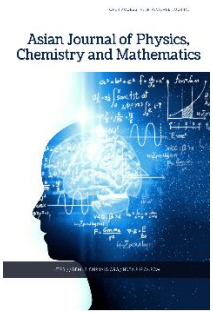

Measurement of Radon Levels in Dwellings in Some Regions in Al-Tuz Salah Al-Din Governorate during Winter Season

Karar Samen Ali[1]

[1]Ministry of Education , General Directorate of Salah al Din Education ,Tuz Education , Iraq.
Sunodunanen88@yahoo.com

Loqman Abdallah Ali[2]

[2]Ministry of Education , General Directorate of Salah al Din Education ,Tuz Education , Iraq.
Kl3147460@gmail.com

ABSTRACT

This study aims to assess the radioactivity of radon gas and the risks because of exposure to it and to calculate the annual effective dose ratesand the risks of lung cancer. Radon gas concentrations were measured in dwellings consisting of (14) houses in some areas of Tuz city during the winter season (January 1st to 1st March) in 2022, using the CR-39 nuclear trace detector.

The results obtained from 14 sites in the city of Tuz Khurmatu showed that the lowest and highest concentrations recorded in site No. (3) (Akso neighborhood Tuz 2), and the highest concentration was recorded in site No. (5) (Tuz Al Tayyar District 2). While the other sites, the concentration of radon gas ranged between the two. The results showed that the lowest value of the effective radium content (CR) was recorded in site No. (3) with a rate of 14.7 $Bq.m^{-3}$, and the highest value of 45.4 Bq/m^3 was in site No. 5, with a rate of 27.63. Bq/m^3 · In addition, the lowest value of the balanced radon equivalent concentration (ECC) was recorded in site No. (3) with a rate of Bq/m^3 (5.88 Bq/m^3), and the highest values of (18.16 Bq/m^3) was recorded in site No. (5), with a rate of (11.05 Bq/m^3). We also noticed that the lowest value of the annual equivalent dose in site No. (3) was (0.37) msv/y and the highest value was(1.14) msv/y in site No. (5), with an average of (0.69) mv/y .

Keywords:

1. Introduction

One of the causes of environmental pollution is the spread of radioactive materials of HIn surface soils, rocks and water, whether this diffusion is natural or as a result of external pollution. The sources of radioactive pollution have increased due to wars and nuclear explosions for that. So, studies have increased this radiological[1] Radioactive air, soil, rocks, heavy water[2], food and others are used to measure the level of radiation doses to which humans are exposed .Radon(^{222}R) is considered One of the sources of radioactive pollution which is that danger is the gas, for it is not only a radioactive element However, it is also because a gas can spread to wide areas, in addition to the transformation of radon after a period of time[3].(3.83) day to the element poloniumw for alpha particles, polonium is deposited on plants and homes, which poses dangers HBigH. The population in such areas, radioactivity is defined as a particular sort of radiation emitted out of active substances Hradioactive, and the radioactivity is apparent HEternal surrounded the human environment and polluted

water[4], air, and soil have also been contaminated with plant and animal food, in the presence of nuclides of radioactive elements that are subject to this phenomenon. Pollution is known as the existence of a species with a concentration higher than the permissible concentrations in the local and international environmental standards that lead to damaging the environment. Hin generally and people in particular radon of the chemically inert gases and atomic number 86 The overall number of its more stable counterpart is [5]. 222Its density is(9.7kg.m^{-3}) and its boiling point (-61.8) C and degree Freeze (-71)C because it is heavier than air in a way that tends to stay close to the ground. That is, on the ground floors, it is considered radon gas 222 One of the sources of natural nuclear radiation that is mainly generated by the natural decomposition of the uranium chain ^{238}Uranium and uranium. It is the only metal that exists in a gaseous situational case, and radon has several isotopes, radon gas ^{222}R and the eruption element ^{220}R and actinium ^{219}R. It is known in geological and environmental studies[6], it is an analogue with a relatively long half-life, while the role of the other two isotopes can be neglected because the half-life is short and its unity is second. When radon has become a source of danger to human life, designs guarantee resistance to climatic fluctuations. One of the most important characteristics of which is to preserve the internal atmosphere through controlling ventilation processes and reducing rates of exposure to radon to acceptable minimum levels and according to the supporting standards, that should be mentioned, have become radon[7]. It is the rate of ventilation. The goal of this research is to measure the concentration of radioactive radon gas in the air for areas of Tuz Khurmato district, Salah al-Din governorate, because this city has been subjected to bombing and environmental neglect more than other cities, in addition to the population density that the city has[8].

