RJC

RASĀYAN *J. Chem.*
Vol. 11 | No. 1 |37-40 | January - March | 2018
ISSN: 0974-1496 | e-ISSN: 0976-0083 | CODEN: RJCABP
http://www.rasayanjournal.com
http://www.rasayanjournal.co.in

ASSESSMENT OF RADON GAS CONCENTRATIONS LEVELS AND RADIATION HAZARDS IN THE DWELLINGS OF BAGHDAD PROVINCE, IRAQ

Laith A. Najam[1,*], Sameera A. Ebrahiem[2], Shaemaa A. Abbas[2] and Hind A. Mahdi[2]

[1]Department of Physics, College of Science, University of Mosul, Mosul, Iraq
[2]Department of Physics, College of Education Ibn Al-Haytham, University of Baghdad, Iraq
*E-mail: prof.lai2014@gmail.com

ABSTRACT

In this work, a set of indoor Rn-222 measurements was carried out in different dwellings of Baghdad province. Radon gas concentrations were determined by using Rad-7 detector. The results show that the highest average C_{Rn} in indoor dwellings was found in Al-Rashid region which was (119.30 Bq/m^3), while the lowest average C_{Rn} was found in Al-khamiyah region which was (72.33 Bq/m^3), the hazard indices (PAEC, Ep, A.E.D. and L.G.) values were lower than the permissibility limit value.

Keywords: Radon gas, Rad-7 detector, Indoor C_{Rn}, Baghdad province.

INTRODUCTION

Radon is a respectable gas common starting point, individual from U-238 chain, radon gas is discharged minerals and soil and moves into the environment. It is half life about of (3.81 days) is sufficiently long to permit wide appropriation and collection in the earth[1] Indoor C_{Rn} is amassed and may achieve huge fixation. This can happen both in abodes and in work environments, bringing about a noteworthy characteristic wellspring of introduction to the people.[2] Wellbeing impacts of C_{Rn} most strikingly lung disease have been researched for quite a few years. At first, examinations concentrated on underground mineworkers presented to high convergences of C_{Rn} in their work-related condition. Be that as it may, in mid 1980 a few overviews of C_{Rn} in residences and different structures were completed and the aftereffects of these reviews together with chance evaluations in view of the investigations of diggers gave roundabout confirmation that C_{Rn} might be an imperative reason for lung tumor in the overall public. C_{Rn} is currently perceived as the second most imperative reason for lung disease in the wake of smoking in the overall public. At the point when radon gas is breathed in thickly ionizing alpha particles radiated by stored rot results of radon gas can connect with organic tissue in the lungs prompting DNA harm. In for the most part disease thought to require the event of at any rate expansion of middle of the road cells that have maintained level of (DNA) harm which can extraordinarily expand the pool of the cells accessible for improvement of malignancy.[3]

Description of Study Area

Baghdad region has the biggest populace of every Iraqi territory and is additionally the area of Iraq's capital, Baghdad, the most crowded city in the nation. The region is separated into 14 regions. The regions of Al-khamiyah, Karkh, Karadah, Kadhimyah, Mansour, Sadr City, Al Rusafa, Rashid and 9 Nissan are a piece of Baghdad city, while the regions of Al-Mada'in, Taji, Tarmiya, Mahmudiya and Abu Ghraib contain whatever remains of the region. Situated on the Tigris alluvial plain in focal Iraq, Baghdad is the littlest region of the nation. The atmosphere of Baghdad is described as hot and parched and situated around (32 m) above ocean level, with an aggregate zone about of (4550 km^2) .[4]

EXPERIMENTAL

The inward cell of the RAD-7 indicator is a side of the equator with volume 0.7 liter. The high voltage control circuit charges within the channel to a capability of (2000-2500) V, in respect to the finder, making an electric field all through the volume of the cell. At the point when the radon and thoron little girls, saved on the surface of the indicator, rot, they radiate alpha particles of trademark vitality straightforwardly into the strong state identifier. The RAD-7 locator chip grabs flag and stores it as indicated by the vitality of the molecule. The gatherings of many signs result in a range. The sniff mode ought to be utilized when following the quick changes in radon fixation by the inner pump, the RAD-7 draws air from the earth through the desiccant and delta channel into the estimation chamber. The air will then come back to the earth .[5] RAD-7 was associated with tubing and desiccant (CaSO4) to assimilate the dampness Fig.-1.

