of requirements relating to radon in building codes, and the development of measures to reduce radon levels in existing or new buildings that are relevant to the customs and practices for the construction of buildings in the Member State. The questionnaire was divided into six parts: radon policies and strategies, radon in civil engineering, radon measurement, radon survey, radon awareness, and education.

The TECDOC will serve as a baseline for monitoring progress in the effectiveness of TC projects in assisting Member States to develop and implement national radon action plans. It will also be helpful to experts developing training materials, and those involved in missions provided by the IAEA to provide assistance to Member States who seek to further develop their national radon action plans.

1.4. STRUCTURE

Section 2 of the TECDOC provides a summary of how the questionnaire was developed and how the data were collected. Section 3 provides a compilation of the data by topical sections summarizing the existing policies and approaches to protection of the public against exposure to radon in the Member States involved in the project. The summary of the collected information for each Member State is presented separately in Annexes I−XXVIII.

2. THE QUESTIONNAIRE

The questionnaire consists of six sections covering all key issues relating to the development and implementation of a national radon strategy or national radon action plan:

- Radon policies and strategies
- Radon in civil engineering
- Radon measurement
- Radon survey
- Radon awareness
- Education

The results of two previously published radon surveys were used as a source for the questions in the questionnaire:

- Final report of International Radon Project – Survey on Radon Guidelines, Programmes and Activities published in 2007 by the World Health Organization Project WHO/HSE/RAD/07.01 [6]

- Master Questionnaire on National Strategies on Indoor Radon and its Control developed in the frame of the project Radon Prevention and Remediation (RADPAR) which was funded by the European Commission DG SANCO Second Public Health Programme (2009–2012).

The questionnaire was converted from a text document to an online survey using the SurveyMonkey platform. The advantage of the online survey is that it provides a better service for the responders – it offers the question-logic that allows the questionnaire to automatically skip or add questions depending on previous responses.

The questionnaire can be easily distributed to collect data on radon strategies and national radon action plans in other regions outside Europe.

3. COMPILATION OF THE RESPONSES BY TOPICAL SECTIONS

3.1. RADON POLICIES AND STRATEGIES

3.1.1. Summary

Representatives of 28 Member States completed the questionnaire.

Radon related activities exist in almost all of the responding Member States. Many of these activities only involve the measurement of activity concentrations of radon indoors, in soil, or in water, for scientific purposes.

The legal framework for protection of the public against exposure due to radon in dwellings is implemented in 21 Member States involved in the project. A radon action plan or radon programme is established in 12 Member States involved in the project.

The responsible authority for radon in dwellings is the national regulatory body for radiation safety in 16 Member States and the Ministry of Health, the Health Inspectorate or Institute of Public Health in 9 Member States. Reference levels or limits for indoor radon concentration are set in 21 Member States for existing and new dwellings.

The concept of radon prone areas is not widely used in the Member States. Seven of them had utilized the concept of radon prone areas, but only four reported using radon prone areas either to support measurement requests from the public, to target public awareness campaigns, or for the design of preventive measures for new buildings.

A national radon database was established in 11 Member States. The database is mainly used for developing national maps and supporting actions within the framework of national radon action plan.

3.1.2. Legal framework

Table 1 shows an overview of responsible authorities for various facilities and activities and sources of radiation used in the Member States in the project. In 16 Member States, the responsible authority for radon in dwellings is the national regulatory body for radiation safety, while in 9 Member States, the Ministry of Health, the Health Inspectorate, or Institute of Public Health is the responsible authority.

Radon activities (e.g. radon programme, radon measurement, radon risk communication etc.) are being carried out in all of the Member States participating in the project (see Table 2). In some Member States (Bosnia and Herzegovina, Hungary, Kyrgyzstan, Ukraine, Tajikistan), these activities comprise only the measurement of radon which is being carried out only or mostly for scientific reasons. However, a radon programme or radon action plan is established only in 10 Member States.

The legal framework for protection of the public against exposure due to radon in dwellings is implemented in 22 Member States, the legal framework for protection of the public in buildings with high occupancy factor for the members of the public is established in 18 Member States, and the legal framework for protection of workers against exposure to radon in workplaces is established in 24 Member States. The list of relevant legal documents is presented in Table 3.

One element of the regulatory framework is a set of requirements relating to: the setting of reference levels, action levels, or limits for radon in dwellings and in workplaces; radon in drinking water; radionuclides in building materials; and gamma dose rates inside buildings. Table 4 summarizes the types of reference levels, action levels and/or limits set in the Member States. Further details are provided in the Sections 3.1.3–3.1.7.

TABLE 1. AUTHORITIES RESPONSIBLE FOR REGULATION OF DIFFERENT EXPOSURE PATHWAYS IN THE MEMBER STATES

Country	Rn indoors	Rn work-places	Foodstuff	Water	Medical exposure	Occupat-ional exposure	Radiation sources	Nuclear safety and security
Albania	Reg	Reg	-	EPA	Reg	Reg	Reg	-
Armenia	Reg	Reg	MA	Reg, MH	Reg	Reg	Reg	Reg
Belarus	MH	MH	MH	ME	MH	MH	MEm, MH	MEm, MH
Bosnia and Herzegovina	-	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Bulgaria	MH	MH	MA	MH	MH	MH; Reg	Reg	Reg
Croatia	Reg	Reg			Reg	Reg	Reg	Reg
Cyprus	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Czech Republic	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Estonia	EPA	EPA	MA	HI	HI	EPA	EPA	EPA
Georgia	Reg	Reg	MA	MA	Reg	Reg	Reg	Reg
Greece	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Hungary	-	HI	HI	HI	-	HI	Reg	Reg
Kazakhstan	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Kyrgyzstan	MH, HI	MH, HI	MH, HI	MH, HI	MH, HI	MH, HI	MH, HI	no NPP
Latvia	Reg	Reg	MA	Reg	Reg, HI	Reg	Reg	Reg
Lithuania	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Montenegro	EPA	EPA	EPA	EPA	EPA	EPA	EPA	EPA
Poland	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Rep. of Moldova	MH	MH	MH	MH	MH	MH	Reg	Reg
Romania	MH	Reg, MH	MH, HI	ME	MH, HI	MH, Reg	ME	Reg
Russian Federation	Reg, MH	Reg, MH	Reg	Reg	Reg	Reg, MH	Reg	Reg, MH
Serbia	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Slovakia	HI	HI	HI	HI	HI	HI	HI	Reg
Slovenia	Reg	Reg	Reg, MA	Reg, MA	Reg	Reg	Reg	Reg
Tajikistan	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
The FYR of Macedonia	HI	HI	HI	HI	Reg	HI	Reg	Reg
Turkey	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Ukraine	MH	MH, Reg	MH	MH	MH, Reg	MH, Reg	Reg	Reg

Reg: Regulatory body for radiation safety; MH: Ministry for Health; HI: Health Inspectorate or Institute of Public Health; EPA: Environment Protection Agency, ME: Ministry of Environment, MEm: Ministry of Emergencies; MA: Ministry of Agriculture.

TABLE 2. OVERVIEW OF POLICIES EXISTING IN THE MEMBER STATES PARTICIPATING IN THE PROJECT

Country	Any radon related activity exists	Radon programme or radon action plan exists	Legal framework for protection of the public against high radon levels in:		
			Dwellings	Buildings*	Workplaces
Albania	Yes	No	Yes	Yes	Yes
Armenia	Yes	Yes	Yes	Yes	Yes
Belarus	Yes	No	Yes	Yes	Yes
Bosnia and Herzegovina	Yes	No	No	No	Yes
Bulgaria	Yes	Yes	Yes	Yes	Yes
Croatia	Yes	No	Yes	No	Yes
Cyprus	Yes	Yes	Yes	Yes	No
Czech Republic	Yes	Yes	Yes	Yes	Yes
Estonia	Yes	No	No	Yes	Yes
Georgia	Yes	No	Yes	No	Yes
Greece	Yes	Yes	No	No	Yes
Hungary	Yes	No	No	No	Yes
Kazakhstan	Yes	Yes	Yes	Yes	Yes
Kyrgyzstan	Yes	No	No	No	No
Latvia	Yes	No	Yes	No	Yes
Lithuania	Yes	Yes	Yes	Yes	Yes
Montenegro	Yes	No	Yes	Yes	Yes
Poland	Yes	No	No	No	No
Republic of Moldova	Yes	No	Yes	Yes	Yes
Romania	Yes	No	Yes	No	Yes
Russian Federation	Yes	No	Yes	Yes	Yes
Serbia	Yes	No	Yes	Yes	Yes
Slovakia	Yes	No	Yes	Yes	Yes
Slovenia	Yes	Yes	Yes	Yes	Yes
Tajikistan	Yes	No	Yes	Yes	Yes
The FYR of Macedonia	Yes	Yes	Yes	Yes	Yes
Turkey	Yes	Yes	Yes	Yes	Yes
Ukraine	Yes	No	Yes	No	No

* buildings with high occupancy factors for members of the public

TABLE 3. LIST OF LEGAL DOCUMENTS RELEVANT TO PROTECTION OF THE PUBLIC AND WORKERS AGAINST EXPOSURE TO RADON

Country	List of legal documents relevant to protection of the public and workers against exposure to radon
Albania	Regulation "For permitted levels of Radon Concentration in Buildings and water, guidance levels of radionuclides in construction materials as well as permitted levels of radionuclides in food and cosmetic products", approved by the Council of Ministers on 18 August 2011.
Armenia	Government Decree No. 1219-N as of 18 August 2006 on approval of radiation safety norms Decree No.1489-N as of 18 August 2006 on approval of radiation safety rules.
Belarus	Law of the Republic of Belarus "On Radiation Safety of the Public" ; Sanitarian Rules and Standards "Requirements to Radiation Safety"; Hygienic standard "Criteria for the Radiation Impacts Assessment"; Sanitarian Rules and Standards "Requirements for radiation safety of the personnel and the public, when implementing procedures using nuclear energy and sources of ionizing radiation."
Bosnia and Herzegovina	Regulation on radiation protection for occupational and public exposure (This regulation is transposition of Council Directive 96/29 EURATOM in the legal system of Bosnia and Herzegovina, "Official Gazette B&H" No. 102/11) deals with radon on working places.
Bulgaria	Regulation on basic norms of radiation protection.
Croatia	Act on radiological and nuclear safety (OG 141/13); Ordinance on the monitoring of the radioactivity status in the environment (OG 89/13) Ordinance on the limits of exposure (OG 59/13), Ordinance on the authorization of expert technical services to carry out professional tasks of protection against ionising radiation (63/11).
Cyprus	The Protection from Ionising Radiation and Nuclear Safety Laws of 2002 to 2011; The Health and Safety at Work Laws of 1996 to 2011; Radon in dwellings is not included in the scope of the above legislation on radiation protection and nuclear safety in Cyprus, which is based on the BSS Directive 96/29; however, the concentration values in the following Commission Recommendations apply as reference levels: Commission Recommendation 90/143/EURATOM of 21 February 1990, 2001/928/EURATOM of 20 December 2001, 2000/473/EURATOM of 8 June 2000.
Czech Republic	Act No. 18/1997 Coll., as amended (Atomic Act) and its legal codes of practice Act No. 183/2006 Coll., as amended (Building Code) and its legal codes of practice.

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TABLE 3. LIST OF LEGAL DOCUMENTS RELEVANT TO PROTECTION OF THE PUBLIC AND WORKERS AGAINST EXPOSURE TO RADON (cont.)

Country	List of legal documents relevant to protection of the public and workers against exposure to radon
Estonia	Government Regulation No 131, adopted on 6 October 2011: "Requirements of Health Protection for Territory, Buildings, Rooms, Furnishings and Indoor Climate of Preschool Childcare Facilities".; Government Regulation No 84, adopted on 3 June 2013: "Requirements of Health Protection for Schools"; In addition to members of the public, the intention is to also protect workers of preschool facilities and schools, even though this aspect is not directly addressed. There is no given definition of workplace in the context of existing exposure situations in Estonian legal framework. The radon situation at workplaces is only addressed indirectly in case of childcare facilities and schools.
Georgia	Nuclear and Radiation Safety Law of Georgia, Article 13. Limiting Radiation Causes by Natural Sources website, 13/01/2014, registration code 300160070.10.003.017585; Order of Government of Georgia №28, 3 January 2014, Tbilisi; Technical Regulations - Radiation Safety Norms on the territory of Georgia.
Greece	National Radiation Protection Law.
Hungary	16/2000 Ministry of Health decree.
Kazakhstan	Law on Atomic Energy Use, 1993; Law on Radiation safety of Population, 1998; Code of Public Health and Health System, 2009; Ecological code, 2007; Hygienic Standards "Sanitary-Epidemiological Requirements for Providing Radiation Safety", 2012.
Kyrgyzstan	N/A.
Latvia	Cabinet Regulation No.149 "Regulations for Protection against Ionising Radiation", adopted 9 April 2002.
Lithuania	Hygiene Standard HN 85:2011 "Natural exposure. Standard of Radiation Protection" adopted by the Order No. V-890 of 7 October 2011 by the Minister of Health Care.
Montenegro	Law on ionizing radiation protection and safety from 2009; Decree on the systematic testing of the radionuclide content in the environment ("Official Gazette of the FRY", No. 45/97); Rulebook on the ionizing radiation exposure limits ("Official Gazette of the FRY", No. 32/98); Rulebook on requirements to be met by legal entities for carrying out systematic testing of the radionuclide content in the environment ("Official Gazette of the FRY", No. 32/98, 67/2002 and 70/2002 - corr.).
Poland	N/A.
Republic of Moldova	Fundamental Norms of radiation Protection "NFRP - 2000" Hygienic Norms and Rules "RNI - 2001".

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TABLE 3. LIST OF LEGAL DOCUMENTS RELEVANT TO PROTECTION OF THE PUBLIC AND WORKERS AGAINST EXPOSURE TO RADON (cont.)

Country	List of legal documents relevant to protection of the public and workers against exposure to radon
Romania	Regulatory body legal framework (NMR 01, NMR 02, NMR 03) - CNCAN NMR 01 Radiological Safety Rules on operational radiation protection in the mining and preparation of uranium and thorium - CNCAN NMR 02; Radiological Security Norms regarding the Management of Radioactive Waste resulted from mine of Uranium and Thorium - CNCAN NMR 03; Ministry of Health legal framework (Order no. 381/2004) on the approval of basic sanitation for the safe deployment of nuclear activities.
Russian Federation	Federal Law on the Public Radiation Protection. 1996; Federal Law on the Public Sanitary Epidemiological Wellbeing. 1999; Radiation Safety Standards. NRB 99−2009; Main Sanitary Rules for Radiation Safety. OSPORB 99/2010; Sanitary regulations and standards. Hygienic Requirements on Public Exposure to Natural Ionizing Radiation. SanPiN 2.6.1. 2800−10; Building code Federal Law 384-FZ -Technical regulation of safety of buildings and constructions; Town planning code of the Russian Federation.
Serbia	Regulations on limits of exposure to ionizing radiation and measurements to estimate the level of exposure to ionizing radiation; Regulation on the limits of radioactive contamination of person, workplace and environment and the methods of decontamination.
Slovakia	Decree of the government of Slovakia No 345/2006 Coll. Laying down basic safety standards for the protection of health workers and general public against the dangers arising from ionizing radiation; Regulation of the Ministry of Health of Slovakia No 528/2007 Coll., on the establishment of circumstances for the limitation of naturally occurring ionizing radiation sources.
Slovenia	Ionising Radiation Protection and Nuclear Safety Act (Off. Gazette 102/2004; 60/2011); Decree on Dose Limits, Radioactive Contamination and Intervention Levels (Off.G. 49/2004); Rules on the Requirements and Methodology of Dose Assessment for the Radiation Protection of the Population and Exposed Workers (Off. Gazette 115/2003); Construction Act (Off. Gazette 102/2004; 14/2005; 126/2007; 108/2009; 57/2012; 110/2013); Rules on the Ventilation and Air-Conditioning of Buildings (Off. Gazette 42/2002). Programme on Systematic Monitoring of Working and Residential Environment and Raising Awareness About Measures to Reduce Public Exposure due to the Presence of Natural Radiation Sources (Off. Gazette 17/2006).
Tajikistan	Radiation Safety Standards (RSS-06) 2.6.1.001−06.
The Former Yugoslav Republic of Macedonia	Law on radiation protection and safety (Official Gazette 48/2002 and 135/2007); Regulations on exposure levels (Official Gazette 29/2010); Regulations on radionuclides in metals, building materials, fertilizers, ashes from the thermal power plants and the residues from mines and melting industry ((Official Gazette 98/20120); National radon programme (Official Gazette 15/2014).
Turkey	Radiation Safety Regulation (29 September 2004, Off. Gazette No. 25598 of Article 37 of the Radiation Safety Regulation).
Ukraine	Radiation Safety Standard of Ukraine.

TABLE 4. REFERENCE LEVEL, ACTION-LEVEL AND/OR LIMIT VALUES FOR VARIOUS SOURCES OF NATURAL RADIATION

Country	Radon concentration indoors	Activity concentration of Rn, Ra, U and gross alpha/beta activity in water	Activity concentration of natural radionuclides in building materials	Radon exhalation from building materials	Gamma dose rate in buildings	Radon concentration in workplaces
Albania	Yes	Yes	Yes	No	Yes	Yes
Armenia	Yes	Yes	Yes	No	Yes	Yes
Belarus	Yes	Yes	Yes	No	Yes	Yes
Bosnia and Herzegovina	No	-	-	-	-	-
Bulgaria	Yes	Yes	Yes	No	Yes	Yes
Croatia	Yes	Yes	Yes	No	No	Yes
Cyprus	Yes	Yes	Yes	No	Yes	Yes
Czech Republic	Yes	Yes	Yes	No	Yes	Yes
Estonia	Yes	Planned	Yes	No	Yes	Yes
Georgia	Yes	Yes	No	Yes	Yes	Yes
Greece	Planned	Planned	Yes	No	No	Yes
Hungary	No	Yes	No	No	No	Yes
Kazakhstan	Yes	Yes	Yes	No	Yes	Yes
Kyrgyzstan	-	-	-	-	-	-
Latvia	Yes	Yes	Yes	No	Yes	Yes
Lithuania	Yes	Yes	Yes	No	Yes	Yes
Montenegro	Yes	Yes	Yes	No	No	Yes
Poland	No	No	Yes	No	No	No
Republic of Moldova	Yes	Yes	Yes	No	Yes	Yes
Romania	Yes	No	Yes	No	No	Yes
Russian Federation	Yes	Yes	Yes	No	Yes	Yes
Serbia	Yes	Yes	Yes	No	No	Yes
Slovakia	Yes	Yes	Yes	No	Yes	Yes
Slovenia	Yes	Yes	Yes	No	Yes	Yes
Tajikistan	Yes	Yes	Yes	No	No	Yes
The FYR of Macedonia	Yes	Yes	Yes	No	No	Yes
Turkey	Yes	Yes	Yes	No	No	Yes
Ukraine	Yes	Yes	Yes	No	Yes	No

3.1.3. Reference levels, action levels and limits for radon activity concentration indoors

Table 5 presents the reference levels, action levels or limits for activity concentrations of radon indoors that apply for existing dwellings in 22 Member States.

In most Member States, the levels or limits are expressed in terms of radon activity concentration. In some Member States, the levels or limits are expressed in terms of equilibrium equivalent activity concentration (EEC, activity concentration of radon progenies). Armenia and Republic of Moldova consider in their requirements not only radon (^{222}Rn), but also thoron (^{220}Rn). Limits on radon concentration or on EEC are set in eight Member States.

The responsible authority for radon in the Member State has the responsibility to recommend or require that the building owner implement corrective actions to prevent the ingress of radon in an existing dwelling if one of the levels is exceeded. Corrective actions to an existing building are recommended or required in 10 Member States (Bulgaria, Belarus, Czech Republic, Latvia, Romania, Russian Federation, Slovakia, Slovenia, Turkey and Tajikistan). The initial recommendation for the affected dwellings is to increase the ventilation, and then to find more long-term and effective solutions.

