Detection, 2016, 4, 40-44
Published Online April 2016 in SciRes. http://www.scirp.org/journal/detection
http://dx.doi.org/10.4236/detection.2016.42006

Assessment of Indoor Radon Concentrations in Dwellings for Baghdad Governorate by Using RAD-7 Detector

Mahmood S. Karim, Hasan H. Daroysh, Ali N. Mohammed

Department of Physics, College of Education, Al-Mustansiriyah University, Baghdad, Iraq
Email: Mahmood_msc74@yahoo.co.uk

Received 24 February 2016; accepted 25 April 2016; published 28 April 2016

Abstract

In the present work, radon gas concentrations in different dwellings in Baghdad governorate are measured by using RAD-7 detector. The results have shown that, the radon gas concentrations ranged between (40.67 ± 3.1 Bq/m^3) to (190.00 ± 2.7 Bq/m^3) with an average value (113.66 ± 30.2 Bq/m^3); in the first one we draw the map radiations for indoor radon gas concentrations in Baghdad governorate. We would like to mention that the present study is considered to be very important and vital because it is concerned with people health and safety in the first place.

Keywords

Radon, Dwellings, RAD-7 Detector, CR-39, Indoor Radon Concentration, Baghdad Governorate

1. Introduction

Radon (^{222}Rn) is a radioactive gas with a half-life of (3.82 d). It is produced by the decay of naturally occurring radionuclide (^{226}Ra), which was decay product in the uranium (^{238}U) series. Thoron gas (^{220}Rn), which is a radon isotope, is a decay product in the thorium (^{232}Th) series. The half-life of thoron is (56 s) which is much shorter than that of radon. Because of such a short half-life of thoron, its emanation from building materials, as well as, its infiltration from the ground and further migration is restricted to a few centimeters only. When radon is inhaled into the lungs it decays by means of alpha-emission which causes ionization damage when it strikes the lung tissue. Over time, this damage causes lung cancer [1] [2]. The radon concentration in air varies in accordance with location, high level of the houses, material of the houses built, different room in the same house, and ventilation rate [3]. Radon exhalation rates in the areas, where uranium deposits and phosphate rocks located, are significant, and this is the main source of exposure to uranium. Long-term exposure to elevated levels of ra-

How to cite this paper: Karim, M.S., Daroysh, H.H. and Mohammed, A.N. (2016) Assessment of Indoor Radon Concentrations in Dwellings for Baghdad Governorate by Using RAD-7 Detector. *Detection*, **4**, 40-44.
http://dx.doi.org/10.4236/detection.2016.42006

don increases risk of containing lung cancer. The purpose of this study is to gather information about the natural radiation and to evaluate the Radon concentration throughout. This is motivated by the concern about the possible consequences of long term exposure to higher concentration of radon and its short-lived product in air [4].

2. Experimental Procedure

A-The Detector

The RAD-7 is a true, real-time continuous radon monitor. This means that a varied radon concentration level can be observed during a measurement period. This is very helpful, in the sense that one can investigate the factors influencing the radon concentration with time. The factors may include temperature changes, wind speeds, relative humidity and may even give insight into air movements in a room [5]. **Figure 1** shows RAD-7 electronic continuous radon monitor.

Sniff mode and circle time was set to be 1 hour in accordance with running time of each path of the valve. In order to investigate radon released from the sample to air, the sample was enclosed into a column and airborne radon was measured with a continuous monitor of electrostatic type (RAD-7, Durridge company, USA). The experimental setup shown in **Figure 2** shows the schematic diagram RAD-7-Air in dwellings.

The air flow rate was 0.7 $L \cdot min^{-1}$. Room air was drawn from the inlet and radon generated in the air flow system was measured with the RAD-7. The measurement interval was 1 hour. The sample weight was different from sample to sample [6].

3. Results and Discussion

In this work measurement the radon gas concentrations in different dwellings in 50 locations for Baghdad governorate. **Table 1** presents the radon gas concentrations in indoor dwellings in 50 locations for Baghdad governorate. From **Table 1** it can be noticed that, the highest average radon gas concentration in air in dwellings was found in Shaab city which was (190.00 ± 2.7 Bq/m^3), while the lowest average radon gas concentration was found in AL-Karada city which was (40.67 ± 3.1 Bq/m^3), see **Figure 3**, with an average value of (113.66 ± 30.2 Bq/m^3) and see **Figure 4** shows that the in the first one the map radiations for indoor radon gas concentrations by using the RAD-7 detector in Baghdad governorate, all radon gas concentrations in Baghdad governorate was less than the lower limit of the recommended ranged (200 - 300 Bq/m^3) (International Committee on Radiation Protection ICRP, 2009) [7]. Finally, we would like to mention that the present study is considered to be very important and vital because it is concerned with people health and safety in the first place, and to the best of our knowledge.