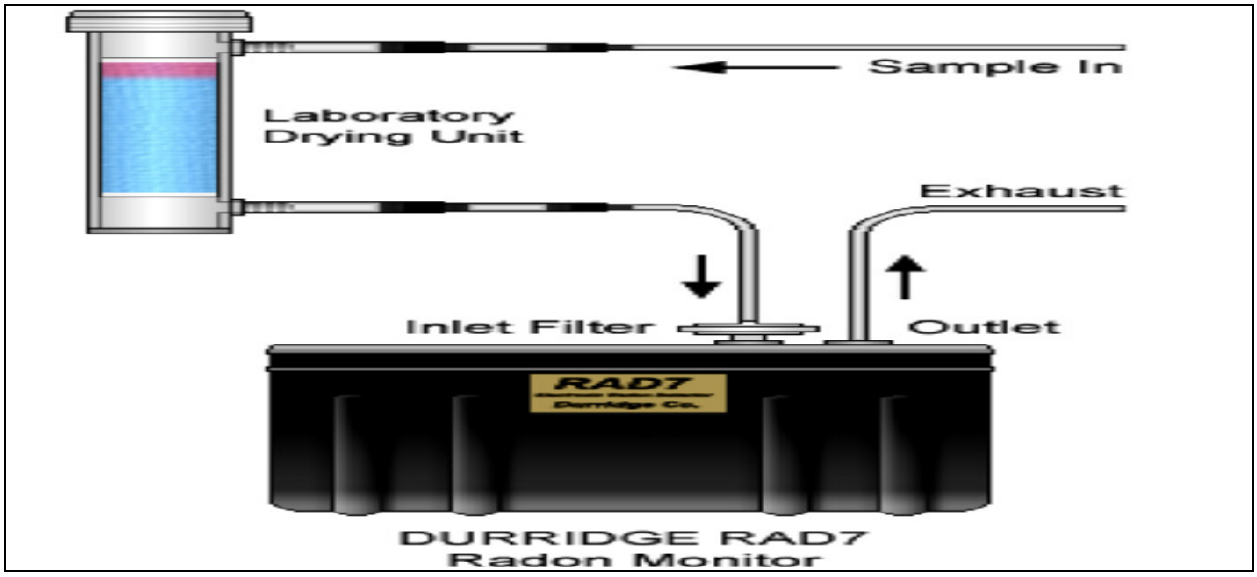

Fig.-1: RAD-7 detector

Measurements Hazard Indices

1. The Potential Alpha Energy Concentration (PAEC): [6]

$$PAEC(WL)=(0.4)\times C_{Rn}/3700 \quad (1)$$

2. Exposure to radon progeny (E_P) is then related to the average radon concentration C_{Rn} by following expression: [7]

$$E_P\,(WLMY^{-1})=8760\times n\times F\times C_{Rn}/3700\times 170 \quad (2)$$

Where C_{Rn} is in $Bq.m^{-3}$, n is the fraction of time spent indoors which is equal to (0.8) , 8760 is the number of hours per year ,170 is the number of hours per working month and F is the equilibrium factor for radon is equal to 0.4 .

3. Annual effective dose (A.E.D.): [8]

$$AED\ (m\ Sv/y) = F \times H \times C_{Rn} \times T \times D \quad (3)$$

Where F is the equilibrium factor and it is equal to (0.4) ,(H) is the occupancy factor (0.8), (T) is the time in hours in a year, (T=8760 h/y), (D) is the dose conversion factor equal to $[9\times10^{-6}\ (m\ Sv)/(Bq.h.m^{-3})]$.