Table 6 summarizes the reference levels, action levels and the limit values established for buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals). In most Member States, the requirements for these types of buildings are similar to those for existing dwellings. The only exceptions are the Czech Republic and Slovakia which has set a limit of 4 000 Bq/m^3 and Estonia which has set a limit of 200 Bq/m^3 for preschool facilities. Latvia and Croatia have not established any requirements for existing buildings with high occupancy for members of the public. The requirements for corrective actions to prevent ingress of radon for buildings with high occupancy factors for members of the public are similar to those for existing dwellings.

The corrective action is in most cases paid by the owner of the building. In specific cases, a government authority or ministry will share the costs e.g. kindergarten with high radon levels (Russian Federation) or public and state buildings (Slovenia). A government subsidy for corrective actions exists in the Czech Republic (if the average radon concentration exceeds 1 000 Bq/m^3 (400 Bq/m^3 for schools and preschools facilities) and the building was constructed before the legal framework with provisions on radon came into force in 1991) and in Turkey (if the limit values are exceeded in a large number of buildings in a specific area).

Table 7 summarizes the reference levels, action levels and the limits for activity concentrations of radon in new dwellings that have been established in 22 Member States. In most of the States, the value of the levels for new dwellings is set to half of the value of the levels established for existing dwellings. In 12 Member States, the mandatory level or limit for the radon activity concentration or the equilibrium equivalent activity concentration is set.

The requirements on preventive measures in new dwellings are similar to those for corrective actions in existing buildings. In the Russian Federation, if a new house is built with high radon levels, the owner is recommended to make a complaint to the builder and to request the installation of appropriate corrective measures.

Table 8 summarizes the reference levels, action levels and limits set for newly designed buildings with high occupancy factors for members of the public.

TABLE 5. REFERENCE LEVEL, ACTION LEVEL AND LIMIT FOR RADON ACTIVITY CONCENTRATION IN EXISTING DWELLINGS

Country	Existing dwellings		
	Reference level (Bq/m^3)	Action level (Bq/m^3)	Limit value (Bq/m^3)
Albania	No	No	Yes, 400
Armenia	Yes-M, 200 EEC $^{222}Rn+^{220}Rn$	No	No
Belarus	Yes-M, 200 EEC	No	No
Bosnia and Herzegovina	No	No	No
Bulgaria	Yes-R, 300	No	No
Croatia	Yes-R, 400	No	No
Cyprus	Yes-R, 400	No	No
Czech Republic	Yes-R, 400	No	No
Estonia	No	No	No
Georgia	Yes-M, 200	No	No
Greece	No	No	No
Hungary	No	No	No
Kazakhstan	No	No	Yes-M, 200
Kyrgyzstan	No	No	No
Latvia	Yes-R, 200	Yes-R, 1 000 Bq/m^3 actual, 600 Bq/m^3 year average	Yes, 600
Lithuania	Yes-M, 300	No	No
Montenegro	Yes-R, 400	No	No
Poland	No	No	No
Republic of Moldova	No	No	Yes, 150 EEC $^{222}Rn+^{220}Rn$
Romania	Yes-R, 400	No	No
Russian Federation	No	Yes-R, 200 EEC $^{222}Rn+^{220}Rn$	No
Serbia	No	Yes-R, 400	No
Slovakia	No	Yes-R, 400	Yes, 4 000
Slovenia	Yes-M, 400	No	Yes, 6 mSv/y
Tajikistan	No	No	Yes, 200 EEC
The FYR of Macedonia	Yes-R, 400	Yes-M, 400	No
Turkey	No	No	Yes, 400
Ukraine	No	Yes-R, 100 EEC	No

M – Mandatory, R – Recommended, EEC – activity concentration of radon progenies (Bq_{eqv}/m^3)

TABLE 6. REFERENCE LEVEL, ACTION LEVEL AND LIMIT FOR RADON ACTIVITY CONCENTRATION IN EXISTING BUILDINGS WITH HIGH OCCUPANCY FACTORS FOR MEMBERS OF THE PUBLIC (e.g. SCHOOLS, KINDERGARTENS, HOSPITALS)

Country	Existing buildings with high occupancy factors for members of the public		
	Reference level (Bq/m^3)	Action level (Bq/m^3)	Limit value (Bq/m^3)
Albania	No	No	Yes, 400
Armenia	Yes-M, 200 EEC $^{222}Rn+^{220}Rn$	No	No
Belarus	Yes-M, 200 EEC	No	No
Bosnia and Herzegovina	No	No	No
Bulgaria	Yes-R, 300	No	No
Croatia	No	No	No
Cyprus	Yes-R, 400	No	No
Czech Republic	Yes-R, 400	No	Yes, 4 000
Estonia	No	No	Yes, 200
Georgia	Yes-M, 200	No	No
Greece	No	No	No
Hungary	No	No	No
Kazakhstan	No	No	Yes-M, 200
Kyrgyzstan	No	No	No
Latvia	No	No	No
Lithuania	Yes-M, 300	No	No
Montenegro	Yes-R, 400	No	No
Poland	No	No	No
Republic of Moldova	No	No	Yes, 150 EEC $^{222}Rn+^{220}Rn$
Romania	No	No	No
Russian Federation	No	Yes-R, 200 EEC $^{222}Rn+^{220}Rn$	No
Serbia	No	No	No
Slovakia	No	Yes-R, 400	Yes, 4 000
Slovenia	Yes-M, 400	No	Yes, 6 mSv/y
Tajikistan	No	No	Yes, 200 EEC
The FYR of Macedonia	Yes-R, 400	Yes-M, 400	No
Turkey	No	No	Yes, 400
Ukraine	No	Yes-R, 100 EEC	No

M – Mandatory, R – Recommended, EEC – activity concentration of radon progenies (Bq_{eqv}/m^3)

TABLE 7. REFERENCE LEVEL, ACTION LEVEL AND LIMIT FOR RADON ACTIVITY CONCENTRATION IN NEW DWELLINGS

Country	New dwellings		
	Reference level (Bq/m^3)	Action level (Bq/m^3)	Limit value (Bq/m^3)
Albania	No	No	Yes, 200
Armenia	No	No	Yes, 100 EEC $^{222}Rn+^{220}Rn$
Belarus	Yes-M, 100 EEC	No	No
Bosnia and Herzegovina	No	No	No
Bulgaria	Yes-R, 200	No	No
Croatia	Yes-R, 200	No	No
Cyprus	Yes-R, 200	No	No
Czech Republic	Yes-R, 200	No	No
Estonia	No	No	No
Georgia	Yes-M, 100	No	No
Greece	No	No	No
Hungary	No	No	No
Kazakhstan	No	No	Yes-M, 100
Kyrgyzstan	No	No	No
Latvia	Yes,-R, 200	No	No
Lithuania	Yes-M, 200	No	No
Montenegro	Yes-R, 200	No	No
Poland	No	No	No
Republic of Moldova	No	No	Yes, 100 EEC $^{222}Rn+^{220}Rn$
Romania	Yes-R, 200	No	No
Russian Federation	No	No	Yes, 100 EEC $^{222}Rn+^{220}Rn$
Serbia	No	Yes-R, 200	No
Slovakia	No	Yes-R, 200	Yes, 4 000
Slovenia	Yes-R, 200	No	Yes, 6 mSv/y
Tajikistan	No	No	Yes, 100 EEC
The FYR of Macedonia	Yes-M, 200	Yes-M, 200	No
Turkey	No	No	Yes, 400
Ukraine	No	Yes-M, 50 EEC	No

M – Mandatory, R – Recommended, EEC – activity concentration of radon progenies (Bq_{eqv}/m^3)

TABLE 8. REFERENCE LEVEL, ACTION LEVEL AND LIMIT FOR RADON ACTIVITY CONCENTRATION IN NEW BUILDINGS WITH HIGH OCCUPANCY FACTORS FOR MEMBERS OF THE PUBLIC

Country	New buildings with high occupancy factors for members of the public		
	Reference level (Bq/m^3)	Action level (Bq/m^3)	Limit value (Bq/m^3)
Albania	No	No	Yes, 200
Armenia	No	No	Yes, 100 EEC $^{222}Rn+^{220}Rn$
Belarus	Yes-M, 100 EEC	No	No
Bosnia and Herzegovina	No	No	No
Bulgaria	Yes-R, 200	No	No
Croatia	Yes-R, 200	No	No
Cyprus	Yes-R, 200	No	No
Czech Republic	Yes-R, 200	No	Yes, 4 000
Estonia	No	No	Yes, 200
Georgia	Yes-M, 100	No	No
Greece	No	No	No
Hungary	No	No	No
Kazakhstan	No	No	Yes-M, 100
Kyrgyzstan	No	No	No
Latvia	No	No	No
Lithuania	Yes-M, 200	No	No
Montenegro	Yes-R, 200	No	No
Poland	No	No	No
Republic of Moldova	No	No	Yes, 100 EEC $^{222}Rn+^{220}Rn$
Romania	No	No	No
Russian Federation	No	No	Yes, 100 EEC $^{222}Rn+^{220}Rn$
Serbia	No	No	No
Slovakia	No	Yes-R, 200	Yes, 4 000
Slovenia	No	No	Yes, 6 mSv/y
Tajikistan	No	No	Yes, 100 EEC
The FYR of Macedonia	Yes-M, 200	Yes-M, 200	No
Turkey	No	No	Yes, 400
Ukraine	No	Yes-M, 50 EEC	No

M – Mandatory, R – Recommended, EEC – activity concentration of radon progenies (Bq_{eqv}/m^3)

3.1.4. Reference levels, action levels and limits for the content of radionuclides in drinking water

This section was completed by 26 Member States. For 22 Member States, reference levels, action levels, or limits for activity concentrations of radionuclides in drinking water are defined for radon (^{222}Rn), radium (^{226}Ra, ^{224}Ra), uranium (^{234}U, ^{238}U), gross alpha and beta activity. Estonia and Greece plan to establish levels in the near future. Poland and Romania do not have requirements for activity concentration of radionuclides in drinking water specified in their legal framework.

If the activity concentration of radionuclides in drinking water presented in Table 9 is exceeded, the responsible authority recommends or requires the application of technology to remove or decrease the content of radionuclides in the water. If this action is successful then the permit to supply the drinking water is renewed. However, Bulgaria, Belarus, Lithuania, Republic of Moldova, Slovakia, Slovenia and The Former Yugoslav Republic of Macedonia stop the permit for water use for public water supplies. In most countries, while public water supplies are required to comply with the regulations, the owners of private wells are only recommended to follow the regulations and to carry out measurements for their own information.

3.1.5. Reference levels, action levels and limits for content of natural radionuclides in building materials

Requirements for activity concentration or mass activity concentration of natural radionuclides in building materials are established in 25 Member States. Table 10 summarizes the requirements regarding the content of natural radionuclides in building materials. The activity concentration index *I* describes the relation of the activity concentration of ^{226}Ra, ^{232}Th and ^{40}K and is defined as:

$$I = \frac{C_{Ra-226}}{300} + \frac{C_{Th-232}}{200} + \frac{C_{K-40}}{3\,000} \quad (1)$$

where:

$C_{Ra\text{-}226}$ represents the activity concentration of ^{226}Ra in the building material (Bq/kg);

$C_{Th\text{-}232}$ represents the activity concentration of ^{232}Th in the building material (Bq/kg);

$C_{K\text{-}40}$ represents the activity concentration of ^{40}K in the building material (Bq/kg).

The activity concentration index *I* in many of the Member States (see Table 10).

3.1.6. Reference levels, action levels and limits for radon exhalation from building materials

Exhalation of radon from building material is not limited in any of the Member States involved in the project. The requirements on the radium (^{226}Ra) content in building material are considered as sufficient to prevent elevated radon concentrations in dwellings.

TABLE 9. REFERENCE LEVEL, ACTION LEVEL AND LIMIT FOR CONTENT OF RADIONUCLIDES IN DRINKING WATER

Country	Radon (^{222}Rn)	Radium	Uranium	Gross alpha	Gross beta
Albania	Limit, 100 Bq/l	-	-	Limit, 0.1 Bq/l	Limit, 1 Bq/l
Armenia	RL, 60 Bq/m^3	RL, 50 Bq/m^3	RL, 0.07 Bq/m^3	RL, 0.1 Bq/m^3	RL, 10 Bq/m^3
Belarus	-	RL, 1 Bq/l; ^{228}Ra 0.1 Bq/l	RL, 1 Bq/l	RL, 0.5 Bq/l	RL, 1 Bq/l
Bulgaria	-	-	Limit, 0.03 mg/l	Limit, 0.5 Bq/l	Limit, 1 Bq/l
Croatia	RL, 100 Bq/l	-	-	-	-
Cyprus	AL, 100 Bq/l	AL 0.5 Bq/l (^{226}Ra) 0.2 Bq/l (^{228}Ra)	AL, 2.8 Bq/l (^{234}U) 3 Bq/l (^{238}U)	AL, 0.1. Bq/l	AL, 1 Bq/l
Czech Republic	RL, 50 Bq/l; Limit, 300 Bq/l	Limit 6 Bq/l (^{224}Ra) 1.5 Bq/l (^{226}Ra) 0.5 Bq/l (^{228}Ra)	Limit 12 Bq/l (^{234}U) 12 Bq/l (^{238}U)	RL, 0.2 Bq/l	RL, 0.5 Bq/l excluding ^{40}K
Georgia	RL, 60 Bq/kg	-	-	RL, 0.1 Bq/kg	RL, 1 Bq/kg
Greece	RL, 100 Bq/l	RL 0.5Bq/l (^{226}Ra) 0.2Bq/l (^{228}Ra)	RL 2.8 Bq/l (^{234}U) 3 Bq/l (^{238}U)	RL, 0.1 Bq/l	RL, 1 Bq/l
Hungary	-	-	-	RL, 0.1 Bq/l	RL, 1 Bq/l
Kazakhstan	Limit 60 Bq/kg	Limit 0.49 Bq/kg	Limit 3.0 Bq/kg	Limit 0.2 Bq/kg	Limit 0.1 Bq/kg
Latvia	RL, 100 Bq/l	-	-	0.1 Bq/l	1 Bq/l
Lithuania	RL, 100 Bq/l	-	-	0.1 Bq/l	1 Bq/l
Montenegro	-	RL 0.2 Bq/l (^{226}Ra)	RL, 0.4 Bq/l	RL, 0.1 Bq/l	RL, 1 Bq/l
Republic of Moldova	Limit, 60 Bq/kg	-	-	Limit, 0.1 Bq/l	Limit, 1 Bq/l
Russian Federation	AL, 60 Bq/l Limit, 600 Bq/l	AL 0.5 Bq/kg (^{226}Ra) Limit 5Bq/kg	AL 2.8-3 Bq/kg Limit 28-30 Bq/kg	AL, 0.2 Bq/kg	AL, 1 Bq/kg
Serbia	-	AL, 0.49 Bq/l	AL, 3 Bq/l	-	-

TABLE 9. REFERENCE LEVEL, ACTION LEVEL AND LIMIT FOR CONTENT OF RADIONUCLIDES IN DRINKING WATER (cont.)

Country	Radon (^{222}Rn)	Radium	Uranium	Gross alpha	Gross beta
Slovakia	AL, 100 Bq/l; Limit, 300 Bq/l	Limit 0.6 Bq/l (^{226}Ra)	Limit 4.3 Bq/l (^{238}U) 3.9 Bq/l (^{234}U)	AL, 0.2 Bq/l	AL, 0.5 Bq/l
Slovenia	-	Limit, 0.48 Bq/l	Limit, 2.8 Bq/l	-	-
Tajikistan	-	-	-	AL, 0.1 Bq/kg	AL, 1 Bq/kg
The Former Yugoslav Republic of Macedonia	IL, 1 000 Bq/l	-	-	AL, 0.5 Bq/l	AL, 1 Bq/l
Turkey	Limit, 100 Bq/l	-	-	Limit, 0.5 Bq/l	Limit, 1 Bq/l
Ukraine	AL, 100 Bq/l	AL, 1 Bq/l	AL, 1 Bq/l	-	-

RL – reference level, AL – action level, IL – investigation level, "-" – no information provided

TABLE 10. REQUIREMENTS ON THE CONTENT OF NATURAL RADIONUCLIDES IN BUILDING MATERIALS USED FOR RESIDENTIAL BUILDINGS

Country	Content of natural radionuclides in building materials used for residential buildings
Albania	Activity concentration index I < 1(equation 1)
Armenia	$C_{eff} = C_{226Ra} + 1.30\ C_{232Th} + 0.09\ C_{40K}$ $C_{eff} \leq 370$ Bq/kg If $C_{eff} > 4\ 000$ Bq/kg the materials should not be used in building.
Belarus	$C_{eff} = C_{226Ra} + 1.30\ C_{232Th} + 0.09\ C_{40K}$ $C_{eff} \leq 370$ Bq/kg If $C_{eff} > 4\ 000$ Bq/kg the materials should not be used in building.
Bulgaria	Activity concentration index I < 1
Croatia	Activity concentration index I ≤ 1
Cyprus	Activity concentration index I ≤ 1
Czech Republic	Guidance level for building material used in bulk amount is I = 0.5 Maximum permitted level for ^{226}Ra of 150 Bq/m^3
Estonia	Activity concentration index I ≤ 1
Georgia	No
Greece	Activity concentration index I ≤ 1
Kazakhstan	$C_{eff} = C_{226Ra} + 1.30\ C_{232Th} + 0.09\ C_{40K} \leq 370$ Bq/kg
Kyrgyzstan	No information provided
Latvia	Action level: $C_{226Ra} \sim 100$ Bq/kg Limit value: The maximum permissible limits of specific radioactivity of natural radio nuclides (^{226}Ra, ^{232}Th) in construction materials and construction products shall be 270 Bq/kg Reference level: sources of gamma radiation – 1 Bq/kg Limit value: sources of gamma radiation – 2 Bq/kg
Lithuania	Activity concentration index I ≤ 1
Montenegro	Activity concentration index I ≤ 1
Poland	$C_{226Ra} = 276$ Bq/m^3, $C_{232Th} = 231$ Bq/ m^3, $C_{40K} = 3716$ Bq/m^3
Republic of Moldova	$C_{eff} = C_{226Ra} + 1.31\ C_{232Th} + 0.09\ C_{40K} \leq 300$ Bq/kg

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TABLE 10. REQUIREMENTS ON THE CONTENT OF NATURAL RADIONUCLIDES IN BUILDING MATERIALS USED FOR RESIDENTIAL BUILDINGS (cont.)

Country	Content of natural radionuclides in building materials used for residential buildings
Romania	Legal framework contains a list of building materials with admitted mass activities, otherwise I should be less than 0.5
Russian Federation	$C_{eff} = C_{226Ra} + 1.30\ C_{232Th} + 0.09\ C_{40K}$ $C_{eff} \leq 370$ Bq/kg Facing tile for inner and outer surfaces of a building – 740 Bq/kg
Serbia	Activity concentration index $I < 1$
Slovakia	Action level: $C_{226Ra} \sim 120$ Bq/kg Limit value is $I = 1$ for materials used in bulk amounts, e.g. concrete, building bricks, etc., resp. $I = 2$ for materials with restricted use.
Slovenia	200 Bq/kg for ^{232}Th, 300 Bq/kg for ^{226}Ra, 5 000 Bq/kg for ^{40}K
Tajikistan	$C_{eff} = C_{226Ra} + 1.30\ C_{232Th} + 0.09\ C_{40K}$ $C_{eff} \leq 370$ Bq/kg If $C_{eff} > 4\ 000$ Bq/kg the materials should not be used in building.
The Former Yugoslav Republic of Macedonia	Action level - 0.3 mSv/y $I < 0.5$ for unrestricted use of building materials $0.5<I<2$ for limited use of building material
Turkey	Activity concentration index $I \leq 1$
Ukraine	$C_{eff} = C_{226Ra} + 1.31\ C_{232Th} + 0.085\ C_{40K} < 370$ Bq/kg

3.1.7. Reference levels, action levels and limits for gamma radiation emitted from building material

Requirements related to gamma radiation emitted from the building material in the form of gamma dose rate or photon dose equivalent rate have been established in 15 Member States.