Used materials

This study was to measure radon levels in residential homes, specifically in living rooms in some areas of Tuz, and to identify the concentration of radon gas R-222, which is a natural product of the decay of uranium U-238.

K = 1 /4 × r (2Cosθc − r / Rα (

Where r =.radius of the tube employed as a propagation, chamber (1.77.cm) and (c) the crucial angle of the detector (CR-39) and its magnitude (35°), and (R) indicates the range of alpha particles in the air generated and released into the atmosphere by radon gas equal to 4.15cm, and when such values are reimbursed in the equation, the value of the constant propagation is equivalent to The concentration of radon gas in the airflow of the compartment between the sample surface and the detector surface of units (Bq.m-3) [9] was determined employing the relevant equation:

C_{Rn}= ρ /TK…….(2)

Where, Where, CRn is concentration of the radon gas, (ρ) is the tracks density (tracks*mm^{-2}), T could be the duration of exposing of the air detector and (K) is the balance factor [10].

The following equation may be used to calculate EEC, which stands for equilibrium concentration value. [11,12]:

EEC= C_{Rn}* K …….. (3)

unit of measure (EEC) is (Bq/m^3).

(D) is the yearly absorbed dose including its unit (mSv/y), which may be calculated using the equation below. [13]:

$D = C_{Rn} * H * K * Df * T$……. (4)

(D) is the yearly absorbed dose (mSv/y).

($\boldsymbol{C_{Rn}}$) is Radon of Concentration of (Bq/m^3).

(H) is the internal occupancy factor = (0.8).

(T) is the internal occupancy = 24h*365 = 8760 $h.y^{-1}$.

(D_f) is the dose conversion factor= $9*10^{-6}$ (msv.m^3/Bq.h).

CR-39. Nuclear Trace Detector

A soft and thin sponge was used to prevent radon gases from reaching the detector. Radon gas is used to reach a height of 200 cm, which is the average height of an individual for two

months, after which it is lifted from a location to two months' filling months and then removed from the site for a two-month filling, after which the result of the signs appearing in their forms can appear, these chemical treated reagents, picdexid, sometimes because of their appearance and because of the signs of their appearance. There were 14 detectors in the city of Tuz Khurmatu.

Figure (1) The method of spreading the reagents inside the cups and the effects shown in the detector represents

Results and discussion: -

In the current paper, radon gas concentrations were detected in various areas of the city of Tuz Khurmatu. Table (1) illustrates the subsequent concentrations of radon gas in such places. From measuring the radon concentration in such places, the results show that the maximum concentration is (45.4 Bq/m3) in the site (5) Tuz Al-Tayyar 2. The lowest concentration was (14.7 Bq/m3) was in the site (3), Tuz, Akso district, and the average concentration for all areas under study. The annual active dose was taken into calculation from the values of radon concentrations as illustrated in Figure (1). Also, it was found that the annual equivalent dose in some areas is (0.37 mSv/y). It is much less than the permissible limit, such as the residential area in (Aqso District 2). The highest value of the annual equivalent dose is (1.14mSv/y), which is also less than the permissible limit for residents of (Al-Tayyar Al-Thaniya neighborhood). Regarding the limits of exposure to radon gas, the International Agency for Prevention The level of exposure to the population has been determined (200 Bq/m3) [14], and the cumulative annual exposure dose is (2.0 mSv/y) [14,15]The results that were taken into account that there is a discrepancy in the concentrations of radon gas in different locations as shown in Figure (2). This is due to the various nature of the areas and houses. It was found that the house located in the Al-Tayyar neighborhood is the most concentrated area with radon gas, because it is one of the areas whose houses are of old construction compared to other areas, in addition to the fact that most of their houses are small in area, not exceeding 100 meters, and lack healthy ventilation. Also from natural uranium, as the windows and doors of the dwellings are tightly closed, this leads to the accumulation of radon gas liberated out of the walls and floors, as well as causing high radon concentrations in them. Some areas were Concentrations of radon gas in their homes are much less than the permissible limit. These reduced concentrations of radon