4. Lung cancer (L. C.) cases per year per million people: [9]

$$(CPPP)= (18\times10^{-6} mSv^{-1}.y) \times AED \quad (4)$$

RESULTS AND DISCUSSION

In this present work indoor C_{Rn}, were measured in various compartments for fourteen unique abodes in Baghdad region by utilizing rad-7 indicator (three homes in every district). Table-1 condense the outcomes acquired in the present work for radon gas fixations in indoor abodes in various districts in Baghdad province. From Table-1 it can be seen that the most elevated normal C_{Rn} in indoor abodes was found in Al-Rashid region which was (119.30 Bq/m^3), while the least normal C_{Rn} was found in Al-khamiyah locale which was (72.33 Bq/m^3), see Fig.-2, with a normal esteem (94.9±10.81), which is not exactly the suggested run (200-300 Bq/m3).[10]

The highest value of (PAEC) was found in Al-Rashid region which was (0.013 mWL), while the lowest value of (PAEC) was found in Al-khamiyah region which was (0.008 mWL) with an average value (0.01±0.001 mWL), which is less than the recommended value (53.33 mWL).[11]

The highest value of (E_P) was found in Al-Rashid region which was equal to (0.53 WLMY^{-1}), while the lowest value of (E_P) was found in Al-khamiyah region which was equal to (0.32 WLMY^{-1}), with an average value (0.42±0.05 WLMY^{-1}), which is higher than the recommended range (1-2 WLMY^{-1}).[12]

Also from Table-1, it can be noticed that, The highest value of (A.E.D.) was found in Al-Rashid region which was equal to (3.01 mSv/y), while the lowest value of (A.E.D.) was found in Al-khamiyah region which was equal to (1.82 mSv/y) , with an average value (2.39±0.27 mSv/y). Which is less than the recommended range (3-10 mSv/y).[13]

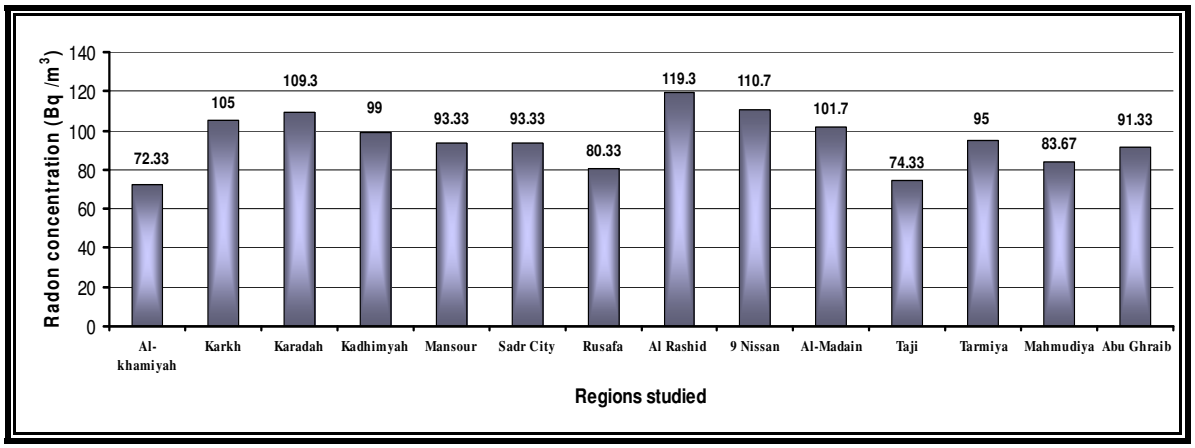

Fig.-2: C_{Rn} in indoor dwellings samples in all regions studied.

Table -1: C_{Rn} , PAEC, E_p to Radon Progeny, (A.E.D.) and L.G. in Different Indoor Dwellings in Baghdad Province.