The Czech Republic and Latvia have set a limit of 0.5 μSv/h for gamma dose rate in new buildings and a limit of 1 μSv/h for gamma dose rate in existing buildings. Belarus, Bulgaria and Georgia have set a reference level of 0.2 μSv/h. The Republic of Moldova has set a reference level of 0.25 μSv/h and a limit of 0.5 μSv/h. Estonia has set a limit of 0.5 μSv/h that applies only to school and preschool centres. Slovakia has set an action level of 0.5 μSv/h. Slovenia sets a limit of 0.1 μSv/h above background levels at the distance of 1 m from the surface. Ukraine has set the mandatory levels of gamma radiation which are not to exceed 30 micro-roentgen per hour for new dwellings and 50 micro-roentgen per hour for existing dwellings. Lithuania has set a reference level of 0.35 μSv/h for dwellings and a reference level of 0.45 μSv/h for workplaces. The Russian Federation has set a limit of 0.3 μSv/h for dwellings and a limit of 0.6 μSv/h for workplaces. Armenia has set a reference level of 0.3 μSv/h and a limit of 0.6 μSv/h. Albania and Cyprus reported a guideline for permitted

level of activity of radionuclides in construction materials and construction products which is based on allowing an effective dose of 1mSv per year for the public above background.

3.1.8. Reference levels, action levels and limits for radon concentration in workplaces

Requirements related to radon activity concentration in workplaces are established in 25 Member States; Kyrgyzstan, Poland and Ukraine have no provisions related to radon in workplaces (see Table 2). In Estonia the requirements for radon activity concentration in workplaces are set for school and preschool facilities. An action level or limit is usually specified as the radon activity concentration of 1 000 Bq/m^3. If this level is exceeded then the employer is required to reduce the radon activity concentration by technical measures (corrective action, increased ventilation). This approach is also used in Belarus, Bulgaria, Croatia, Cyprus, Greece, Hungary, Montenegro, Romania, Serbia, Slovakia, Slovenia, and Turkey. Greece applies a limit of 3 000 Bq/m^3. The Czech Republic applies the exemption level for working hours: if workers spend less than 100 hours per year in a particular workplace, then the probability of exceeding the dose limit is considered to be negligible and measurements are not required to be made in the workplace. The Republic of Moldova applies a reference level of 300 Bq /m^3. Latvia applies a reference level of 400 Bq/m^3. The Czech Republic and Greece apply an investigation level of 400 Bq/m^3. The Russian Federation applies a reference level of 300 Bq /m^3 of equivalent equilibrium activity (EEC).

Armenia and Tajikistan consider radon and thoron progenies as follows: For category A personnel, the ALI and ACI of the radon (^{222}Rn) and thoron (^{220}Rn) progenies: (^{218}Po (RaA); ^{214}Pb (RaB); ^{214}Bi (RaC); ^{212}Pb (ThB); ^{212}Bi (ThC) expressed in equivalent equilibrium activity units are:

$$\text{ALI: } 0.10\ A_{RaA} + 0.52\ A_{RaB} + 0.38\ A_{RaC} = 3.0 \text{ MBq} \quad (2)$$

$$0.91\ A_{ThB} + 0.09\ A_{ThC} = 0.68 \text{ MBq} \quad (3)$$

$$\text{ACI: } 0.10\ A_{RaA} + 0.52\ A_{RaB} + 0.38\ A_{RaC} = 1\ 000 \text{ Bq/m}^3 \quad (4)$$

$$0.91\ A_{ThB} + 0.09\ A_{ThC} = 270 \text{ Bq/m}^3 \quad (5)$$

where ALI and ACI are the annual limit of intake and the average annual activity concentrations of the relevant radon progenies in the breathing zone. Usually the breathing rate is: $V_{pers}= 2.4 \times 10^3$ m^3 per t_{pers}, t_{pers} = 1 700 h (category A workers).

3.1.9. Radon in selling-buying process for dwellings

In five Member States, radon is considered in the selling-buying process for existing dwellings. In the Czech Republic and Turkey, either the measurement of radon is recommended at the time of the sale or the purchaser requests the results of previous measurements from the seller. In Belarus, Georgia and the Republic of Moldova the measurement of radon at the time of the sale is mandatory. The cost of the measurement is covered by the person who is selling the property. They also recommend that costs associated with any corrective actions be included in the contract. There is no obligation to inform the buyer of any existing corrective actions or of the results of past radon measurement. This obligation is required in the Czech Republic only for rental contracts.

The Republic of Moldova requires the measurement of radon in the purchase of newly constructed houses; the owner will not be allowed to register the house if the limit value is exceeded.

3.1.10. Radon and reconstruction or renovation of a building

The Czech Republic, the Russian Federation, Slovakia and Turkey have requirements that radon is considered in the planning stage for the reconstruction or renovation of buildings. Table 11 summarizes the results for this topic. The Czech Republic commented that radon is required to be considered if a building permit was needed for reconstruction work, whether the area was considered as radon prone or not. The measurement of radon indoors is mandatory before the commencement of renovation work in the Czech Republic and Turkey; while such measurements are only recommended before the commencement of renovation work in the Russian Federation and in Slovakia.

The Czech Republic requires measurement of radon gas in soil that is used as one of the bases for the design of building's substructure as part of the process for the design of an extension to a building. Corrective action is mandatory in Turkey if the radon levels inside an extension to a building exceeds the reference level or limit value. The Czech Republic and Russian Federation only recommend that corrective actions are carried out if the measured radon levels exceed the reference level or limit value.

Radon measurement after the construction work is finished is mandatory in Turkey; in other Member States the measurement is recommended.

TABLE 11. LIST OF BUILDING MODIFICATIONS AND THEIR APPLICATION

Type	Member State
Building extension	Czech Republic, Russian Federation, Slovakia, Turkey
Energy efficiency improvement	Russian Federation, Turkey
Replacement of windows	Russian Federation, Turkey
Replacement of old timber floors	Russian Federation

3.1.11. National radon programme and action plan

A radon programme is a long term (~30–50 years) strategy that aims at decreasing the overall public exposure to radon and its progenies. A radon action plan is usually a shorter term activity (5–10 years) with clearly described tasks to be done to contribute to the achievement of the long term goal.

A radon programme or a radon action plan has been established in twelve Member States involved in the project – Armenia, Bulgaria, Cyprus, the Czech Republic, Estonia, Greece, Kazakhstan, Lithuania, The Former Yugoslav Republic of Macedonia, Slovakia, Slovenia and Turkey. The existence of a radon programme or a radon action plan is, if established in the Member State, officially acknowledged by legal documents that are listed in Table 12. Greece does not have any legal document; radon related activities are carried out through the initiative of the regulatory body. In Estonia, radon related activities are listed in the National Radiation Safety Development Plan 2008–2017 in the chapter describing natural radiation.

The list of activities e.g. radon survey, communication with the public, implementation of legislation etc., which are covered by the national radon programme/radon action plan in Member States involved in the project are presented in Table 13. The primary goals are radon survey, radon maps, and increasing awareness of radon among the public. Some Member States have also included increasing awareness of radon issues among civil engineers and supported research activities in their national strategies.

A multidisciplinary approach is required to address radon related issues, therefore a number of ministries and agencies are usually involved in the radon related activities in the country. Usually, it is the national regulatory body and the ministry of health who have the main responsibility and they co-ordinate the radon related work with the other ministries and agencies that are responsible for construction of buildings, science, finance, etc. The list of bodies involved in national radon strategies in the Member States is provided in Table 14.

TABLE 12. LIST OF LEGAL DOCUMENTS ESTABLISHING A RADON PROGRAMME OR A RADON ACTION PLAN

Country	Type of document
Armenia	Governmental decree
Bulgaria	Governmental decree
Cyprus	Law
Czech Republic	Governmental decree
Estonia	National Radiation Safety Development Plan 2008–2017
Greece	Initiative of the Greek Atomic Energy Commission
Lithuania	Law and Hygiene Standard HN 85:2011
Slovenia	Law and governmental decree
The Former Yugoslav Republic of Macedonia	Governmental decree
Turkey	Governmental decree

TABLE 13. ACTIONS CONSIDERED IN A RADON PROGRAMME OR A RADON ACTION PLAN IN MEMBER STATES

Country	Actions covered by national radon programme/radon action plan
Armenia	Epidemiological investigations data and possible risk for the public; Requirements for elaboration of indoor radon requirements and for elaboration of drinking water requirements; Geological investigation on exhalation radon; Mining and milling activities; Control of construction materials (local and imported).
Bulgaria	Action Plan Structure 1) To establish an appropriate system for reducing any exposure to indoor radon concentrations through legislative, administrative and social measures; 2) National survey of indoor radon and draw up a radon map of Bulgaria; 3) To establish a control system for new and existing buildings; 4) To improve public awareness; 5) Introduction of exposure due to radon as a mandatory parameter for the assessment of occupational risk.
Cyprus	Comprehensive radon survey and radon maps; communication with the public and increase in public awareness, adoption of new European Union legislation.
Czech Republic	Action Plan Structure 1) Awareness strategy; 2) Radon prevention strategy; 3) Strategy of regulation of the existing exposure; 4) Expert scientific and technical support of the Action Plan task implementation.
Estonia	1) Organization of radon research. Target level for 2017 as compared to 2007: at least 6 radon surveys or respective projects have been organized; 2) Number of indoor air and soil-gas radon content measurements. Target level for 2017 as compared to 2007: the number of measured sites increases by 500 each year; 3) Number of information event participants. Target level for 2017: at least 1 000 people have participated in information events.
Greece	Radon survey, communication with the public, adoption of new European Union legislation.
Kazakhstan	Radon control and monitoring, radon surveys.
Lithuania	Radiation Protection Centre (RPC) performs radon survey in dwellings, radon measurements in soil, radon mapping. The RPC also issued books, brochures etc. about radon hazard, also presents in TV, radio and other media.

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TABLE 13. ACTIONS CONSIDERED IN A RADON PROGRAMME OR A RADON ACTION PLAN IN MEMBER STATES (cont.)

Country	Actions covered by national radon programme/radon action plan
Slovakia	The first action plan for radon risk management in Slovakia (1991 – 2005) was developed through working relationships between the Ministry of Health, Ministry of Construction, and the Ministry of Environment. Methods for radon monitoring, diagnosis of buildings, coordinating policies of education and research, and catalogues of remedial actions (involved in regulation of the Ministry of Health of Slovakia No.12/2001) were drawn up. Unfortunately, from 2005, due to the shortage of finances, the radon programme continues in a very limited range without national coordination.
Slovenia	Programme includes basic and additional radon measurements in selected places. Selection is based on the probability of exceeding 6 mSv. At least 20 buildings per year for educational, cultural or health purpose shall be included. Effective doses shall be estimated. Care is devoted to children, youth, ill or other handicapped persons. Analysis of reasons for higher concentration and searching of radon sources is obligatory.
The Former Yugoslav Republic of Macedonia	1) National survey of indoor radon through the country; 2) Mapping radon in schools, kindergartens and health care centres; 3) Establish national radon database; 4) Radon in soil (active measurements); 5) Develop information and communication materials focused on general population, construction companies and health workers; 6) Raising awareness for radon testing and smoking related information.
Turkey	1) Increase the number of public awareness activities (such as symposiums, sharing information by network or leaflets and by press releases); 2) Measure indoor radon levels by passive detectors in 65 000 randomly chosen houses which represent the whole country in city base and complete questionnaires with the residents of the dwellings while placing the detectors; 3) Preparing national radon map via these measurements; 4) Reclamation project for buildings that have high radon levels; 5) Establish control mechanisms for indoor radon measurement; 6) Prepare radon prevention guidelines; 7) Long term follow up for people living in houses with high radon levels for cancer.

TABLE 14. MINISTRIES, AGENCIES OR INSTITUTES CO-OPERATING UNDER THE NATIONAL RADON PROGRAMME/ACTION PLAN

Country	Ministries, agencies or institutes and their responsibilities
Albania	Radiation Protection Commission, Institute of Applied Nuclear Physics, Centre of Geoscience
Armenia	ANRA-regulatory control; Ministry of Health – epidemiological study; National Academy of Sciences – geological investigations; Ministry of Civil Construction – review of civil construction codes and implementations of their requirements.
Bulgaria	Ministry of Health, Ministry of Environment and Water, Ministry of Regional and Urban Development, Nuclear Regulatory Agency, Ministry of Education, Youth and Science.
Cyprus	Radiation Inspection and Control Service, Department of Labour Inspection, Ministry of Labour, Welfare and Social Insurance, in collaboration with the University of Cyprus, which carries out measurements in dwellings and high-occupancy buildings and prepare the first radon map in Cyprus. The regulatory body is the final user of the results and the radon map.
Czech Republic	State Office for Nuclear Safety along with the Ministry of Finance, Ministry of the Environment, Ministry for Regional Development, Ministry of Agriculture, Ministry of Industry and Trade and Ministry of Health.
Estonia	Ministry of the Environment, Environmental Board – overall organization, radon surveys/projects and radon measurements. Ministry of Economic Affairs and Communication – issues related to construction and operation of public buildings. Ministry of Social Affairs – public health regulations.
Greece	Ministry of Education, Greek Atomic Energy Commission
Kazakhstan	Ministry of National Economic (Control and monitoring of radon and radioactivity in dwellings, public buildings, food, water and building materials), Ministry of Energy, LLP “ECOSERVICE-S”, (Radiation monitoring, radiation surveys, radon investigations)
Lithuania	Radiation Protection Centre under the Ministry of Health Care is responsible for the national radon programme, and the State Nuclear Power Safety Inspectorate is responsible for the national radon programme in nuclear facilities.
Slovakia	Ministry of Health

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TABLE 14. MINISTRIES, AGENCIES OR INSTITUTES CO-OPERATING UNDER THE NATIONAL RADON PROGRAMME/ACTION PLAN (cont.)

Country	Ministries, agencies or institutes and their responsibilities
Slovenia	Ministry of Health: ensure education, information, publications and funds for mitigation and other measures for workers and population in public health buildings, Slovenian Radiation Protection Administration: detailed annual programme, inspections and enforcement, Ministry of Education, Science and Sport: ensure finance funds for mitigation and other measures in schools, kindergartens, Slovenian Research Agency at the Ministry of Education, Science and Sport supports radon research via research programmes and projects in which also indoor radon in dwellings and workplaces are included. Other Ministries: ensure funds for mitigation and other measures in buildings under their competence.
The Former Yugoslav Republic of Macedonia	Institute of Public Health (coordination, measurement, drafting proposals, communication with different stakeholders ...), Governmental committee for health and environmental protection (supervision), Ministry of Health (Regulator, Communication with health sector, public), Ministry of Transport and Communications (regulator and inspection responsibilities of new and existing buildings), Ministry of Economy (regulator and inspection responsibilities for building materials), Radiation Safety Directorate (regulation, authorization and inspection responsibilities of practices with radiation sources), Ministry of Environment (regulator, inspection ...)
Turkey	Turkish Atomic Energy Authority that depends on Ministry of Energy and Natural Resources – supply and evaluate passive radon detectors; Ministry of Health, Turkish Public Health Agency − distribution of passive radon detectors.

3.1.12. Radon prone areas

The concept of radon prone areas is currently used in eight Member States – Armenia, Estonia, Hungary, Kazakhstan, Poland, Romania, Russian Federation and Serbia. Greece plans to establish the concept by 2018. Table 15 provides the list of criteria used in the Member States to define the radon prone areas. Hungary, Romania and Serbia are using the concept only for scientific purposes. Armenia reported that the delineation was requested by the Government. In the Russian Federation, this concept is used for the design of preventive measures for newly built houses.

The measurement of indoor radon levels is mandatory in radon prone areas in the Russian Federation and such measurements are provided free of charge. Special information campaigns are organized in Estonia and Greece to persuade people to measure the radon level and if found high, to reduce it. Preventive measures are to be incorporated into new houses that are built in radon prone areas in the Russian Federation and in Greece. In Armenia the building code has special requirements on protection against exposure due to radon if a building is to be built in a radon prone area.

TABLE 15. LIST OF CRITERIA USED IN MEMBER STATES INVOLVED IN THE PROJECT TO DEFINE RADON PRONE AREAS

Country	The criteria for defining radon prone areas
Armenia	The delineation of radon prone area is based on geological investigations that were carried out in the late 1960s for uranium mines exploration purposes.
Estonia	No definition of radon–prone area exists in legal documents. The list of radon prone areas is given in the standard (building code) EVS 840:2009 "Design of the Radon-Safe Building" and is mainly based on geological data.
Greece	To be defined by 2018.
Hungary	The following formula was used to define the radon–prone area based on Neznal et al. [7]: GRP= $C\infty/(-\log_{10} k\text{-}10)$, where GRP means the geological radon potential risk; $C\infty$ means the radon concentration of the soil at 80–100 cm depth (unit: kBq/m^3); k means soil gas permeability (unit: m^2).
Kazakhstan	Median value of measurements in a region or settlement greater than 100 Bq/m^3.
Poland	Geological location structure and mining industry.
Romania	A radon prone area is defined as an area where the radon level in more than 10% of dwellings exceeds 400 Bq/m^3.
Russian Federation	Density of radon flux from ground, $mBq/(m^2s)$ Activity concentration of radon in soil, kBq/m^3; Radionuclide specific activity (^{226}Ra), Bq/kg; EEC of radon isotopes in the nearest buildings, Bq/m^3.
Serbia	Scientific experience – the region of Niška Banja.

3.1.13. National radon database

A radon database has been established in 15 of the Member States participating in the project. In Cyprus and Latvia the establishment of the database is currently in progress as the national radon survey is still being carried out. Slovenia and Romania plan to establish a database in 2016. Croatia plans to establish a radon database at the end of 2014.

In all of the Member States the database contains data on indoor radon measurement.

In the Russian Federation the database contains data on gamma dose rate levels in homes.

In the Czech Republic, Lithuania, the Republic of Moldova and Romania the results of the measurement of radon gas in soil are stored in the database.

In the Republic of Moldova and Romania, the underground water monitoring results are stored in the database.

In Croatia the database will be used to define the action levels and to identify the radon prone areas.

In Lithuania and the Russian Federation the database is also used to calculate the effective doses received by members of the public.

In most of the Member States only the regulatory body for radiation safety or authority responsible for the national radon strategy has access to the database. In Romania the database is open to the public as well, while in The Former Yugoslav Republic of Macedonia, access for the public is restricted.

The submission of measured data to the database is mandatory only in Bulgaria, Greece and Romania.

Information related to the national radon database is listed in Table 16.

TABLE 16. LIST OF ORGANIZATIONS THAT HAVE ACCESS TO THE NATIONAL RADON DATABASE AND WHO PROVIDE DATA TO THE DATABASE

Country	Access to the database	Who provides the results
Bulgaria	Database administrated by the National Center of Radiobiology and Radiation Protection.	All experts and laboratories on the list of subjects providing measurement of radon.
Croatia	The results will be published on web sites in table and map format.	Official technical service for radon measurements send the results to State Office for Radiological and Nuclear Safety (SORNS); it is obligatory for those measurements ordered by SORNS.
Cyprus	Radiation Inspection and Control Service, Department of Labour Inspection, Ministry of Labour, Welfare and Social Insurance.	University of Cyprus.
Czech Republic	Database administrated by the National Radiation Protection Institute (NRPI) – access NRPI and State Office for Nuclear Safety. Database administrated by the Czech Geological Survey (CGS).	NRPI and CGS.
Estonia	The database is kept (and can be accessed only) by the Radiation Safety Department of the Environmental Board.	The database contains only the data measured by the Radiation Safety Department or its predecessor Estonian Radiation Protection Centre.
Greece	Department of Environmental Radioactivity Monitoring of GAEC.	All the involved parties; mandatory to provide data.
Kazakhstan	LLP “ECSERVICES-S”; Committee of Environmental Regulation.	Researchers according to agreements.
Lithuania	Staff of Radiation Protection Centre (RPC).	Not mandatory. Radon measurements performed only by RPC.
Republic of Moldova	National Centre of Public Health.	Regional Centres of Public Health: Radiation monitoring laboratories.
Romania	Public.	All the laboratories that monitor radon (soil, air, water, indoor) send the results to the database. It is obligatory to report the results to the National Authority for Research.