4. Conclusion

The results have shown that, the radon gas concentrations ranged between (40.67 ± 3.1 Bq/m^3) to (190.00 ± 2.7 Bq/m^3) with an average value (113.66 ± 30.2 Bq/m^3). All the results in the present work which were lower

Figure 1. The durridge RAD-7 electronic continuous radon monitor with an HP printer mounted for immediate printing of results.

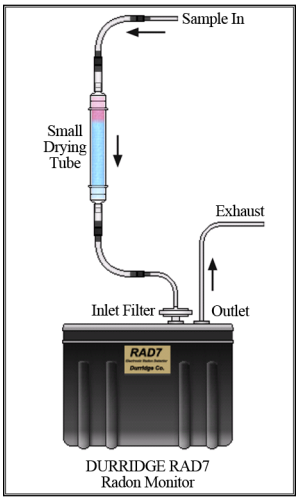

Figure 2. Schematic diagram for the Radon measurement in indoor air.

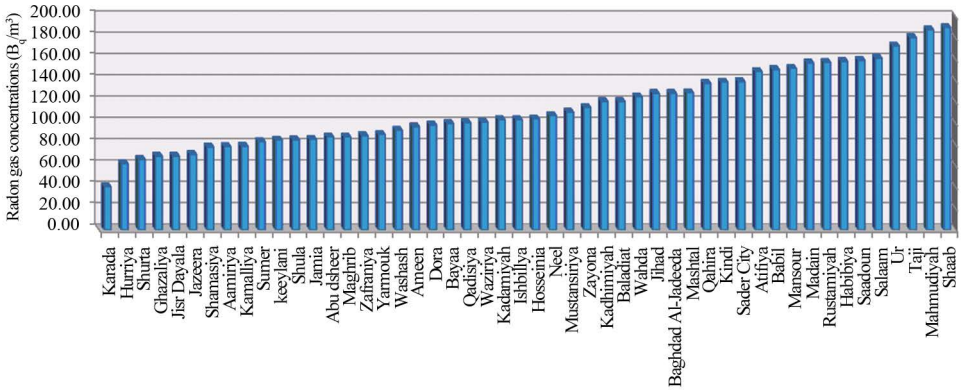

Figure 3. Schematic diagram for the Radon measurement in indoor air.

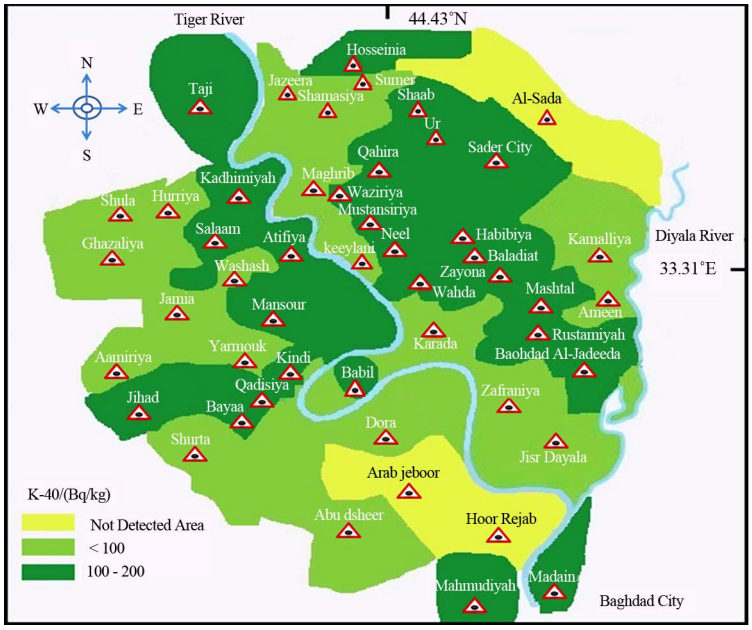

Figure 4. Sketch map showing locations for the studied sites in Baghdad governorate.

Table 1. The radon gas concentrations (C_{Rn}), in dwellings in Baghdad governorate.