S. No.	Sample Location	C_{Rn} (Bq/m^3)			Mean of C_{Rn} (Bq/m^3)	PAEC (m WL)	(E_P) (WLM Y^{-1})	(A.E.D.) (mSv /y)	L. C. /10^6 person
1	Al-khamiyah	54	87	76	72.33	0.008	0.32	1.82	32.85
2	Karkh	99	93	123	105.00	0.011	0.47	2.65	47.68
3	Karadah	75	121	132	109.30	0.012	0.49	2.76	49.65
4	Kadhimyah	39	46	212	99.00	0.011	0.44	2.5	44.96
5	Mansour	97	75	108	93.33	0.01	0.42	2.35	42.38
6	Sadr City	76	107	97	93.33	0.01	0.42	2.35	42.38
7	Rusafa	60	84	97	80.33	0.009	0.36	2.03	36.48
8	Al Rashid	98	124	136	119.30	0.013	0.53	3.01	54.19
9	9 Nissan	104	94	134	110.70	0.012	0.49	2.79	50.26
10	Al-Madain	98	86	121	101.70	0.011	0.45	2.56	46.17
11	Taji	69	67	87	74.33	0.008	0.33	1.88	33.76

12	Tarmiya	111	95	79	95.00	0.01	0.42	2.4	43.14
13	Mahmudiya	78	83	90	83.67	0.009	0.37	2.11	37.99
14	Abu Ghraib	94	80	100	91.33	0.01	0.41	2.3	41.48
	Average				94.9±10.81	0.01±0.001	0.42±0.05	2.39±0.27	43.1±4.909
	Worldwide average				(200-300 Bq/m^3)	(53.33 mWL)	(1-2WLM Y^{-1})	(3-10 mSv/y)	(170-230)

Finally, it can be noticed from Table-1 that the highest value of (L.G.) was found in Al-Rashid region which was equal to (54.19), while the lowest value of (L.G.) was found in Al-khamiyah region which was equal to (32.85), with an average value (43.1±4.909) which is higher than the recommended range [(170-230)[13] , All results in the present work a little more than the anthers work in Wassit province – Iraq.[14]

CONCLUSION

This present investigation uncovers that the C_{Rn} in indoor homes in fourteen districts in Baghdad province is well beneath the suggested safe cutoff esteems. Varieties in levels of radon fixation show up because of the utilization of building materials utilized for the development of residences and the level of their ventilation.

REFERENCES

1. T.S. Shashikumar, M.S. Chandrashekara, L. Paramesh. *International Journal of Environmental Sciences*, **1(5),** 787(2011).
2. J. Chmiles, and J. D. Appleton, *Journal of Radiological Protection*, **25**, 257(2005).
3. S.A. Durrani, *Nucl. Tracks Radiation Measurement*, **22(1-4)**, 303 (1993).
4. M. S. Karim M. S., A. H. Mohammed and A.A. Abbas, *Journal of College of Ibn Al- Haytham Education*, **23 (2)**, 25 (2010).
5. R. Hayes and C. H. Cheng *, J. of Health Physics*, **84(5)**, 589 (2003).
6. A. H. Ismail and M. S. Jaafar, Bioinformatics and Biomedical Engineering (iCBBE) , **ldo 4th** international Conference in Cheng du (2010).
7. ICRP,(International Commission on Radiological Protection Publication), Protection against Radon-222 at home and at work, Annals of ICRP, Oxford, Pergamon Press,1(1994).
8. A. M. Mowlavi, M.R. Fornasier, A. Binesh and M. Denasier, *Environ. Monit. Assess.*, **184(2)**,1085 (2012).
9. A.A. Abdullah, Ph.D. Thesis, Department of Physics, University Sains Malaysia, Malaysia (2013).
10. ICRP, (International Commission on Radiological Protection Statement on Radon), Ref. **00/902/09** (2009).
11. UNSCEAR ,Genetic and somatic effects of ionizing radiation ,United Nations (1993).
12. A. H. Ismail and M.S. Jaafar, Bioinformatics and Biomedical Engineering (iCBBE) , **ldo 4th** international Conference in Cheng du ,18-20 June (2010).
13. ICRP (International Commission on Radiological Protection Publication),Annals of ICRP, Pergamon Press, Oxford, **23(2)** (1993)
14. L. A. Najam, T. K. Hameed and A. O.Farhan**,** *Rasayan Journal of Chemistry*,**10 (4),** 1311(2017).

[RJC-1696/2017]