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TABLE 16. LIST OF ORGANIZATIONS THAT HAVE ACCESS TO THE NATIONAL RADON DATABASE AND WHO PROVIDE DATA TO THE DATABASE (cont.)

Country	Access to the database	Who provides the results
Russian Federation	Institute of Radiation Hygiene.	Regional managements (Radiation monitoring laboratories) of Rospotrebnadzor and FMBA, Ministry of Internal Affairs, Ministry of Defence.
Slovakia	Slovak Medical University in Bratislava.	Department of Radiation Hygiene of Slovak Medical University.
Slovenia	SRPA; Jožef Stefan Institute-Radon Center; Institute of Occupational Safety.	SRPA: transcript from the reports of radiation protection experts; Radon Center and Institute of Occupational Safety: Mainly own measurements. Providing results is not obligatory.
The Former Yugoslav Republic of Macedonia	Agencies/Ministries involved in national radon programme and public with limited access.	Information not provided.
Turkey	Turkish Atomic Energy Authority.	Turkish Atomic Energy Authority.

3.2. RADON IN CIVIL ENGINEERING

The advice of architects and building professionals is essential to developing guidelines on techniques to reduce radon levels in new and existing buildings. The availability of specific guidelines regarding preventive measures in new buildings and corrective actions in existing buildings can help to establish best practices and make the information available for a broader audience. Including requirements on preventive measures in building codes for new buildings will assist efforts to prevent the occurrence of elevated radon levels in newly constructed buildings. Such requirements can be used to support the purchaser of new homes in legal actions against the building professional responsible for the design/construction of the dwelling.

3.2.1. Summary

Guidance on preventive measures for new buildings, corrective actions for existing buildings or requirements in building regulations for reducing radon levels are available in eight Member States (Albania, Belarus, Czech Republic, Estonia, Poland, Russian Federation, Slovenia and Turkey). Such guidance is planned in two countries in the near future (Bulgaria, Latvia). There is no such guidance on methods to reduce radon levels in buildings in the remaining 17 Member States.

Requirements for radon are included in building codes in five Member States (Czech Republic, Belarus, Estonia, Russian Federation and Slovenia). In Estonia, this code serves more as a guideline than a set of requirements, which influences its applicability and

enforcement. The building code is applicable to the entire country and not just to selected areas of the country (e.g. radon prone areas). Half of the countries reported the positive effect of the building codes on radon levels in their country.

3.2.2. Corrective actions

Guideline(s) for technical measures to decrease radon levels in existing dwellings have been developed in four Member States: Czech Republic, Poland, Russian Federation, and Slovenia. Some information about the corrective actions is available also in Albania, Belarus, Estonia, Turkey and Poland. The corrective actions recommended or included in the guidelines were radon–proof waterproof membrane, passive soil depressurization, active soil depressurization, water treatment, and increased building ventilation.

There is no restriction given on who can implement the corrective actions; only Slovenia recommends that references for the building company to implement the corrective actions be checked. None of the Member States maintains a list or database of building professionals or companies qualified for the design and installation of corrective actions.

The cost of corrective action depends on the type of action (Russian Federation) and the technical state of the building (Czech Republic) and could reach up to thousands of euros which equals a few month's salary for these countries. The cost of the corrective actions is in most cases paid by the owner of the building; in specific cases e.g. kindergarten with high radon levels (Russian Federation) or public and state buildings (Slovenia), the local authority shares the cost. A government subsidy for corrective actions exists only in the Czech Republic for those buildings where the average radon concentration exceeds 1 000 Bq/m^3, (400 Bq/m^3 in case of schools and preschool facilities) and the building was constructed before the law with provisions on radon entered into force in 1991; and in Turkey (if the limit values are exceeded in a high number of buildings in a specific area).

The target level for indoor radon concentration following the installation of corrective actions is set in Albania (200 Bq/m^3), Belarus (EEC of 100 Bq/m^3), Czech Republic (ALARA), Russian Federation (EEC of 100 Bq/m^3), Slovakia (400 Bq/m^3), Slovenia (200 Bq/m^3). The corrective action is considered effective if the target level is not exceeded or if $C_{before}/C_{after} > 5$ (Slovenia) and $(C_{before} - C_{after})/C_{before} > 0.75$ (Czech Republic, applicable for those buildings receiving government subsidy). If the result is not satisfactory, the system of corrective action is required to be reviewed and modified accordingly.

There is a low percentage of home owners who have undertaken corrective action when informed that the radon levels in their home was above the reference level. The radon concentration is measured after the installation of corrective actions in all of the countries with exception of Albania and Belarus. The functionality of corrective actions are verified periodically only in public buildings in Slovenia.

3.2.3. Preventive measures

Five Member States indicated that there were recommendations or guidelines available for preventive measures for new buildings: Estonia, Czech Republic, Poland, Russian Federation and Slovakia. The design level for radon concentration in new buildings is set in the Russian Federation (EEC of 100 Bq/m^3). The preventive measures recommended or included in the guidelines were radon proof waterproof membrane, passive soil depressurization, and building ventilation. The criteria and parameters used for the design of preventive measures

are presented in Table 17. No specific regulations or recommendations relating to radon and energy efficient buildings are applied.

The preventive measures are designed at the planning stage for new buildings. There were no specific requirements for the education of building professionals in relation to preventive measures against exposure due to radon.

The cost of preventive measures depends on the type of preventive measure and varies between States; it can be hundreds to one thousand euro (Slovakia), less than 1% of the cost of the house (Czech Republic, the Russian Federation), more than 100 euro (Poland) and the cost is not known in Estonia. The percentage of new dwellings in which the preventive measures have been incorporated is not available in most of the Member States. The estimate in Slovakia is about 5–10%. In the Czech Republic, the preventive measures are obligatory, but are not subject to official control.

The measurement of radon levels after construction of the building is completed is recommended in the Czech Republic and Slovakia and is mandatory in the Russian Federation where the measurements are required by the Building Code.

TABLE 17. CRITERIA FOR THE DESIGN OF PREVENTIVE MEASURES

Member State	Criteria and parameters
Czech Republic	Czech Technical Standard 73 0601. Protection of buildings against radon from the soil – radon index of construction site, type of building foundation, floor heating, type of ventilation. Waterproof membrane is required to be tested according to prescribed method.
Estonia	Soil radon concentration.
Poland	Construction type of building, soil radon concentration, radon maps.
Russian Federation	Soil radon concentration, radon flux density of 80 mBq/m^{2}s at construction area for new dwellings, and 250 mBq/m^{2}s for workplaces. Rn control limits on completion, EEC 100 Bq/m^3 for dwellings, EEC 150 Bq/m^3 for workplaces. Radon maps, construction type, purpose of building. Radiation Safety Standards. NRB 99−2009, Main Sanitary Rules for Radiation Safety. OSPORB 99/2010.
Slovakia	Soil radon concentration and type of building construction. Waterproof membrane is required to be tested according to prescribed method.

3.3. MEASUREMENT OF RADON

The only way to determine if radon is of concern for public health is through the measurement of radon in dwellings. Several types of radon detectors and monitors are available in the Member States participating in the project. In some Member States, radon measurement services are provided on a commercial basis, and some are the result of scientific work by laboratories. Clear protocols are recommended to ensure reliable and comparable results for radon measurements.

This part of the survey was dedicated to finding the measurement techniques that were available in the Member States, the metrological requirements relevant for the results, the measurement protocols, and the use of results.

3.3.1. Summary

Radon detectors or monitors are available in all of the Member States involved in the project. In general, the total number of radon measurements carried out in the Member States in the project is quite low. However, there are some exceptions: some States are supporting measurement campaigns or there are ongoing national radon surveys. Measurement results are often used for scientific purposes and many of these results come from continuous radon monitoring rather than from passive integral measurement. Legal requirements on organizations or companies providing measurement are only established in nine Member States.

Passive detectors, when used, are usually located in the living room and the bedroom located on the ground floor or the first occupied floor. The most frequent duration of measurement is 2–3 months. Measurement duration for active monitors was in some cases reported to be shorter than 24 hours. Such short measurements are usually done under conservative closed conditions with respect to the ventilation of the room of the dwelling. The measurement report generally contains all relevant information regarding the description of the location of the detectors, description of the age of the dwelling, building material, information about ventilation and information about the inhabitants.

Measurement results are used for the development of radon maps, for input to the development of a national radon strategy and for scientific purposes (see Table 23).

3.3.2. Legal requirements

Requirements for organizations or companies providing measurement of radon or radon progenies are set in ten Member States (Belarus, Bosnia and Herzegovina, Croatia, Czech Republic, Kazakhstan, Latvia, Montenegro, Russian Federation, Slovakia and Slovenia). There may be different requirements for those circumstances where the measurement results are used for official purposes (e.g. building permit). Accreditation for making measurements is required in the Russian Federation, Slovakia and Slovenia, while a license is required in Bosnia and Herzegovina, Croatia and Georgia. Written requirements on accuracy and precision for detectors used in radon or radon progeny measurements are established in Armenia, Belarus, Bulgaria, Czech Republic, Hungary, Montenegro, Russian Federation, Serbia, Slovakia, Slovenia, Turkey and Ukraine. Ensuring measurement quality is usually done through metrology certification, participation in inter-comparison measurement and periodical calibration of detectors and monitors. Metrology requirements in the Member States involved in the project are summarized in Table 18.

3.3.3. Passive radon detectors

Passive radon detectors are used for long-term radon or radon progenies concentration measurement. The result of this measurement is the average activity concentration for the duration of measurement. Passive radon detectors are not available on a regular basis in Belarus, Bosnia and Herzegovina, Cyprus, Montenegro, the Republic of Moldova and Tajikistan. Armenia, Hungary, Kyrgyzstan, Poland, and Romania are purchasing passive detectors from a commercial provider. Estonia, Lithuania, Serbia, Slovenia, The Former

Yugoslav Republic of Macedonia and Turkey purchase the passive detectors from commercial provider, but national laboratories do the evaluation and give support to the customers. Other Member States participating in the project have their own measurement system for passive radon measurements.

CR-39 based detectors are the most frequently used passive detectors. Electrets are used in the Czech Republic, Greece, Latvia, Lithuania and Slovakia. Activated charcoal detectors are used only in Poland and the Russian Federation, and Montenegro is planning to use them in the future. LR115 detectors are used in the Czech Republic, the Russian Federation, Ukraine and Croatia. The Russian Federation and Ukraine require the measurement of the equilibrium equivalent radon activity concentration (EEC) and the EEC is used in measurement reports rather than radon activity concentration.

Two detectors per dwelling are usually used to monitor the radon concentration in most of the Member States. One detector per dwelling is used in Armenia, Hungary and Romania, while Croatia uses one detector per dwelling and two detectors per dwelling in 10% of measured locations. The Czech Republic, Estonia, and Kyrgyzstan modify the number of detectors according to the size of the dwelling.

The content of the measurement protocols for passive detectors is summarized in Table 19 and Table 20. Table 19 provides the information collected about the dwelling in which the measurement is carried out, along with information about the inhabitants. Table 20 displays the requirements regarding the duration of measurement and the location of detectors in the dwelling in the Member States. The measurement protocol in all of the Member States also requests information regarding the full address, name of the house owner, date for beginning and end of the measurement. Other requirements that may be specified in the measurement protocol by the regulatory body relate to the evaluation of results and information to be included the final report.

Seasonal correction factors are applied in Armenia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, The Former Yugoslav Republic of Macedonia, Romania, Russian Federation and Slovenia. The electrets are corrected to gamma dose rate. The Russian Federation applies a correction factor for thoron and Greece for fading of CR-39 signal. The required measurement duration is summarized in Table 20; the preferred season for measurement is winter or the heating season in Bulgaria, Czech Republic (for short term measurement), Estonia, Georgia, Kyrgyzstan, Lithuania, Slovenia, Turkey, and Ukraine. The measurement is usually carried out under normal user conditions.

The average radon level calculated from the measured results for the dwelling is compared to the reference level or action level or the limit set in the legal framework. The maximum measured level for the house or dwelling is used for comparison with the action level or limit value set in Slovakia.

TABLE 18. REQUIREMENTS ON METROLOGY OF RADON AND/OR RADON DECAY PRODUCTS MEASUREMENT

Country	None	Periodical metrology certification	Mandatory comparison measurements	Mandatory periodical calibration
Albania	x			
Armenia	x			
Belarus		x	x	x
Bosnia and Herzegovina	x			
Bulgaria		x	x	x
Croatia				x
Cyprus		x		x
Czech Republic		x		
Estonia	x*			
Georgia	x			
Greece	x			
Hungary	x			
Kazakhstan				x
Kyrgyzstan	x			
Latvia		x	x	x
Lithuania	x			
Montenegro	x			
Poland		x		
Republic of Moldova		No information provided		
Romania	x			
Russian Federation		x		x
Serbia		x	x	x
Slovakia		x	x	x
Slovenia		x	x	x
Tajikistan		No information provided		
The Former Yugoslav Republic of Macedonia	x			
Turkey		x	x	x
Ukraine				x

*The standard EVS 840:2009 states: “When ordering measurements, preference is to be given to accredited laboratories that participate in inter-comparisons”

TABLE 19. MEASUREMENT PROTOCOL FOR PASSIVE MEASUREMENT (INFORMATION COLLECTED)

Country	Type of detector	Building type	Construction material	Ventilation rate	Number of inhabitants	Year of construction	Basement/ cellar	Other information requested in the measurement protocol
Albania	CR-39	x		x	x			
Armenia	Alpha track	x						
Bulgaria	Alpha track	x	x	x	x	x	x	
Croatia	LR115	x			x			number of children below 12 years
Czech Republic	Electrets	x	x	x	x	x	x	water source, other relevant information found on site
Czech Republic	LR115	x	x	x	x	x	x	water source
Estonia	CR-39	x	x	x		x	x	location (on level surface or slope), type of soil, source of water
Georgia	CR-39 bare	x	x					
Greece	Electrets	x	x	x		x	x	heating type, smoking habits
Greece	CR-39	x	x	x		x	x	
Hungary	CR-39	x	x	x	x			presence of sludge in the floor or ceiling, type of heating system
Kazakhstan	CR-39	x	x	x	x			Air temperature inside and outside, smoking habits
Kyrgyzstan	CR-39	x						gamma dose rate
Latvia	Electrets	x	x	x				level of a house
Lithuania	Electrets	x	x	x		x	x	source of water
Poland	Activated charcoal	x	x					local geological structure
Poland	CR-39	x	x					local geological structure

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TABLE 19. MEASUREMENT PROTOCOL FOR PASSIVE MEASUREMENT (INFORMATION COLLECTED) (cont.)

Country	Type of detector	Building type	Construction material	Ventilation rate	Number of inhabitants	Year of construction	Basement/ cellar	Other information requested in the measurement protocol
Romania	CR-39	x	x	x	x			presence of sludge in the floor or ceiling
Russian Federation	LR115	x	x		x	x	x	heating system, source of water
Serbia	CR-39							N/A
Slovakia	Electrets	x	x	x	x	x	x	water supply, type of heating, age and sex of inhabitants, entrance to the ceiling from the house
Slovakia	CR-39	x	x	x	x	x	x	
Slovenia	CR-39	x	x			x	x	
The Former Yugoslav Republic of Macedonia	CR-39	x	x	x	x	x	x	water supply, heating
Turkey	CR-39	x	x	x	x	x	x	type of heating, smoking habit, age and gender of inhabitants, floor number in the house
Ukraine	LR115 bare	x	x	x	x			number of children below 14 years

TABLE 20. MEASUREMENT PROTOCOL FOR PASSIVE MEASUREMENT – MEASUREMENT DURATION AND LOCATION

Country	Type of detector	Preferred detector location		Measurement duration	
		Room	Level of a house	Typical	Minimal required
Albania	CR-39	L, B	G	90 or 180 days	90 days
Armenia	Alpha track	B	N/A	3 months	1 month
Bulgaria	Alpha track	L, B	G	6 months	3 months
Croatia	LR115	L, B	G	1 year	1 year
Czech Republic	Electrets, LR115	L, B *	G	1 week (electrets), 2 months and 1 year (LR115)	1 week (electrets), 2 months (LR115)
Estonia	CR-39	L, B	G or 1st occupied floor	More than two months.	2 months
Georgia	CR-39 bare	K, B	first floor	6−12 month	3 month
Greece	Electrets, CR-39	L, B	G	3 months (electrets), 6 months (CR-39)	3 months
Hungary	CR-39	L, B	G (no cellar under the measured room)	from 3 month up to 1 year	1 month
Kazakhstan	CR-39	L, B	G	3 months	1-2 months
Kyrgyzstan	CR-39	L, B, K	G	3−6 months	3 months
Latvia	Electrets	K, B	basement	From 5 days to 1−2 months	5 days
Lithuania	Electrets	Ch, L, B	G	30 days	21 days
Poland	Activated charcoal	no	no	48h	24-96h
Poland	CR-39	no	no	3−6 months	depends on user
Romania	CR-39	B	G	3 months	2 months

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TABLE 20. MEASUREMENT PROTOCOL FOR PASSIVE MEASUREMENT – MEASUREMENT DURATION AND LOCATION (cont.)

Country	Type of detector	Preferred detector location		Measurement duration	
		Room	Level of a house	Typical	Minimal required
Russian Federation	LR115	L, B	G or 1st occupied floor	1−3 months (2 seasons−heating and summer)	1 month per each season
Serbia	CR-39	no	no	6 months	3 months
Slovakia	Electrets, CR-39	B	G	1 week (electrets), 6 months (CR-39)	
Slovenia	CR-39	occupied	G	1−3 months	1 month
The Former Yugoslav Republic of Macedonia	CR-39	L	G or 1st occupied	6 months	N/A
Turkey	CR-39	L, B	basement	2−3 months	2 months
Ukraine	LR115, bare	B, Ch	G	30 days	30 days

L- Living room, K – kitchen, B – Bedroom, Ch – children room, G – ground floor in contact with soil

*Rooms where building material with high radionuclide content might be used

3.3.4. Active radon monitors

Active radon monitors are available in 21 of the Member States participating in the project. Albania, Armenia, Belarus, Croatia, The Former Yugoslav Republic of Macedonia, Tajikistan and Ukraine do not have active radon monitors available on a regular basis.

The measurement protocols for active monitors differ from those for passive detectors in regards to the duration of the measurement and the conditions relating to ventilation in the dwelling during the measurement period. Table 21 summarizes the duration and the prescribed ventilation conditions for radon measurements with active radon monitors. Table 22 summarizes the information collected for measurements made with active radon monitors in those Member States without passive radon monitoring systems. No information was provided by the Republic of Moldova. The other Member States have the same requirements on collected information for measurements made with passive radon monitors and active radon monitors. Seasonal correction factors are applied in Cyprus, Georgia, Kazakhstan, the Republic of Moldova, Romania, and the Russian Federation. In the Czech Republic, the Republic of Moldova, and Slovenia, the preferred season for measurement is winter or the heating season.

The average radon level calculated from the measured results for the dwelling is compared to the reference or action levels or limits set in the legal framework in most of the Member

States who responded to this question. The maximum value for the dwellings is used in Bosnia and Herzegovina and Slovakia.

3.3.5. Reporting of results

The protocol for reporting results usually contains the information collected during the measurement and the measurement results. Bulgaria requires the report to be in agreement with the requirements of ISO 17025; Lithuania with the requirements of ISO 9001; and Greece with the requirements of ISO 11665−4. The Czech Republic has the requirements written in the law or the official example report as issued by the regulatory body. The following Member States have no rules on the content of the protocol for reporting results: Albania, Armenia, Croatia, Cyprus, Georgia, Kyrgyzstan, Latvia, The Former Yugoslav Republic of Macedonia, Poland, Romania, Serbia and Ukraine.

The owner of the results is either the owner of the dwelling or the organization which makes the measurements. The aggregated data from the measurement of radon are used for several purposes in the Member States: development of radon maps, planning communication plans, verification of effectiveness of corrective actions, verification of preventive measures in new dwellings, publication of results in scientific journals, determining the need for a national radon action plan, and the health impact of radon in the country (see Table 23).