No.	Sample location	C_{Rn} (Bq/m^3)			Mean of C_{Rn} (Bq/m^3)
1	Mansour	141	156	158	151.70 ± 7.1
2	Yarmouk	84	92	93	89.67 ± 3.8
3	Ghazaliya	66	69	73	69.33 ± 2.4
4	Karada	36	43	43	40.67 ± 3.1
5	Mustansiriya	104	112	116	110.70 ± 4.4
6	Kadamiyah	94	103	114	103.70 ± 6.9
7	keeylani	81	83	89	84.33 ± 3.1
8	Mahmudiyah	184	188	192	188.00 ± 2.7
9	Kadhimiyah	112	121	129	120.70 ± 5.8
10	Zafraniya	77	92	97	88.67 ± 7.8
11	Jisr Dayala	61	73	74	69.33 ± 5.6
12	Abu dsheer	78	86	98	87.33 ± 7.1
13	Baladiat	111	123	128	120.70 ± 6.4
14	Ameen	79	100	112	97.00 ± 12
15	Hurriya	54	62	71	62.33 ± 5.8
16	Jihad	124	129	132	128.30 ± 2.9
17	Jazeera	62	75	76	71.00 ± 6.0
18	Babil	143	151	158	150.70 ± 5.1
19	Rustamiyah	153	157	162	157.30 ± 3.1
20	Kamalliya	72	79	85	78.67 ± 4.4
21	Qahira	132	137	144	137.70 ± 4.2
22	Ishbillya	96	104	111	103.70 ± 5.1
23	Shamasiya	69	75	90	78.00 ± 8.0
24	Washash	87	95	99	93.67 ± 4.4
25	Atifiya	143	147	156	148.70 ± 4.9
26	Mashtal	125	129	132	128.70 ± 2.4
27	Jamia	76	85	94	85.00 ± 6.0
28	Kindi	132	141	143	138.70 ± 4.4
29	Neel	101	108	113	107.30 ± 4.2
30	Shaab	187	189	194	190.00 ± 2.7
31	Ur	165	176	177	172.70 ± 5.1
32	Sader City	135	138	145	139.30 ± 3.8
33	Habibiya	147	157	171	158.30 ± 8.4
34	Zayona	111	112	122	115.00 ± 4.7
35	Waziriya	95	100	109	101.30 ± 5.1
36	Bayaa	88	95	117	100.00 ± 11
37	Sumer	76	81	92	83.00 ± 6
38	Shurta	59	67	73	66.33 ± 4.9
39	Hosseinia	92	105	116	104.30 ± 8.2
40	Maghrib	79	86	97	87.33 ± 6.4
41	Baghdad AL-Jadeeda	122	130	133	128.30 ± 4.2
42	Madain	153	156	162	157.00 ± 3.3
43	Taji	176	182	184	180.70 ± 3.1
44	Salaam	153	161	170	161.30 ± 5.8
45	Shula	76	88	90	84.67 ± 5.8
46	Wahda	121	127	127	125.00 ± 2.7
47	Saadoun	157	159	162	159.30 ± 1.8
48	Dora	91	99	106	98.67 ± 5.1
49	Aamiriya	76	78	81	78.33 ± 1.8
50	Qadisiya	89	102	111	100.70 ± 7.8
			Average		**113.66 ± 30.2**
	Global limits				**(200 - 300 Bq/m^3) (ICRP, 2009)** [7]

than the ranged (200 - 300 Bq/m^3) recommended by (International Committee on Radiation Protection, ICRP in 2009).

Acknowledgements

The authors are thankful to the residents of the Baghdad governorate for their co-operation during the fieldwork.

References

[1] Guo, Q., Shimo, M., Ikebe, Y. and Minato S. (1992) The Study of Thoron and Radon Progeny Concentrations in Dwellings in Japan. *Radiation Protection Dosimetery*, **45**, 357-359.

[2] Forkapic, S., Bikit, I., Conkic, LJ., Veskovic, M., Slivka, J., Krmar, M., Zikic-Todorovic, N., Varga, E. and Mrđa, D. (2006) Methods of Radon Measurement. *Physics, Chemistry and Technology*, **4**, 1-10. http://dx.doi.org/10.2298/fupct0601001f

[3] Durrani, S.A. and Ilic, R. (1997) Radon Measurements by Etched Track Detectors. Applications in Radiation Protection. Earth Science and the Environment, Singapore.

[4] Soharabi, M. and Solamanian, A. (1988) Indoor Radon Levels in Some Regions of Iran. *Nuclear Tracks and Radiation Measurements*, **15**, 616.

[5] Hayes, R. and Cheng Chiou, H. (2003) Preliminary Evaluation of Real Time False CAM Alarm through Continuous Radon Monitoring. *Health Physics*, **84**, 589-592.

[6] Durridge Company Inc. (2010) Reference Manual Version 6.0.1, RAD-7 Electronic Radon Detector.

[7] ICRP (International Commission on Radiological Protection Statement on Radon) (2009) ICRP, Ref. 00/902/09.