are caused by the presence of ventilation and the capacity of the house, as well as new buildings. The results of this study in the district of Tuz Khurmatu, Salah al-Din governorate reveal that the values we attained for radon concentrations are less than the permissible limit. Globally [16], it gives a good indication that there is no danger or radioactive contamination with radon in the air of the city of Tuz Khurmatu.

Table (1) shows the study areas in the city of Tuz

Sq	home sites	C(Bq/m3)	EEC(Bq/m3)	D(mSv/y)
1	Tuz - Military District	15.2	6.08	0.38
2	Tuz - Akso District 1	26.9	10.76	0.67
3	Akso neighborhood Tuz 2	14.7	5.88	0.37
4	Tuz Al Tayyar District 1	32.3	12.92	0.81
5	Tuz Al Tayyar District 2	45.4	18.16	1.14
6	Tuz District 1	12.1	4.84	0.30
7	Tuz District 1	38.4	15.36	0.96
8	Chardagli Village 1	44.5	17.8	1.12
9	Chardagli Village2	37.8	15.12	0.95
10	BirawchleyVillage1	27.6	11.04	0.69
11	Birawchley Village2	21.8	8.72	0.54
12	Qaranaz Village 1	18.4	7.36	0.46
13	Qaranaz Village 2	32.7	13.08	0.82
14	Asrya	19.1	7.64	0.48
lowest value		14.7	5.88	0.37
highest value		45.4	18.16	1.14
the average		27.63	11.05	0.69
global average		(Bq/m3)200		(2.0mSv/y)