The results are reported to the house owner (the customer) and in some cases also to a governmental organization. In Bosnia and Herzegovina, and Serbia, the measurement results are used only for the purpose of scientific research (see Table 24).

The governmental or non-profit organizations providing radon measurements are listed in Table 25. Private companies providing radon measurements exist only in the Czech Republic, Slovakia and Estonia. The number of measurements made each year is quite low (tens up to hundred per year) in each of the Member States; except during the years in which there were national surveys or government supported measurement campaigns or research activities carried out.

TABLE 21. DURATION OF MEASUREMENT AND PRESCRIBED CONDITIONS FOR ACTIVE MONITORS

Country	Duration of measurement		Conditions
	Typical	Minimum required	
Bosnia and Herzegovina	24−48 h	24 h	N
Bulgaria	1 d	3 h	C
Cyprus	24 h	2 h	N
Czech Republic	1 week	1 week	D
Estonia	24 h per room	24 h recommended	N
Georgia	4−6 h	2 h	N
Greece	1 week	1 d	C
Hungary	3 d	1 d	C
Kazakhstan	4 min	4 min	C
Kyrgyzstan	45 min	25 min	C
Latvia	8 h	4 h	C
Lithuania	30 min	10 min	N
Montenegro	48 h	48 h	C
Poland	no	-	D
Republic of Moldova	15, 30, 45 and 60 min	15 min	D
Romania	1−3 d	1 d	N
Russian Federation	several minutes−3 h		D
Serbia	2 h	2 h	N
Slovakia		1 week	N
Slovenia	1 week	2 d	N
Turkey	24 h	1 h	N

N - Normal conditions, dwelling occupied, C - Closed conditions, ventilation set to minimum,
D - It depends on the purpose of the measurement.

TABLE 22. MEASUREMENT PROTOCOL FOR ACTIVE MEASUREMENT (INFORMATION COLLECTED)

Country	Building type	Construction material	Ventilation rate	Number of inhabitants	Year of construction	Other
Bosnia and Herzegovina	x	x	x	x	x	geological characteristics of the terrain on which a building is constructed; source of water; proximity to industrial zones.
Cyprus	x	x	x	x		geological characteristics of the terrain on which a building is constructed (rock/soil type in the region selected); floor where the room is located; type of building (school, hospital, etc.).
Montenegro	x	x	x	x	x	smoking habits.

TABLE 23. THE USE OF THE MEASUREMENT RESULTS

Country	Radon Maps	Communication campaign plans	Verification after corrective actions	Verification after preventive measures	Scientific journals	Purpose of action plan, health issues
Bosnia and Herzegovina	x				x	
Bulgaria	x		x		x	x
Cyprus	x				x	x
Czech Republic	x	x			x	x
Estonia	x	x				
Georgia	x					
Greece	x					
Hungary	x					
Kazakhstan	x	x				
Kyrgyzstan						
Latvia						x
Lithuania	x	x			x	x
Montenegro			x			
Poland	x					
Republic of Moldova	x				x	
Romania	x		x			
Russian Federation	x		x			x
Serbia	x					
Slovakia	x		x			
Slovenia	x		x		x	
Turkey	x					x

TABLE 24. DISTRIBUTION OF MEASUREMENT RESULTS

Country	Results are reported to	Governmental institution informed of the results
Bosnia and Herzegovina	Research.	Federal Ministry of Education and Science of Bosnia and Herzegovina.
Bulgaria	House owners.	None.
Cyprus	Research; Regulatory body; House owners may ask independently for private radon measurements.	Radiation Inspection and Control Service, Department of Labour Inspection, Ministry of Labour, Welfare and Social Insurance is one of the final users of the results.
Czech Republic	House owners.	Regional authority in case of free measurements within the Radon Programme.
Estonia	House owner.	In case the measurement is done by the Radiation Safety Department it will also be entered into the database.
Georgia	Results are not reported to anyone.	Tbilisi State University.
Greece	House owner.	Greek Atomic Energy Commission.
Hungary	House owners, research.	None.
Kazakhstan	House owner, Committee of Ecological Research.	UPRRP of Oblast.
Latvia	Ministry of Environmental Protection and Regional Development, European Commission.	Ministry of Environmental Protection and Regional Development.
Lithuania	Every year RPC reports results to Ministry of Health Care.	Municipalities.
Montenegro	House owner.	Environmental Protection Agency of Montenegro.
Poland	Results are not reported to anyone.	None.
Republic of Moldova	Head of the radiation hygiene laboratory.	Ministry of Health.
Romania	IRART project.	National Authority for Scientific Research.
Russian Federation	Federal Supervision Service for Protection of Consumers' Rights and Public Welfare (ROSPOTREBNADZOR), Federal Medical Biological Agency.	
Serbia	Research.	None.
Slovakia	House owner.	Public Health Authority.
Slovenia	House owner.	SRPA.
Turkey	Turkish Atomic Energy Authority.	

TABLE 25. LIST OF GOVERNMENT AND NON-PROFIT ORGANIZATIONS PROVIDING RADON MEASUREMENTS

Country:	Organization
Bosnia and Herzegovina	University of Tuzla, Faculty of Science, Tuzla.
Bulgaria	National Center of Radiobiology and Radiation Protection; Executive Environment Agency (under the administration of Ministry of Environment and Water); Sofia University, Faculty of Physics.
Cyprus	Radiation Inspection and Control Service, Department of Labour Inspection, Ministry of Labour, Welfare and Social Insurance; University of Cyprus.
Czech Republic	National Radiation Protection Institute.
Estonia	Environmental Board, Radiation Safety Department.
Georgia	Tbilisi State University, Institute of Geophysics.
Greece	Greece Atomic Energy Commission; Universities.
Hungary	University of Pannonia, Institute of Radiochemistry and Radioecology Eötvös Lóránd University, Institute of Geography and Earth Sciences, "Frédéric Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene.
Kazakhstan	Territorial Centres of Sanitary – Epidemiological Expertise.
Latvia	State limited Liability Company "Latvian Environment, Geology and Meteorology Centre".
Lithuania	Radiation Protection Centre.
Montenegro	Center for Ecotoxicological Research.
Poland	Central Laboratory for Radiological Protection, Warsaw Central Mining Institute, Katowice Medical University of Bialystok Institute of Nuclear Physics, Krakov Nofer Institute of Occupational Medicine, Łódź Wrocław University of Technology, Wroclaw Building Research Institute, Warsaw University of Silesia, Katowice.
Republic of Moldova	National Center for Public Health.
Romania	Environmental Radioactivity and Nuclear Dating Center, Babes Bolyai University, Cluj.
Russian Federation	Radiation Hygiene Scientific Research Institute, St. Petersburg , Research and Technical Center of Radiation-Chemical Safety and Hygiene FMBA Russia (RTC RChSH) (FMBA of Russia)State Research Center Federal Medical Biophysical Centre (FMBA of Russia) Institute of Industrial Ecology Ural Branch of Russian Academy of Science.
Serbia	University of Novi Sad, Faculty of Science, Department of Physics, Chair of Nuclear Physics, Novi Sad, University of Belgrade, Vinča Institute of Nuclear Sciences, University of Belgrade, Institute of Physics Belgrade, Low-Background Laboratory for Nuclear Physics, Institute of Occupational Health of Serbia "Dr Dragomir Karajović", Center for Radiological Protection, Belgrade, University of Kragujevac, Faculty of Science Kragujevac, Institute of Physics.
Slovakia	Slovak Medical University in Bratislava; Regional Public Health Authority in Banska Bystrica.
Slovenia	Jožef Stefan Institute, Department of Environmental Sciences, Radon Center.
Turkey	Turkish Atomic Energy Authority; Some universities.

3.4. RADON SURVEY

A radon survey collects information on the radon activity concentration in a geographical area of interest. The purpose of this section is to provide information about the surveys at national or regional levels in dwellings, workplaces and/or in buildings with high occupancy factors for members of the public, their methodology and the results. If more than one survey was reported, the information provided in this report is taken from the survey that was labelled as a representative survey.

A radon survey (not necessarily representative) has been carried out in all Member States involved in the project with the exception of Belarus, Republic of Moldova, and Tajikistan. Albania started a radon survey at the beginning of 2014. A survey in Greece is still being carried out and no detailed data were reported.

Results of various radon surveys carried out in the past in the Member States are presented in Tables 26−29. The duration of measurement varies from 1 month to 1 year. The most commonly used detectors are CR-39 in a diffusion chamber. The details about the radon surveys are presented in Table 30 and Table 31. The reported return rate for radon dosimeters varied from 65% (Slovakia) to 98% (Bulgaria), with an average reported return rate of 87%.

The following corrections are made to the collected data (results of measurement):

- Background correction: Croatia, Cyprus, Georgia, Kyrgyzstan, Latvia, Russian Federation, Slovakia
- Seasonal correction factor: Armenia, Hungary, Kazakhstan, Kyrgyzstan, Romania, Russian Federation, Slovenia, The Former Yugoslav Republic of Macedonia.

Thoron measurements accompanying the radon measurement were performed in Kyrgyzstan, the Russian Federation and Slovenia. Gamma dose rate measurements, which can reveal the building material with elevated content of natural radionuclides, were carried out in 50% of the surveys.

The accompanying questionnaire which is used to collect some information about the premises in which the radon measurements were carried out was used in 50% of surveys. The information collected was usually as follows: type of dwellings, construction material, type of foundation, presence of basement/cellar, type of window, heating, smoking habits, number of inhabitants, year of construction, number of floors, last renovation, etc.

The results of the measurements were provided to the inhabitants of the dwelling or employers in the case of workplace measurements in most of the Member States. The results were not provided in Armenia, Bosnia and Herzegovina, and Montenegro. The owner of the buildings was usually interested in receiving the results from the measurements; only Armenia, Bulgaria, and Kyrgyzstan reported that they were not.

The health impact on the population based on the survey results was evaluated in Estonia, Georgia, Hungary, Kyrgyzstan, Romania, Russian Federation and Slovakia.

Further information on the radon surveys that have been performed in the Member States can be found in refs [8−45], and in Table 32.

TABLE 26. DISTRIBUTION OF RADON LEVELS AND ESTIMATED PERCENTAGE OF DWELLINGS EXCEEDING REFERENCE LEVEL OR LIMIT VALUE – NATIONAL SURVEY IN DWELLINGS

Country	Distribution characteristics (Bq/m^3)			Percentage of dwellings exceeding	
	AM	GM	GSD	reference level	limit value
Armenia	-	-	-	30	5
Bulgaria	158	99	2.25	8	0
Estonia	95	-	-	9% > 200 Bq/m^3	1% > 400 Bq/m^3
Latvia	70	-	5	-	-
Lithuania	55	-	-	1	-
Montenegro	105	49.6	3.2	5.6	-
Poland	85.5	43.1	-	~3,5% > 400 Bq/m^3; ~8,5% > 200 Bq/m^3	
Slovakia	108	59.6	2.22	-	-
The Former Yugoslav Republic of Macedonia	105	84	1.86	8	-
Turkey	81	57	2.3	1 % > 200 Bq/m^3	-
Ukraine	62	42	-	19	-

AM – Arithmetic mean, GM – Geometric mean, GSD – Geometric standard deviation

TABLE 27. RADON LEVELS BASED ON REPORTED INFORMATION IN MEMBER STATES – LOCAL SURVEY IN DWELLINGS

Country	Location	Arithmetic mean (Bq/m^3)
Bosnia and Herzegovina	Bihać municipality.	82.1
Bosnia and Herzegovina	Tuzla city dwellings.	27.9
Cyprus	Lefkosia (Nicosia).	20.6±13.2
Georgia	West Georgia.	Values from 5 to 245
Kazakhstan	Zhambyl oblast.	87
Serbia	Province of Vojvodina.	144

TABLE 28. DISTRIBUTION OF RADON LEVELS AND ESTIMATED PERCENTAGE OF BUILDINGS EXCEEDING REFERENCE LEVEL OR LIMIT VALUE – NATIONAL SURVEY IN DWELLINGS AND SCHOOLS

Country	Distribution characteristics (Bq/m^3)			Percentage of buildings exceeding	
	AM	GM	GSD	reference level	limit value
Croatia	68	50	2.3	1.8	
Hungary	133	100	21	0,5−1,5 > 400 Bq/m^3	
Slovenia	87	60	2.2	10	2

AM – Arithmetic mean, GM – Geometric mean, GSD – Geometric standard deviation

TABLE 29. DISTRIBUTION OF RADON LEVELS AND ESTIMATED PERCENTAGE OF BUILDINGS EXCEEDING REFERENCE LEVEL OR LIMIT VALUE – SURVEYS IN KINDERGARTENS AND SCHOOLS

Country	Location	Distribution characteristics (Bq/m^3)			Percentage of buildings exceeding	
		AM	GM	GSD	reference level	limit value
Bulgaria	Kindergartens in Sofia city.	132	101	2.08	14	0
Lithuania	Childcare facilities and working places.	51	-	-	0	-
Romania	Schools and kindergartens-national.	120	78	-	-	-
Russian Federation	Regional (rural, urban) – dwellings, kindergartens Sverdlovsk region.	50	30	3.32	6.7	-
Serbia	Primary schools – national.	119/73*	100	1.8	13% > 200 Bq/m^3	3.7% > 300 Bq/m^3

AM – Arithmetic mean, GM – Geometric mean, GSD – Geometric standard deviation
*119 weighted mean, the mean calculated considering the number of students attending each school was 73 Bq/m^3

TABLE 30. DETAILS ON REPORTED RADON SURVEYS

Country	Type of survey	Beginning and duration of survey (y)		Detector	Duration of measurement on site
Armenia	Dwellings - national	2010	2	CR-39, diffusion chamber	2x 6 m
Bosnia and Herzegovina	Dwellings - local, Bihać municipality	2006	1	CR-39, diffusion chamber	3 m
Bosnia and Herzegovina	Dwellings - local, Tuzla city	2010	1	CR-39, diffusion chamber	4 m
Bulgaria	Dwellings - national	2011	0.75	CR-39, diffusion chamber	6 m
Bulgaria	Kindergartens - local survey, Sofia city	2013	0.25	CR-39, diffusion chamber	3 m
Croatia	Dwellings and schools, national	2003	2	LR115, diffusion chamber	1 y
Cyprus	Dwellings and buildings with high occupancy in Lefkosia (Nicosia) central area	2011	2	Radim 3	24 h
Estonia	Dwellings - national	1998	3	CR-39, diffusion chamber	2−3 m., heating period.
Georgia	Dwellings - local, West Georgia	2007	4	CR-39, bare	6−12 m
Greece	Dwellings - national	2011	6	CR-39, diffusion chamber	6 m
Hungary	National & local	1993	14	CR-39, diffusion chamber	1 y
Kazakhstan	Dwellings, workplaces, public buildings- local, Zhambyl oblast		0.6	CR-39, RSFS	3 m
Latvia	Dwellings - national	1993	2	Electrets	no information
Lithuania	Dwellings - national	1995	4	Electrets	not less than 1 d
Lithuania	Schools and kindergartens - local	2001	5	Electrets	not less than 21 d

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TABLE 30. DETAILS ON REPORTED RADON SURVEYS (cont.)

Country	Type of survey	Beginning and duration of survey (y)		Detector	Duration of measurement on site
Montenegro	Dwellings - national	2002	2	CR-39, diffusion chamber	2x 6 m
Poland	Dwellings - national	1991		CR-39, diffusion chamber	6 to 12 m
Romania	Schools and kindergartens - national	2008	4	CR-39, diffusion chamber	2−3 m
Serbia	Schools and kindergartens - local	2008	3	CR-39, diffusion chamber	1 y
Slovakia	Dwellings - national	1999	6	CR-39, diffusion chamber	6 m
Slovenia	Dwellings and schools, national	1990	4	Scintillation chambers and alpha track detectors	3 m
Russian Federation	regional survey (urban, rural), dwellings, kindergartens Sverdlovsk region	1993	5	LR115, diffusion chamber	Heat /warm seasons, 2 m duration each
The Former Yugoslav Republic of Macedonia	Dwellings - national	2008	2	CR-39, diffusion chamber	3 m
Turkey	Dwellings - national	1984	28	CR-39, diffusion chamber	at least 2 m
Ukraine	Dwellings - national	1989	20	LR115- bare	30 d in heating season

TABLE 31. DETAILS ON REPORTED RADON SURVEYS

Country	Type of survey	Number of dwellings, buildings, kindergartens measured	Criteria to select dwellings/buildings/workplaces			
			Random selection	Geographically based	Geologically based	Population weighted
Armenia	Dwellings - national	800			x	
Bosnia and Herzegovina	Dwellings - local, Bihać municipality	100		x	x	x
Bosnia and Herzegovina	Dwellings - local, Tuzla city, near thermal power plant	48		x		x
Bulgaria	Dwellings - national	373				x
Bulgaria	All kindergartens - local survey, Sofia city	296				
Croatia	Dwellings and schools, national	1 000	x			x
Estonia	Dwellings - national	560	x	x		
Georgia	Dwellings - local, West Georgia	2 000		x	x	
Greece	Dwellings - national	5 000		x	x	x
Hungary	National + local	17 000 dwellings, workplaces, kindergartens, schools		x	x	x
Kazakhstan	Dwellings, workplaces, public buildings- local, Zhambyl oblast	1500			x	x
Latvia	Dwellings - national	263	x			
Lithuania	Dwellings - national	400	x			x
Lithuania	Schools and kindergartens - local	146 childcare rooms, 20 workplaces in basement	x			

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TABLE 31. DETAILS ON REPORTED RADON SURVEYS (cont.)

Country	Type of survey	Number of dwellings, buildings, kindergartens measured	Criteria to select dwellings/buildings/workplaces			
			Random selection	Geographically based	Geologically based	Population weighted
Poland	Dwellings - national	3 305		x		
Romania	Schools and kindergartens - national	50	x			
Russian Federation	regional survey (urban, rural), dwellings, kindergartens Sverdlovsk region	3 000 dwellings 300 kindergartens			x	x
Serbia	Every primary school in the region	327				
Slovakia	Dwellings - national	3 657	x		x	
Slovenia	Dwellings and schools, national	730 kindergartens, 890 primary schools, 892 dwellings (1990-1994)	x			
The Former Yugoslav Republic of Macedonia	Dwellings - national	437	x	x		
Turkey	Dwellings - national	7 293	x	x	x	x
Ukraine	Dwellings - national	> 30 000		x		

TABLE 32. REFERENCES FOR NATIONAL RADON SURVEYS

Country	References for further information on national radon surveys
Bulgaria	[8]
Croatia	[9]
Cyprus	[10]
Czech Republic	[11]
Estonia	[12]
Georgia	[13−15]
Hungary	[16]
Kazakhstan	[17]
Latvia	[18]
Montenegro	[19−22]
Romania	[23]
Russian Federation	[24]
Serbia	[25−26]
Slovakia	[27]
Slovenia	[28−33]
Turkey	[34−40]
Ukraine	[41−45]

3.5. RADON AWARENESS

Radon awareness is a combination of preparation of information materials, communication campaigns, and surveys carried out to determine the level of radon awareness and risk perception. Radon risk communication is very complex issue as dealing with health risks associated with exposure to radon requires a multidisciplinary approach covering radiation protection, the construction industry, indoor air quality, and public health.

3.5.1. Information materials

Information material on radon has been developed in 16 Member States.

Belarus, Cyprus and The Former Yugoslav Republic of Macedonia are planning to develop information material in the near future, and no information material is available nor planned in the near future in Armenia, Bosnia and Herzegovina, Georgia, Hungary, Kyrgyzstan, Republic of Moldova, Serbia, Tajikistan, and Ukraine. Ukraine organized a pilot project “Stop radon” in Kirovograd region in 2010.

The most frequently developed information materials (see figure 1) are the internet web pages with the national regulatory body as the author. Internet web pages are easy to set up and relatively inexpensive. Brochures and newspaper articles (case studies or information) are also often an efficient way to spread the desired information. The interest of TV channels is found to be important especially due to high acceptance of TV as a source of reliable

information among the population. In Czech Republic, Latvia, Lithuania, and Slovenia, information about radon has been broadcast on television.

The list of websites that provide information is presented in Table 34.

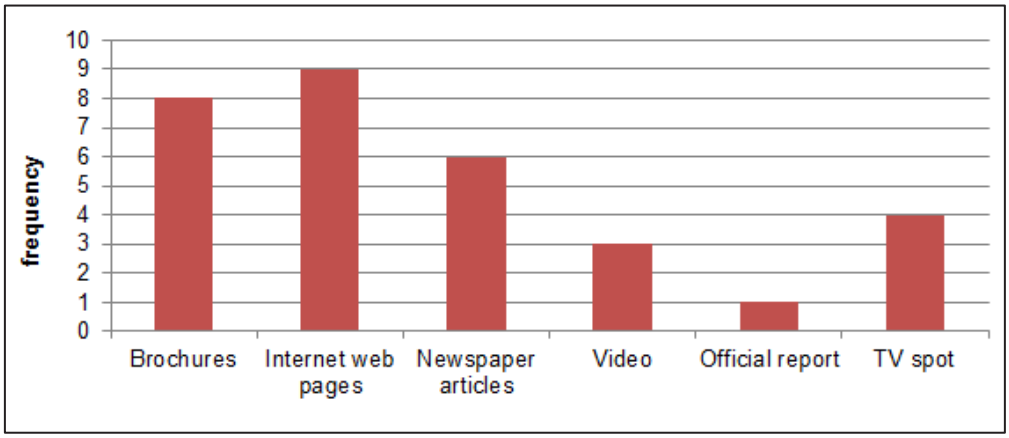

FIG. 1. Type of materials produced to communicate radon risk.

TABLE 33. EXISTING RADON AWARENESS ACTIONS IN MEMBER STATES

Country	Information material developed	Communication campaign organised	Radon awareness survey carried out
Albania	Yes	No	No
Armenia	No	No	No
Belarus	Planned	No	No
Bosnia and Herzegovina	No	No	No
Bulgaria	Yes	No	No
Croatia	Yes	No	No
Cyprus	Planned	No	No
Czech Republic	Yes	Yes	Yes
Estonia	Yes	Yes	No
Georgia	No	No	No
Greece	Yes	No	No
Hungary	No	No	No
Kazakhstan	Yes	Yes	No
Kyrgyzstan	No	No	No
Latvia	Yes	Yes	No
Lithuania	Yes	Yes	No
Montenegro	Yes	No	No
Poland	Yes	Planned	No
Republic of Moldova	No	No	No
Romania	Yes	Yes	No
Russian Federation	Yes	No	No
Serbia	No	No	No
Slovakia	Yes	Yes	Yes
Slovenia	Yes	Yes	No
Tajikistan	No	No	No
The Former Yugoslav Republic of Macedonia	Planned	No	No
Turkey	Yes	No	Yes
Ukraine	No	No	No

TABLE 34. WEB PAGES ON RADON AS REPORTED

Country	Web pages as reported
Bulgaria	http://www.ncrrp.org/new/bg/Informatsionni_materiali-c191
Croatia	http://www.apo.hr/data/certificates/Radon.pdf
Czech Republic	http://www.radonovyprogram.cz http://www.radontrail.eu
Estonia	http://www.keskkonnaamet.ee/public/kiirgus/radoon.pdf http://www.keskkonnaamet.ee/public/kiirgus/Radoon_rus.pdf http://www.keskkonnaamet.ee/public/kiirgus/radooniohutu_elamu.pdf http://www.keskkonnaamet.ee/keskkonnakaitse/kiirgus-3/radoon/ http://www.keskkonnaamet.ee/teenused/kiirgus-2/radooni-mootmine/ http://www.envir.ee/et/radoon
Poland	http://radon.ifj.edu.pl/download/radon-plakat.pdf http://dydaktyka.fizyka.umk.pl/PDF/MSC/Materialy/Liceum-IV/naturalne/radon.htm
Romania	http://www.irart.ro http://radon.com.ro/
Slovenia	http://radon-and-life.narod.ru/ https://www.youtube.com/watch?v=DkoH5C9JNmA http://www.uvps.gov.si/si/pogosta_vprasanja_in_odgovori/#c16810 http://www.abczdravja.si/Revije/februar2012/2012_02_02_11_36_15/OPTI_8.swf http://www.environment.si/organizacija/raziskovalne-skupine/center-za-radon/ http://www.primorske.si/Primorska/Goriska/Zascita-proti-radonu---otroci-bodo-koncno-dobili-v.aspx https://www.dnevnik.si/slovenija/previsoke-vsebnosti-radona-v-tretjini-pregledanih-vrtcev-in-sol-325 http://www.primorske.si/Primorska/Goriska/Bojijo-se-radona,-vsaj-toliko-pa-tudi-izgube-sole.aspx http://www.primorske.si/Primorska/Goriska/-To-je-zavesten-zlocin-nad-generacijami--crnovrski.aspx
Turkey	http://www.taek.gov.tr/bilgi-kosesi/184-radyasyonla-birlikte-yasiyoruz/501-dogal-radyasyon-kaynaklari.html http://www.taek.gov.tr/belgeler-formlar/yayinlar/raporlar/Kapal%C4%B1-Ortamlarda-Radon-Gaz%C4%B1-2012/ http://kanser.gov.tr/bilgi-dokumanlar/raporlar/106-radon-ve-kanser.html

3.5.2. Communication campaign

Communication campaigns have been organized in Czech Republic, Estonia, Kazakhstan, Latvia, Lithuania, Romania, Slovakia, and Slovenia. Lithuania was the only country where the campaign was connected to campaigns on other health issues; in this particular case, radon was combined with a healthy living campaign.

The important parameters of any communication campaign are the target audience(s) of the campaign and the geographic area(s) covered by the campaign. The first influences the message(s) which are to be conveyed and the channels through which the message(s) are transferred to the audience and the latter influences the number of people covered by the campaign (local, national). In some cases, local communication campaigns are recommended as an initial campaign because smaller campaigns require a lower budget and are easier to manage.

Figure 2 gives an overview of the distribution of target audiences and the extent of the campaigns. The most frequently targeted audience were the general public and building professionals. Smokers and real estate agents have not been targeted in any campaign. Table 35 shows the details on communication campaigns in Member States with an existing communication campaign. The aim of all the campaigns was to inform about the radon issue in general.

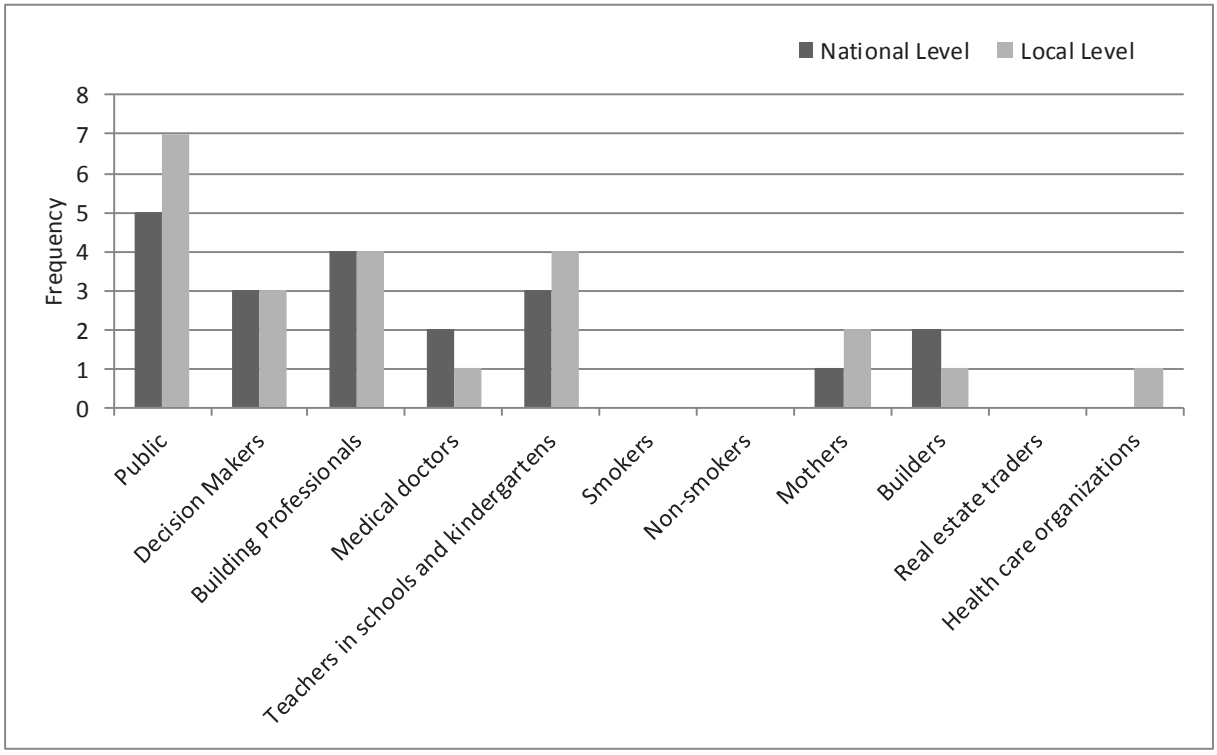

FIG. 2. Target audience in radon communication campaigns in total.

TABLE 35. EXISTING COMMUNICATION CAMPAIGNS AND TARGET AUDIENCES COVERED

Target audience	Public		Decision makers		Building professionals		Medical doctors		Teachers in schools and kindergartens		Mothers		Builders	
Country	L	N	L	N	L	N	L	N	L	N	L	N	L	N
Czech Republic	x	x	x	x	x	x		x	x	x	x			x
Estonia	x		x											
Kazakhstan			x	x					x					
Latvia	x	x			x									
Lithuania	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Romania	x	x												
Slovakia	x				x				x					
Slovenia	x			x		x			x	x				x

L – local level, N – national level

3.5.3. Radon awareness survey

A radon awareness survey has been carried out only in the Czech Republic and Slovakia. A survey was planned to take place in 2014−2015 in The Former Yugoslav Republic of Macedonia.

There were two stages to the Slovakian survey: a survey before the communication campaign and a follow-up survey after the communication campaign, with the aim to verify the efficiency of the campaign. The survey was executed on a regional level.

The survey carried out in the Czech Republic was a national representative awareness survey and was not directly connected to a preceding communication campaign.

The willingness to measure radon in homes and the willingness to carry out corrective action in the event of high radon levels in the home were tested in both countries, in addition to awareness about radon. The results reported from Slovakia showed low radon awareness (below 2%) which resulted in increased efforts by the authorities in better education and communication. The survey in the Czech Republic showed that around 40% of respondents find radon to be important and they are prepared to measure radon levels in their home; approximately 20% of respondents are not interested in radon and they would refuse to measure radon in their homes; and approximately 40% of respondents are not aware or are not interested in radon issues. However, the rate of measurement due to request by the home-owner in the Czech Republic was very low and the authorities decided to update and modify the communication strategy.

3.6. EDUCATION

This part of the questionnaire aimed at obtaining information on whether there are specific educational activities for radon professionals (measurement experts, building engineers, etc.) and for students and public. The educational activities may comprise topical courses, single occasional events or lectures as part of higher education.

3.6.1. Summary

Educational activities for the public, students and professionals have not been developed in more than half of the Member States participating in the project.

The results of the two main questions are summarized in Table 36. Fourteen Member States do not have educational events for the public and students, and 21 Member States have not established educational programmes for radon professionals.

3.6.2. Education of the public and students

Lectures about radon are organized within the framework of physics and/or chemistry classes for students at grammar schools in Albania, Czech Republic and, upon request, in Croatia. At university level, physics students in Greece, Hungary, Poland, Slovakia, and the Czech Republic receive some information about the radon issue in general. In Slovakia and the Czech Republic, lectures are combined with laboratory exercises.

Education about radon related activities is part of the university education for future building professionals only in the Czech Republic and Poland. Radon seminars are organized in Estonia and Slovenia.

TABLE 36. EDUCATION RELATED TO RADON IN MEMBER STATES

Country	Lectures or courses for public, students or medical students	Courses for professionals
Albania	Yes	No
Armenia	No	No
Belarus	Yes	Yes
Bosnia and Herzegovina	No	No
Bulgaria	No	No
Croatia	Yes	No
Cyprus	No	No
Czech Republic	Yes	Yes
Estonia	Yes	No
Georgia	No	No
Greece	Yes	No
Hungary	Yes	No
Kazakhstan	Yes	No
Kyrgyzstan	No	No
Latvia	Yes	No
Lithuania	No	No
Montenegro	No	No
Poland	Yes	Yes
Republic of Moldova	Yes	No
Romania	No	No
Russian Federation	No	No
Serbia	No	No
Slovakia	Yes	Yes
Slovenia	Yes	No
Tajikistan	No	No
The Former Yugoslav Republic of Macedonia	No	No
Turkey	Yes	Yes
Ukraine	No	Yes

3.6.3. Education of professionals

Training courses for professionals are organized in Belarus, the Czech Republic, Poland, Slovakia, Turkey and Ukraine (see Table 37).

The minimum qualification for acceptance into a course is to have completed secondary education. In Belarus, Czech Republic and Turkey the attendance of a course leads to a certificate of successful completion of the course. In the Czech Republic and Turkey, the passing of exams is conditional for the certificate. In Czech Republic and Slovakia, the completion of the course is a prerequisite in order to apply for licence for measurement. The quality of a course is guaranteed by a national regulatory body in the Czech Republic and Turkey, by the Ministry of Education in Belarus; and by the Public Health Authority in Slovakia.

TABLE 37. TYPES OF COURSES ORGANIZED FOR RADON PROFESSIONS IN MEMBER STATES

Type of Course	No. of countries
Radon measurement indoors.	5
Radon measurement in soil.	5
Radon diagnostics.	2 (Belarus, Poland)
Measurement of radionuclide content in building materials.	6
Measurement of radon exhalation rate from building material.	2 (Belarus, Turkey)
Measurement of radon (other natural radionuclides) in drinking water.	5
Preventive measures in buildings.	5 (Belarus, Czech Republic, Poland, Slovakia, Turkey)
Corrective actions in buildings.	6

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ANNEX I.

ALBANIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Radiation Protection Commission (RPC); Institute of Applied Nuclear Physics (IANP)

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/No	Yes, 400 Bq/m^3
Existing public buildings	No/No	Yes, 400 Bq/m^3
Newly built dwellings	No/No	Yes, 200 Bq/m^3
Newly built public buildings	No/No	Yes, 200 Bq/m^3

Are there any requirements on the following items in the State?

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist yet
Actions covered by the national radon programme/action plan:	Do not exist yet
Ministries and agencies involved in national action plan:	Radiation Protection Commission (RPC); Institute of Applied Nuclear Physics (IANP), Radiation Protection Office (RPO), Centre of Geoscience.
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON IN CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/ modification	No
Are there any radon related actions in civil engineering ongoing in the State?	Yes
Radon is included in building code/standard:	No
Guideline for corrective actions exists:	No
Guideline for preventive measures exists:	No
Is it possible to apply for subsidy or grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	No
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
The requirements are different if the measurement is used for official purposes:	No
Passive radon detectors are available in the State:	Yes
Active radon monitors are available in the State:	No
Radon database exists and is used:	No
Result of measurement compared to the radon level(s) stated in legal framework:	Maximum value

Number of measurements of radon carried out in the State annually:	No information
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Institute of Applied Nuclear Physics Centre of Geoscience.
Other:	No

SECTION 4 – RADON SURVEY

- Indoor radon survey started in February 2014.
- The duration of measurement in one place is expected to be 90 days.
- CR39 detectors are used.
- The total number of places measured is expected to be 400. The selection of places is based on population density.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	Not reported
Geometric mean (Bq/m^3):	Not reported
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	Newspaper articles
Means used to disseminate radon risk messages:	Newspaper

SECTION 6 – EDUCATION

Education of general public and students is organized:	Lectures for students
Education for professionals is organized:	No

ANNEX II.

ARMENIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Armenian Nuclear Regulatory Authority (ANRA)

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/No	Activity concentration of ^{222}Rn and ^{220}Rn daughter isotopes should not exceed 200 Bq/m^3
Existing public buildings	No/No	Activity concentration of ^{222}Rn and ^{220}Rn daughter isotopes should not exceed 200 Bq/m^3
Newly built dwellings	No/No	EECRn+4.6EECTn should not exceed 100 Bq/m^3
Newly built public buildings	No/No	EECRn+4.6EECTn should not exceed 100 Bq/m^3

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Prime Minister order
Actions covered by the national radon programme/action plan:	Epidemiological investigations data and possible risk for public requirements for elaboration of indoor radon requirements for elaboration of drinking water. Geological investigation on exhalation of radon, mining and milling activities, control of construction materials (local and imported).
Ministries and agencies involved in the national radon action plan:	ANRA-Regulatory control, Ministry of Health – Epidemiological study. National Academy of Sciences – geological investigations. Ministry of civil construction – review of civil construction codes and implementations of the codes requirements.
Are any radon prone areas specified in the State?	Yes, the geological investigations were done in the late 1960s for uranium mines exploration purposes; the delineation is based on that.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process:	No
Radon is considered in the building reconstruction/modification:	No
Are there any radon related actions in civil engineering ongoing in the State?	No
Radon is included in building code/standard:	No
Guideline for corrective actions exists:	No
Guideline for preventive measures exists:	No
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	No
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes:	No
Are passive radon detectors are available in the State?	No
Are active radon monitors are available in the State?	No
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Maximum value

Number of measurements of radon carried out in the State annually:	Not available
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	No
Other:	No

SECTION 4 – RADON SURVEY

- A local indoor radon survey was carried out.
- The survey commenced in 2010 and took 2 years.
- The duration of measurement in one place was two seasons- winter and summer.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 800. The return rate of detectors was 95%. The selection of places was geologically based.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	Not reported
Geometric mean (Bq/m^3):	Not reported
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	No
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 – EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX III.

BOSNIA AND HERZEGOVINA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

State Regulatory Agency for Radiation and Nuclear Safety

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Under development
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Under development
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/No	No
Existing public buildings	No/No	No
Newly built dwellings	No/No	No
Newly built public buildings	No/No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	No
Content of radionuclides in building material	No
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	1 000 Bq/m^3

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	University of Tuzla independently funds radon research without government support.
Are any radon prone areas specified in the State?	No

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	No
Guideline for corrective actions exists:	No
Guideline for preventive measures exists:	No
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	No
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	Yes, to have the licence for being TSO which perform measurement of the concentration of radon and radon daughters is needed.
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	No reference levels, maximum values are compared to the radon levels given in IAEA protocols.

Number of measurements of radon carried out in the State annually:	No information
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	University of Tuzla, Faculty of Science.
Other:	No

SECTION 4 – RADON SURVEY

- Several local radon surveys in dwellings, kindergartens and some workplaces were carried out

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	
Geometric mean (Bq/m^3):	
Geometric standard deviation:	

SECTION 5 – RADON AWARENESS

Information material is available:	No
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX IV.

BELARUS

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of Health

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Mandatory RL, 200 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	No
Existing public buildings	Mandatory RL, 200 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	No
Newly built dwellings	Mandatory RL, 100 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	No
Newly built public buildings	Mandatory RL, 100 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Does not yet exist
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	Yes
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	Yes
Radon is included in building code/standard:	Yes
Guideline for corrective actions exists:	Yes
Guideline for preventive measures exists:	No
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	No
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	Yes
Are passive radon detectors available in the State?	No
Are active radon monitors available in the State?	No
Does a radon database exist?	No
Result of measurement compared to the radon level(s) stated in legal framework:	Inhabited rooms average

Number of measurements of radon carried out in the State annually:	No information provided
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	The Republican Centre of Hygiene, Epidemiology and Public Health of the Ministry of Health.
Other:	No

SECTION 4 – RADON SURVEY

- No indoor radon survey was carried out

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	
Geometric mean (Bq/m^3):	
Geometric standard deviation:	

SECTION 5 – RADON AWARENESS

Information material is available:	Planned
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	Yes
Education for professionals is organized:	Yes, all professions

ANNEX V.

BULGARIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of Health

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Recommended RL 300 Bq/m^3 / No	No
Existing public buildings	Recommended RL 300 Bq/m^3 / No	No
Newly built dwellings	Recommended RL 200 Bq/m^3 / No	No
Newly built public buildings	Recommended RL 200 Bq/m^3 / No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Law
Actions covered by the national radon programme/action plan:	Radon survey; communication with public etc.
Ministries and agencies involved in the national radon action plan:	Under development
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	Planned
Radon is included in building code/standard:	No
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling)

Number of measurements of radon carried out in the State annually:	
Individual interest:	10-20
Selling/buying process:	N/A
Renovation/modification of buildings:	N/A
Other	N/A

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Yes, National Centre of Radiobiology and Radiation Protection.
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 2011 and took 1 year.
- The duration of measurement in one place was 6 months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 373. The return rate of detectors was 93%. The selection of places was population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	158
Geometric mean (Bq/m^3):	99
Geometric standard deviation:	2.25

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	Brochures*
Channels used to disseminate radon risk messages:	Internet

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

* http://www.ncrrp.org/new/bg/Informatsionni_materiali-c191

ANNEX VI.

CYPRUS

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Radiation Inspection and Control Service, Department of Labour Inspection
Ministry of Labour, Welfare and Social Insurance

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Recommended RL 400 Bq/m^3/ No	No
Existing public buildings	Recommended RL 400 Bq/m^3/ No	No
Newly built dwellings	Recommended RL 200 Bq/m^3/ No	No
Newly built public buildings	Recommended RL 200 Bq/m^3/ No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Law
Actions covered by the national radon programme/action plan:	Radon survey; communication with the public; adoption of new EU legislation.
Ministries and agencies involved in the national radon action plan:	Radiation Inspection and Control Service, Department of Labour Inspection, Ministry of Labour, Welfare and Social Insurance; University of Cyprus.
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	No
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	No
Are active radon monitors available in the State?	Yes
Does a radon database exist?	No
Result of measurement compared to the radon level(s) stated in legal framework:	

Number of measurements of radon carried out in the State annually:	No
Individual interest:	N/A
Selling/buying process:	N/A
Renovation/modification of buildings:	N/A
Other	N/A

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	University of Cyprus, Radiation Inspection and Control Service, Department of Labour. Inspection, Ministry of Labour, Welfare and Social Insurance.
Other:	N/A

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 2011 and lasted 2 years.
- The duration of measurement in one place was 24 h; two measurements of 24 h for each measurement point in different seasons were carried out.
- The active radon monitors were used.
- The total number of places measured was: 108 (schools, municipality buildings, and private houses), the selection was random and population weighted. The return rate of detectors was 100%.

Descriptive statistics of the survey:

Descriptive statistics of the survey:	
Arithmetic mean (Bq/m^3):	20.6
Geometric mean (Bq/m^3):	17.9
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX VII.

CZECH REPUBLIC

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

State Office for Nuclear Safety

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Recommended RL 400 Bq/m^3/ No	
Existing public buildings	Recommended RL 400 Bq/m^3/ No	4 000 Bq/m^3
Newly built dwellings	Recommended RL 200 Bq/m^3/ No	
Newly built public buildings	Recommended RL 200 Bq/m^3/ No	4 000 Bq/m^3

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Government decree
Actions covered by the national radon programme/action plan:	Action Plan Structure: 1) Awareness strategy; 2) Radon prevention strategy; 3) Strategy of regulation the existing exposure; 4) Expert scientific and technical support of the Action Plan task implementation.
Ministries and agencies involved in the national radon action plan:	The implementation of the Action Plan is participated in by the State Office for Nuclear Safety along with the Ministry of Finance, Ministry of the Environment, Ministry for Regional Development, Ministry of Agriculture, Ministry of Industry and Trade and Ministry of Health. They are involved in all of the strategies.
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	Yes
Radon is considered in building reconstruction/modification	Yes
Radon related actions in civil engineering ongoing in the State:	Yes
Radon is included in building code/standard:	Yes
Guideline for corrective actions exists:	Yes
Guideline for preventive measures exists:	Yes
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	Yes
Is the radon concentration measured after the corrective action is installed?	Yes
Is the correct installation of preventive measures verified at the time the building certificate is issued?	Yes

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes, license
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Each room separately

Number of measurements of radon carried out in the State annually:	
Individual interest:	hundreds to thousands
Selling/buying process:	N/A
Renovation/modification of buildings:	N/A
Other	N/A

Organization providing measurement of radon in the State:	
Private companies:	Yes, 100
Governmental organizations, universities etc.:	Yes, FNSPE CTU
Other:	SURO, SUJCHBO, CGS

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1992 and took 1 year.
- The duration of measurement in one place was 1 year.
- The bare LR115tII detectors were used.
- The total number of places measured was 2 000. The return rate of detectors was 90%. The selection of places was random, geographically based, geologically based, population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	118
Geometric mean (Bq/m^3):	Not reported
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Yes
Type of materials developed:	Brochures, internet web pages, newspaper articles, video.
Channels used to disseminate radon risk messages:	Web pages, media, letters, personal contact.

SECTION 6 - EDUCATION

Education of general public and students is organized:	Yes. At some grammar schools radon is mentioned in chemistry or physics lectures; students of medical and architectural and building schools also have some basics.
Education for professionals is organized:	Yes. Measurement of radon, building material, water, 2014 and 2015 courses for building professionals.

ANNEX VIII.

CROATIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

State Office for Radiological and Nuclear Safety

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	No
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Recommended RL 400 Bq/m^3/ No	No
Existing public buildings	Recommended RL 400 Bq/m^3/ No	No
Newly built dwellings	Recommended RL 200 Bq/m^3/ No	No
Newly built public buildings	Recommended RL 200 Bq/m^3/ No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan?	
Are any radon prone areas specified in the State?	Radon prone areas are not defined

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	Yes, Licence is mandatory to issue measurements for official purposes (SORNS) is needed.
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	No
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling).

Number of measurements of radon carried out in the State annually:	Yes
Individual interest:	500
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Yes, Laboratory for Low-Level Radioactivity, Department of Physics, University of Osijek.
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 2003 and took 2 years.
- The duration of measurement in one place was 1 year.
- The LR115 in diffusion chamber detectors were used.
- The total number of places measured was 1 000. The return rate of detectors was 79%. The selection of places was random, population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	68
Geometric mean (Bq/m^3):	50
Geometric standard deviation:	2.3

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	www.apo.hr/data/certificates/Radon.pdf
Channels used to disseminate radon risk messages:	Web pages

SECTION 6 - EDUCATION

Education of general public and students is organized:	Popular lectures on natural radioactivity in environment for public as well as pupils or students are organizing occasionally and on request.
Education for professionals is organized:	No

ANNEX IX.

ESTONIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of the Environment, Environmental Board

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	No
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/ No	No
Existing public buildings	No/ No	200 Bq/m^3
Newly built dwellings	No/ No	No
Newly built public buildings	No/ No	200 Bq/m^3

Are there any requirements on the following items in the State:

Content of radionuclides in water	Planned
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Not as a separate document; the radon is treated in the National Radiation Safety Development Plan 2008-2017 (NRSDP) under the strategic sub-objective "improvement of the awareness of sources of elevated natural radiation".
Actions covered by the national radon programme/action plan:	The NRSDP specifies three quantitative indicators: 1) Organization of radon research. Target level for 2017: as compared to 2007, at least 6 radon surveys or respective projects have been organized; 2) Number of indoor air and soil-gas radon content measurements. Target level for 2017: as compared to 2007, the number of measured sites increases by 500 each year; 3) Number of information event participants. Target level for 2017: at least 1 000 people have participated in information events.
Ministries and agencies involved in the national radon action plan:	Ministry of the Environment, Environmental Board – overall organization, radon surveys/projects and radon measurements. Ministry of Economic Affairs and Communication – issues related to construction and operation of public buildings.
Are any radon prone areas specified in the State?	The list of "radon prone areas" is given in the standard (building code) EVS 840:2009 "Design of the Radon-Safe Building" and is mainly based on geological data.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	Yes
Radon is included in building code/standard:	Yes
Guideline for corrective actions exists:	No
Guideline for preventive measures exists:	Yes
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	Yes
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Each room separately

Number of measurements of radon carried out in the State annually:	
Individual interest:	~50
Selling/buying process:	N/A
Renovation/modification of buildings:	N/A
Other	N/A

Organization providing measurement of radon in the State:	
Private companies:	Not known, but rather less than more than 10.
Governmental organizations, universities etc.:	Environmental Board, Radiation Safety Department.
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1998 and took 3 years.
- The duration of measurement in one place was 2-3 months during the heating period.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 560. The return rate of detectors was 92%. The selection of places was random, geographically based.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	95
Geometric mean (Bq/m^3):	Not reported
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Yes
Type of materials developed:	Brochures, internet web pages
Channels used to disseminate radon risk messages:	Radon seminars organized by the Ministry of the Environment are held every year. Materials of the seminars are available on web: http://www.envir.ee/et/radoon

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX X.

GEORGIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Department of Nuclear and Radiation Safety (DNRS), Ministry of Environment and Natural Resources Protection of Georgia

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Mandatory RL 200 Bq/m^3/ No	No
Existing public buildings	Mandatory RL 200 Bq/m^3/ No	No
Newly built dwellings	Mandatory RL 100 Bq/m^3/ No	No
Newly built public buildings	Mandatory RL 100 Bq/m^3/ No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	Yes
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	no
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist yet.
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	No, radon prone are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	Yes
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	Yes, license is needed.
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	No
Result of measurement compared to the radon level(s) stated in legal framework:	Maximum value

Number of measurements of radon carried out in the State annually:	Not reported
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Tbilisi State University, Institute of Geophysics.
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 2007 and took 4 years.
- The duration of measurement in one place was 6-12 months.
- CR-39 detectors were used.
- The total number of places measured was 2 000. The return rate of detectors was not reported. The selection of places was geographically and geologically based.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	Levels in range 245−500
Geometric mean (Bq/m^3):	Not reported
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	No
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XI.

GREECE

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Greek Atomic Energy Commission (GAEC)

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	No
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	No
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/No	No
Existing public buildings	No/No	No
Newly built dwellings	No/No	No
Newly built public buildings	No/No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Planned
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Initiative of the Greek Atomic Energy Commission.
Actions covered by the national radon programme/action plan:	Radon survey, communication with the public, adoption of EU legislation.
Ministries and agencies involved in the national radon action plan:	Ministry of Education and GAEC.
Are any radon prone areas specified in the State?	Yes, limit exceeding frequency.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling).

Number of measurements of radon carried out in the State annually:	
Individual interest:	30
Selling/buying process:	0
Renovation/modification of buildings:	0
Other	500

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	GAEC, universities.
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 2011 and is planned for 6 years.
- The duration of measurement in one place is 6 months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places planned to be monitored 5 000. The selection of places is geographically and geologically based, population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	
Geometric mean (Bq/m^3):	
Geometric standard deviation:	

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	Internet web pages.
Channels used to disseminate radon risk messages:	web

SECTION 6 - EDUCATION

Education of general public and students is organized:	Health physicists courses (4-6 hours)
Education for professionals is organized:	No

ANNEX XII.

HUNGARY

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

'Frederic Joliot-Curie' National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	No
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	No
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/No	No
Existing public buildings	No/No	No
Newly built dwellings	No/No	No
Newly built public buildings	No/No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	No
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist yet
Actions covered by the national radon programme/action plan:	A co-operation is started under the direction of National Research Institute for Radiobiology and Radiohygiene to establish a national radon programme. Universities, private companies, governmental institutions are involved in the work. The responsibilities are not yet determined
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	Yes, the "radon prone" areas are defined based on radon concentration in soil gas and permeability.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	No
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling).

Number of measurements of radon carried out in the State annually:	
Individual interest:	20-30
Selling/buying process:	20-30
Renovation/modification of buildings:	20-30
Other	300-600 for research

Organization providing measurement of radon in the State:	
Private companies:	Yes, a few
Governmental organizations, universities etc.:	University of Pannonia; Institute of Radiochemistry and Radioecology Eötvös Lóránd University; Institute of Geography and Earth Sciences, "Frédéric Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene.
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1993 and finished in 2004.
- The duration of measurement in one place was usually 1 year.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 15 000. The return rate of detectors was not reported. The selection of places was geographically and geologically based, population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	133
Geometric mean (Bq/m^3):	100
Geometric standard deviation:	21

SECTION 5 – RADON AWARENESS

Information material is available:	No
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	At the university.
Education for professionals is organized:	No

ANNEX XIII.

KAZAKHSTAN

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of Energy of the Republic of Kazakhstan – Committee of Atomic and Power Oversight and Compliance Monitoring.

Ministry of National Economic – Committee on Consumer Protection, Territorial Centres of Sanitary Epidemiological Expertise (CSEE)

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No, No	Yes, 200 Bq/m^3
Existing public buildings	No, No	Yes, 200 Bq/m^3
Newly built dwellings	No, No	Yes, 100 Bq/m^3
Newly built public buildings	No, No	Yes, 100 Bq/m^3

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Budget Programmes of responsible Ministries and some regions.
Actions covered by the national radon programme/action plan:	Radon control and monitoring, radon surveys.
Ministries and agencies involved in the national radon action plan:	Ministry of National Economic, Ministry of Energy.
Are any radon prone areas specified in the State?	Yes

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	Yes
Guideline for corrective actions exists:	Yes
Guideline for preventive measures exists:	Yes
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	No
Is the correct installation of preventive measures verified at the time the building certificate is issued?	Yes

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	Yes
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Yes

Number of measurements of radon carried out in the State annually:	
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	Yes
Governmental organizations, universities etc.:	Yes
Other:	

SECTION 4 – RADON SURVEY

- A local indoor radon survey was carried out.
- The survey took 7 months.
- The duration of measurement in one place was from 2-4 months.
- CR-39 detectors were used.
- The total number of places measured was about 1 500. The return rate of detectors was 85%. The selection of places was geographically based, population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	87
Geometric mean (Bq/m^3):	75
Geometric standard deviation:	Not calculated.

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Yes
Type of materials developed:	Internet, newspaper articles, conference materials.
Channels used to disseminate radon risk messages:	Internet, newspapers, conferences.

SECTION 6 - EDUCATION

Education of general public and students is organized:	Yes
Education for professionals is organized:	No

ANNEX XIV.

KYRGYZSTAN

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of Health,

Department of Prevention Disease and State Sanitary and Epidemiological Surveillance

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	No
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	No
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	No

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings		
Existing public buildings		
Newly built dwellings		
Newly built public buildings		

Are there any requirements on the following items in the State:

Content of radionuclides in water	
Content of radionuclides in building material	
Exhalation of radon from building material	
Gamma dose rate and/or photon dose equivalent in buildings	
Radon concentration in workplaces	

Does the State have a radon programme/radon action plan?	
Type of document(s) based on which the national radon programme/action plan was established:	
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	
Radon is considered in building reconstruction/modification	
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	
Result of measurement compared to the radon level(s) stated in legal framework:	

Number of measurements of radon carried out in the State annually:	
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	
Governmental organizations, universities etc.:	
Other:	

SECTION 4 – RADON SURVEY

- A local indoor radon survey was carried out.
- The survey commenced in 2006 and took 2 years.
- The duration of measurement in one place was from 4 to 6 months.
- The track-etch detectors and active method were used.
- The total number of places measured was 101. The return rate of detectors was 80%. The selection of places was geographically and geologically based, population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	Not reported.
Geometric mean (Bq/m^3):	Not reported.
Geometric standard deviation:	Not reported.

SECTION 5 – RADON AWARENESS

Information material is available:	No
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XV.

LATVIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Radiation Safety Centre of State Environmental Service

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	No
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Recommended RL 200 Bq/m^3/ 1 000 Bq/m^3 actual, 600 Bq/m^3 year average	600 Bq/m^3
Existing public buildings	No/No	
Newly built dwellings	Recommended RL 200 Bq/m^3/ No	
Newly built public buildings	No/No	

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist yet.
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	Planned
Radon is included in building code/standard:	Planned
Guideline for corrective actions exists:	No
Guideline for preventive measures exists:	Yes
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	No
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	

Number of measurements of radon carried out in the State annually:	
Individual interest:	3
Selling/buying process:	0
Renovation/modification of buildings:	0
Other	0

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	State limited Liability Company "Latvian Environment, Geology and Meteorology Centre".
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1993 and took 2 years.
- The duration of measurement in one place was not reported.
- The Electret detectors were used.
- The total number of places measured was 263. The return rate of detectors was not reported. The selection of places was random.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	70
Geometric mean (Bq/m^3):	Not reported
Geometric standard deviation:	5

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Yes
Type of materials developed:	Newspaper articles, TV spot in the 1990s.
Channels used to disseminate radon risk messages:	Newspaper articles, few TV events (1990s).

SECTION 6 - EDUCATION

Education of general public and students is organized:	Yes
Education for professionals is organized:	No

ANNEX XVI.

LITHUANIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Radiation Protection Centre, Vilnius, Lithuania.

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Mandatory RL 300 Bq/m^3/ No	No
Existing public buildings	Mandatory RL 300 Bq/m^3/ No	No
Newly built dwellings	Mandatory RL 200 Bq/m^3/ No	No
Newly built public buildings	Mandatory RL 200 Bq/m^3/ No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
nma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Hygiene Standard HN 85:2011 "Natural exposure. Standard of Radiation Protection" adopted by the Order No. V-890 of 7 October 2011 by the Minister of Health Care. Performing radon programs usually are approved by Ministry of Health or RPC Director.
Actions covered by the national radon programme/action plan:	Radiation Protection Centre performs radon survey in dwellings, radon measurements in soil, radon mapping. The RPC also issued books, brochures etc. about radon hazard, also presents in TV, radio and other media.
Ministries and agencies involved in the national radon action plan:	Radiation Protection Centre under Ministry of Health Care is responsible for national radon programme, and State Nuclear Power Safety Inspectorate is responsible for national radon programme in nuclear facilities.
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling).

Number of measurements of radon carried out in the State annually:	
Individual interest:	30
Selling/buying process:	0
Renovation/modification of buildings:	0
Other	0

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Radiation Protection Centre.
Other:	No

SECTION 4 – RADON SURVEY

An indoor radon survey was carried out.

The survey commenced in 1995 and took 4 years.

The duration of measurement in one place was not less than 21 days.

The Electret detectors were used.

The total number of places measured was 400 dwellings. The return rate of detectors was 99%. The selection of places was random and population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	Not reported
Geometric mean (Bq/m^3):	55
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Yes
Type of materials developed:	Brochures, Internet web pages, newspaper articles, video, TV show.
Channels used to disseminate radon risk messages:	Brochures, books, internet web pages, newspaper articles, TV, radio programs.

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XVII.

MONTENEGRO

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of Sustainable Development and Tourism (legislation)
Environmental Protection Agency (implementation)

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Recommended RL 400 Bq/m^3/No	No
Existing public buildings	Recommended RL 400 Bq/m^3/No	No
Newly built dwellings	Recommended RL 200 Bq/m^3/No	No
Newly built public buildings	Recommended RL 200 Bq/m^3/No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	No, radon prone areas are not defined

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	No
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling)

Number of measurements of radon carried out in the State annually:	
Individual interest:	0
Selling/buying process:	0
Renovation/modification of buildings:	0
Other	20

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Center for Ecotoxicological Research
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 2002 and took 2 years.
- The duration of measurement in one place was measurements twice a year at the same place, each time during approximately six months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 434. The return rate of detectors was 77%. The selection of places was based on grid squares 5x5 km.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	105
Geometric mean (Bq/m^3):	49.6
Geometric standard deviation:	3.2

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	official report of EPA
Channels used to disseminate radon risk messages:	Not reported

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XVIII.