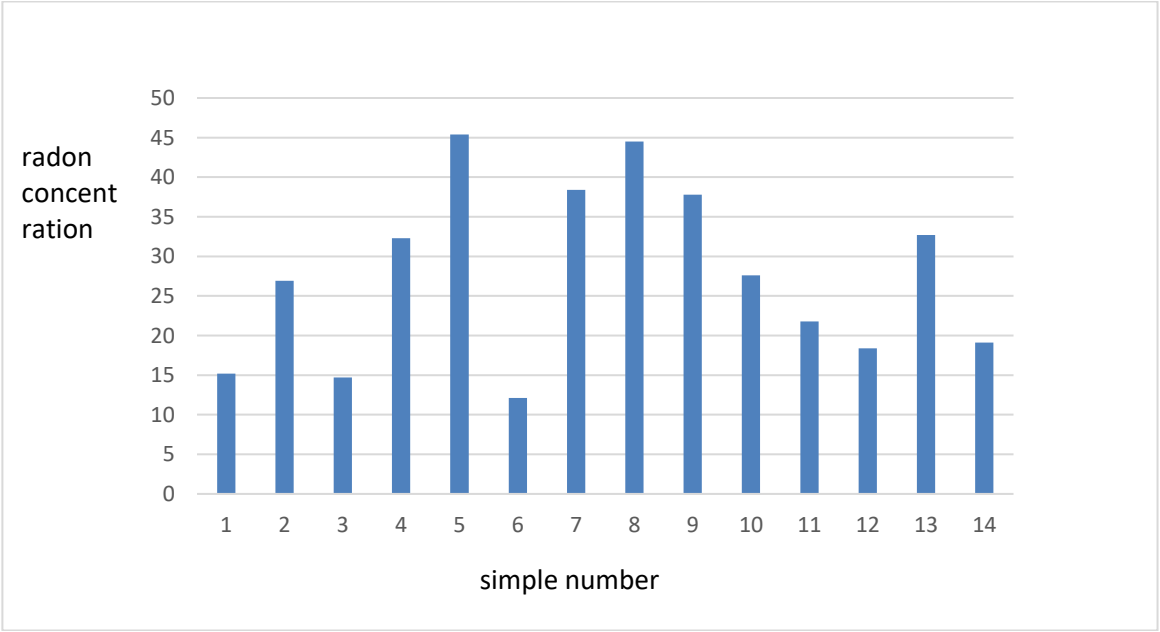

Figure (2) represents the radon

Figure (3) represents the linear relationship among radon concentration and yearly equivalent dose

References

1. Movement and transfer of depleted uranium in the soils of southern regions of Iraq "Decisions of the scientific conference on the impact of the use of depleted uranium weapons on humans and the environment in Iraq, Part I, p. 180 (2002).
2. Warren C.E., "Biology and Water Pollution Control", W.B. Sanders Company, London (1971).
3. Department of Environmental, "A Guide Risk Assessment and Risk Management for Environmental Protection", HMSO, London, U.K., p.78-95 (1995).
4. Ghassan Abdullah Ali, "Radon and its Effect on the Environment and the Human", Atorn and Development Bulletin, volume 11, No. 3 (1999).
5. Ammar Abdul Rahman Al-Saad, "Radon: Its Risks and Benefits," The Atorn & Development Bulletin, Volume 11, No. 2 (1999).
6. Masoud Salih Khalifa, Salih Muhammad Abd al-Salam "Measurement of Radon Concentrations in Soil" Nuclear Research Center - Libya (1996).
7. Archer,V.E.,Wagoner, G.K., Lundin ,F.E., Health Phys.,Vol.25, P.351 (1973).
8. Durrani S. A. and Bll R. K.,''Solid state Nuclear Track Deyection :Principes ,Methode and Applications" Pergamon Boods , Ltd (1987).
9. Sudanese, Zahra Abdel-Hussein, "Concentrations of natural and industrial nuclides in different environmental samples for the city of Amara - Maysan Governorate" PhD thesis - College of Science for Girls - University of Baghdad (2016).
10. Kleeb R W., Salah S A and Ali E S, 2020 "Calculation of Radon Gas Concentration in the Buildings of Samara University Using the Nuclear Track Detector CR-39" Journal of NeuroQuantology,18(2):82-87.
11. Azam A., Naqvi A. H. and Srivastava D. S., 1995, "Radium Concentration and Rado Exhalation Measurements Using LR – 115 Type II Plastic Track Detectors", Nucl.Geophys., 9(6): 653 – 657.
12. Ali E S., Mohammed S F., Mohammed C N and Mahmoud Z S,2020 " Measurement of Radon Radiation Concentration in Imported and Local Powdered Milk using

Nuclear Track Detector CR – 39". Journal of Physics: Conference Series.

13. Nada F. Tawfiq, Hussein M. Nasir and Rafaat Khalid, 2012. Determination of Radon Concentrations in AL-NAJAF Governorate by Using Nuclear Track Detector CR-39, Journal of AlNahrain University, 15 (1): 83-87.
14. UNSCEAR, 2008. United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). UNSCEAR 2006 Report. Annex E. "Sources-to-Effects Assessment for Radon in Homes and Workplaces". New York: United Nations, 2008.
15. UNSCEAR, 2010. (United National Scientific Committee on the Effects of Atomic Radiation), Report to the General Assembly, United Nations, New York
16. UNSCEAR, 2000. Exposures from Natural Sources, Report to General Assembly, Annex B, New York