POLAND

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

National Atomic Energy Agency (PAA)

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	No
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	No
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	No

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/No	No
Existing public buildings	No/No	No
Newly built dwellings	No/No	No
Newly built public buildings	No/No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	No
Content of radionuclides in building material	C Ra=276 Bq/m3 C Th=231 Bq/m3 C K= 3 716 Bq/m3
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	No

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist
Actions covered by the national radon programme/action plan:	Yes, based on geological location structure - mining industry
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	Yes
Radon is included in building code/standard:	Yes
Guideline for corrective actions exists:	Yes
Guideline for preventive measures exists:	Yes
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	N/A
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	0
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling)

Number of measurements of radon carried out in the State annually:	No
Individual interest:	N/A
Selling/buying process:	N/A
Renovation/modification of buildings:	N/A
Other	N/A

Organization providing measurement of radon in the State:	Yes, <10
Private companies:	Yes, Central Laboratory for Radiological Protection, Warsaw Central Mining Institute, Katowice Medical University of Bialystok Institute of Nuclear Physics, Krakow Nofer Institute of Occupational Medicine, Łódź Wrocław University of Technology, Wroclaw Building Research Institute, Warsaw University of Silesia, Katowice.
Governmental organizations, universities etc.:	No
Other:	Yes, <10

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1991. The duration of the survey was not reported.
- The duration of measurement in one place was from 6 to 12 months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was: 3 305 where the selection was geographically based. The return rate of detectors was not reported.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	85.5
Geometric mean (Bq/m^3):	43.1
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Planned in next 4 years
Type of materials developed:	Web pages http://radon.ifj.edu.pl/download/radon-plakat.pdf http://dydaktyka.fizyka.umk.pl/PDF/MSC/Materialy/Liceum-IV/naturalne/radon.htm
Channels used to disseminate radon risk messages:	Internet

SECTION 6 - EDUCATION

Education of general public and students is organized:	Yes. Measurements of the radon and radon progeny concentration in air; methods of measurement and protection - ionizing radiation; radiation protection and radiometry in medicine; training courses in radiation protection
Education for professionals is organized:	Yes. Measurement of building material; radon diagnostics; corrective actions and preventive measures

ANNEX XIX.

REPUBLIC OF MOLDOVA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of Health, National Centre of Public Health

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	No

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Mandatory RL, 150 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	300 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)
Existing public buildings	Mandatory RL, 150 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	300 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)
Newly built dwellings	Mandatory RL, 100 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	300 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)
Newly built public buildings	Mandatory RL, 100 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	300 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist
Actions covered by the national radon programme/action plan:	No, radon prone areas are not defined
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	Yes
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	
Are passive radon detectors available in the State?	No
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	

Number of measurements of radon carried out in the State annually:	No
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	National Centre for Public Health
Other:	No

SECTION 4 – RADON SURVEY

- No, only local measurements.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	
Geometric mean (Bq/m^3):	
Geometric standard deviation:	

SECTION 5 – RADON AWARENESS

Information material is available:	No
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	Yes
Education for professionals is organized:	No

ANNEX XX.

ROMANIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of Health, National Authority for Scientific Research

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	No
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Recommended RL 400 Bq/m^3/No	No
Existing public buildings	Recommended RL 400 Bq/m^3/No	No
Newly built dwellings	Recommended RL 200 Bq/m^3/No	No
Newly built public buildings	Recommended RL 200 Bq/m^3/No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	No
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	National Commission for Nuclear Activities Control, Ministry of Health, Institute of Public Health, Ministry of Education, National Authority for Scientific Research, Uranium National Company, University Babes Bolyai, Faculty of Environment
Are any radon prone areas specified in the State?	Yes, The area where more than 10% is exceeding 400 Bq/m^3

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling)

Number of measurements of radon carried out in the State annually:	
Individual interest:	0
Selling/buying process:	0
Renovation/modification of buildings:	0
Other	in the frame of RAMARO project (2012-2015) about 1800 measurements/year

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Environmental Radioactivity and Nuclear Dating Center - Babes Bolyai University - Cluj
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 2008 and took 4 years.
- The duration of measurement in one place was 2-3 months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was about 500. The return rate of detectors was 82%. The selection of places was random.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	120
Geometric mean (Bq/m^3):	78
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Yes
Type of materials developed:	Brochures, internet web pages, newspaper articles
Channels used to disseminate radon risk messages:	Some brochures in IRART project, internet, newspaper articles in regional journal.

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XXI.

RUSSIAN FEDERATION

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Rospotrebnadzor, Federal Biomedical Agency (FMBA)

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/Mandatory AL 200 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	No
Existing public buildings	No/Mandatory AL 200 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)	No
Newly built dwellings	No/No	100 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)
Newly built public buildings	No/No	100 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes
Does the State have a radon programme/radon action plan?	No

Type of document(s) based on which the national radon programme/action plan was established:	Do not exist yet
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	Yes, delineation is based on density of radon flux, activity concentration of radon in soil, radionuclide specific activity (Ra-226) and EEC of radon isotopes in the nearest buildings.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	Yes
Radon related actions in civil engineering ongoing in the State:	Yes
Radon is included in building code/standard:	Yes
Guideline for corrective actions exists:	Yes
Guideline for preventive measures exists:	No
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	Yes
Is the correct installation of preventive measures verified at the time the building certificate is issued?	Yes, by measurement

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	Yes, accreditation
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Each room separately

Number of measurements of radon carried out in the State annually:	1 000 long-term measurements (track detectors). 200 000 – 250 000 short term measurements (active measurements esp. during building commissioning).
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	Any laboratory accredited for this activity
Governmental organizations, universities etc.:	Radiation Hygiene Scientific Research Institute, St. Petersburg. Research and Technical Center of Radiation-Chemical Safety and Hygiene FMBA Russia (RTC RChSH). State Research Centre Federal Medical Biophysical Centre (FMBA of Russia) Institute of Industrial Ecology Ural Branch of Russian Academy of Science.
Other:	No

SECTION 4 – RADON SURVEY

- A regional indoor radon survey was carried out.
- The survey commenced in 1993 and took 5 years.
- The duration of measurement in one place was heat /warm seasons, 2 month duration each.
- The LR115 in diffusion chamber detectors were used.
- The total number of places measured in the Sverdlovsk region was 3 000 dwellings, 300 kindergartens. The return rate of detectors was 90%. The selection of places was geologically based, population weighted.

Descriptive statistics of the survey:	
Arithmetic mean (Bq/m^3):	50
Geometric mean (Bq/m^3):	30
Geometric standard deviation:	3.32

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	Internet web pages
Channels used to disseminate radon risk messages:	Internet

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XXII.

SERBIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Serbian Radiation Protection and Nuclear Safety Agency, Belgrade, Serbia.

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/Recommended AL 400 Bq/m^3	No
Existing public buildings	No/No	No
Newly built dwellings	No/Recommended AL 200 Bq/m^3	No
Newly built public buildings	No/No	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist yet
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	Yes, It is well-known radon prone areas in Niška Banja, declared as a radon spa.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	No
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling)

Number of measurements of radon carried out in the State annually:	No information
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	University of Novi Sad, Faculty of Science, Department of Physics, Chair of Nuclear Physics, Novi Sad, University of Belgrade, Vinča Institute of Nuclear Sciences, University of Belgrade, Institute of Physics Belgrade, Low-Background Laboratory for Nuclear Physics, Institute of Occupational Health of Serbia "Dr Dragomir Karajović", Center for Radiological Protection, Belgrade, University of Kragujevac, Faculty of Science Kragujevac, Institute of Physics
Other:	No

SECTION 4 – RADON SURVEY

- A regional indoor radon survey was carried out.
- The survey commenced in 2002 and took 2 years.
- The duration of measurement in one place was 3 months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 986. The return rate of detectors was 95%.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	144
Geometric mean (Bq/m^3):	104.2
Geometric standard deviation:	2.3

SECTION 5 – RADON AWARENESS

Information material is available:	No
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XXIII.

SLOVAKIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Public Health Authority of Slovakia

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/Recommended AL 400 Bq/m^3	4 000 Bq/m^3
Existing public buildings	No/Recommended AL 400 Bq/m^3	4 000 Bq/m^3
Newly built dwellings	No/Recommended AL 200 Bq/m^3	4 000 Bq/m^3
Newly built public buildings	No/Recommended AL 200 Bq/m^3	4 000 Bq/m^3

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	
Actions covered by the national radon programme/action plan:	The first action plan for radon risk management in Slovakia (1991-2005) was developed as working relationships between the Ministry of Health, Ministry of Construction, and Ministry of Environment. Methods for radon monitoring, diagnosing of buildings, coordinating policies of education and research, and catalogues of remedial actions (involved in regulation of the Ministry of Health of Slovakia No.12/2001) were drawn up. Unfortunately, from 2005 until now due to the shortage of finances the radon programme continues in very limited range, without national coordination. Indoor radon survey giving data for 0.2% of Slovak National Housing Stock was done.
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	No, radon prone areas are not defined

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	No
Guideline for corrective actions exists:	No
Guideline for preventive measures exists:	No
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	No
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	Yes, authorization from the Public Health Authority of Slovakia is required
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Maximum value

Number of measurements of radon carried out in the State annually:	
Individual interest:	about 100
Selling/buying process:	0
Renovation/modification of buildings:	about 20
Other	0

Organization providing measurement of radon in the State:	
Private companies:	12/ 2 with valid license
Governmental organizations, universities etc.:	Slovak Medical University in Bratislava, Regional Public Health Authority in Banska Bystrica
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1999 and took 6 years.
- The duration of measurement in one place was 6 months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 3 657. The return rate of detectors was 65%. The selection of places was random and geologically based.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	108
Geometric mean (Bq/m^3):	59.6
Geometric standard deviation:	2.22

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Yes
Type of materials developed:	Brochures, newspaper articles, video
Channels used to disseminate radon risk messages:	Courses, seminars, newspaper articles

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XXIV.

SLOVENIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Slovenian Radiation Protection Administration (under Ministry of Health)

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	Mandatory RL 400 Bq/m^3/ No	6 mSv/y
Existing public buildings	Mandatory RL 400 Bq/m^3/ No	6 mSv/y
Newly built dwellings	Recommended RL 200 Bq/m^3/ No	6 mSv/y
Newly built public buildings	No/ No	6 mSv/y

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Law and governmental decree
Actions covered by the national radon programme/action plan:	Programme includes basic and additional radon measurements in selected places. Selection is based on the probability of exceeding 6 mSv. At least 20 buildings per year for educational, cultural or health purpose shall be included. Effective doses shall be estimated. Care is devoted to children, youth, ill or other handicapped person. Analysis of reasons for higher concentration and searching of radon sources is obligatory. Individual ministries are responsible for mitigation or other measures in public buildings. Owners are responsible for other buildings. Inspectors of SRPA are competent for inspections and enforcement. Ministry of Health shall ensure education, seminars, courses, information and publications.
Ministries and agencies involved in the national radon action plan:	Ministry of Health, Slovenian Radiation Protection Administration, Ministry of Education, Science and Sport, Slovenian Research Agency at the Ministry of Education, Science and Sport
Are any radon prone areas specified in the State?	No, radon prone areas are not defined

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	Yes
Radon is included in building code/standard:	Yes
Guideline for corrective actions exists:	Yes
Guideline for preventive measures exists:	No
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	Yes
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State?	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	Yes
Are the requirements different when the measurement is used for official purposes?	Yes, accreditation and approval are mandatory. is needed
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Each room separately

Number of measurements of radon carried out in the State annually:	
Individual interest:	A few per year (< 50)
Selling/buying process:	Rarely
Renovation/modification of buildings:	A few per year
Other	0

Organization providing measurement of radon in the State:	
Private companies:	Yes, 1
Governmental organizations, universities etc.:	Jožef Stefan Institute - Department of Environmental Sciences, Radon Center.
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1990 and took 4 years.
- The duration of measurement in one place was 3 months.
- The scintillation cells and etched track detectors were used.
- The total number of places measured was 730 kindergartens, 890 primary schools, 892 dwellings (1990-1994). The return rate of detectors was 90%. The selection of places was random.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	87
Geometric mean (Bq/m^3):	60
Geometric standard deviation:	2.2

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	Yes
Type of materials developed:	Brochures, internet web pages, newspaper articles
Channels used to disseminate radon risk messages:	Seminars, courses, interviews (newspapers, television, radio), publications

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XXV.

TAJIKISTAN

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Nuclear and Radiation Safety Agency under Academy of Sciences of the Republic of Tajikistan

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/No	200 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)
Existing public buildings	No/No	200 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)
Newly built dwellings	No/No	100 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)
Newly built public buildings	No/No	100 Bq/m^3 EEC (^{222}Rn and ^{220}Rn)

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes
Does the State have a radon programme/radon action	No

plan?	
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	No, radon prone areas are not defined

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	No
Are active radon monitors available in the State?	No
Does a radon database exist?	
Result of measurement compared to the radon level(s) stated in legal framework:	

Number of measurements of radon carried out in the State annually:	No information
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	Vostokredmet
Governmental organizations, universities etc.:	Radiation Authority
Other:	No

SECTION 4 – RADON SURVEY

- No indoor radon survey was carried out.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	
Geometric mean (Bq/m^3):	
Geometric standard deviation:	

SECTION 5 – RADON AWARENESS

Information material is available:	No
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XXVI.

THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Government of The Former Yugoslav Republic of Macedonia (multi sectorial approach of the annual program coordinated by Institute of Public Health).

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/Recommended AL 400 Bq/m^3	No
Existing public buildings	No/Recommended AL 400 Bq/m^3	No
Newly built dwellings	No/Recommended AL 200 Bq/m^3	No
Newly built public buildings	No/Recommended AL 200 Bq/m^3	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Government decree
Actions covered by the national radon programme/action plan:	In 2014 new National Radon Programme – Multi-institutional approach coordinated by Institute of Public Health. Objectives: National survey of indoor, mapping, radon in schools, kindergartens and health care centres. Establish national radon database, radon in soil (active measurements). Develop information and communication materials focused on general population, construction companies and health workers. Raising awareness for radon testing and smoking related information.
Ministries and agencies involved in the national radon action plan:	Institute of Public Health, Governmental Committee for Health and Environmental Protection, Ministry of Health, Ministry of Transport and Communications, Ministry of Economy, Radiation Safety Directorate, Ministry of Environment.
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	No
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Average per house (dwelling)

Number of measurements of radon carried out in the State annually:	No information
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	No
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 2008 and took 2 years.
- The duration of measurement in one place was 3 months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 437. The return rate of detectors was ~ 80%. The selection of places was random and geographically based.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	105
Geometric mean (Bq/m^3):	84
Geometric standard deviation:	1.86

SECTION 5 – RADON AWARENESS

Information material is available:	Planned
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	No

ANNEX XXVII.

TURKEY

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Turkish Atomic Energy Authority, and Turkish Ministry of Health

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	Yes

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/No	400 Bq/m^3
Existing public buildings	No/No	400 Bq/m^3
Newly built dwellings	No/No	400 Bq/m^3
Newly built public buildings	No/No	400 Bq/m^3

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	No
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	No
Radon concentration in workplaces	Yes

Does the State have a radon programme/radon action plan?	Yes
Type of document(s) based on which the national radon programme/action plan was established:	Governmental decree
Actions covered by the national radon programme/action plan:	Our National Radon Control Programme has just started and by this programme we will increase the number of public awareness activities (such as symposiums, sharing information by network or leaflets and by press releases); we will measure indoor radon levels by passive detectors in 65 000 randomly chosen houses which represent the whole country in city base and we will perform questionnaires to the residents of the dwellings while placing the detectors. After preparing "national radon map" via these measurements we are planning to start "reclamation project" for the buildings which have high radon levels, establish control mechanisms for indoor radon measurement; prepare radon prevention guidelines; long term follow up for the people living in houses with high radon levels for cancer.
Ministries and agencies involved in the national radon action plan:	Turkish Atomic Energy Authority, Turkish Ministry of Health.
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	No
Guideline for corrective actions exists:	Yes
Guideline for preventive measures exists:	Yes
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	No
Is the radon concentration measured after the corrective action is installed?	Yes
Is the correct installation of preventive measures verified at the time the building certificate is issued?	No

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	Yes
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Maximum value

Number of measurements of radon carried out in the State annually:	
Individual interest:	200−400
Selling/buying process:	0
Renovation/modification of buildings:	0
Other	0

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Turkish Atomic Energy Authority and some universities
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1984 and took 28 years.
- The duration of measurement in one place was at least 2 months.
- CR-39 in diffusion chamber detectors was used.
- The total number of places measured was 7 293. The return rate of detectors was 80%. The selection of places was random and population weighted.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	81
Geometric mean (Bq/m^3):	57
Geometric standard deviation:	2.3

SECTION 5 – RADON AWARENESS

Information material is available:	Yes
Radon risk communication campaign has been carried out in the State:	No
Type of materials developed:	Brochures, internet web pages
Channels used to disseminate radon risk messages:	Internet

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	Yes, the education is for radon measurement, radionuclides in water and building material and for civil engineers

ANNEX XXVIII.

UKRAINE

SECTION 1 – RADON POLICIES AND STRATEGIES

National authority responsible for radon indoors:

Ministry of Health

Is there any legal framework for protection of people against exposure due to radon in dwellings in the State?	Yes
Is there any legal framework for protection of people against exposure due to radon in buildings with high occupancy factors for members of the public (e.g. schools, kindergartens, hospitals) in the State?	No
Is there any legal framework for protection of people against exposure due to radon at workplaces in the State?	No

Indoor radon levels required	Reference/Action level	Limit value
Existing dwellings	No/ Recommended AL 100 Bq/m^3 EEC	No
Existing public buildings	No/ Recommended AL 100 Bq/m^3 EEC	No
Newly built dwellings	No/ Mandatory AL 50 Bq/m^3 EEC	No
Newly built public buildings	No/ Mandatory AL 50 Bq/m^3 EEC	No

Are there any requirements on the following items in the State:

Content of radionuclides in water	Yes
Content of radionuclides in building material	Yes
Exhalation of radon from building material	No
Gamma dose rate and/or photon dose equivalent in buildings	Yes
Radon concentration in workplaces	No

Does the State have a radon programme/radon action plan?	No
Type of document(s) based on which the national radon programme/action plan was established:	Do not exist
Actions covered by the national radon programme/action plan:	
Ministries and agencies involved in the national radon action plan:	
Are any radon prone areas specified in the State?	No, radon prone areas are not defined.

SECTION 2 – RADON AND CIVIL ENGINEERING

Radon is considered in the selling/buying process	No
Radon is considered in building reconstruction/modification	No
Radon related actions in civil engineering ongoing in the State:	No
Radon is included in building code/standard:	
Guideline for corrective actions exists:	
Guideline for preventive measures exists:	
Is it possible to apply for a subsidy/grant or a special loan for corrective action?	
Is the radon concentration measured after the corrective action is installed?	
Is the correct installation of preventive measures verified at the time the building certificate is issued?	

SECTION 3 – RADON MEASUREMENT

Radon measurement devices/detectors are available in the State:	Yes
Are there any requirements on the company/individuals providing measurement of radon activity concentration?	No
Are the requirements different when the measurement is used for official purposes?	No
Are passive radon detectors available in the State?	Yes
Are active radon monitors available in the State?	No
Does a radon database exist?	Yes
Result of measurement compared to the radon level(s) stated in legal framework:	Inhabited rooms average

Number of measurements of radon carried out in the State annually:	No
Individual interest:	
Selling/buying process:	
Renovation/modification of buildings:	
Other	

Organization providing measurement of radon in the State:	
Private companies:	No
Governmental organizations, universities etc.:	Marzeev Institute of Hygiene and Medical Ecology.
Other:	No

SECTION 4 – RADON SURVEY

- An indoor radon survey was carried out.
- The survey commenced in 1989 and took 20 years.
- The duration of measurement in one place was 30 days in heating season.
- The LR115- bare (open face) detectors were used.
- The total number of places measured was more than 30 000. The return rate of detectors was 85-90%. The selection of places was geographically based.

Descriptive statistics of the survey:

Arithmetic mean (Bq/m^3):	62
Geometric mean (Bq/m^3):	42
Geometric standard deviation:	Not reported

SECTION 5 – RADON AWARENESS

Information material is available:	
Radon risk communication campaign has been carried out in the State:	
Type of materials developed:	
Channels used to disseminate radon risk messages:	

SECTION 6 - EDUCATION

Education of general public and students is organized:	No
Education for professionals is organized:	Yes, the education is for radon measurement, radionuclides in water and building material, corrective actions design.

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