

# Measure of Radon Concentrations in Surface water in Babylon Government (The Holy City of al-Qasim) and its Health Effects

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**Abstract:** Radon chemical element for which an inert gas is colorless, odorless and tasteless, it is also radioactive elements, Radon is chemically inert and non-flammable and very poisonous and carcinogen by inhalation. The aim of this project is Knowledge of radon concentration level and the annual effective dose in Surface water in Babylon Governorate (The holy city of al-Qasim) were carried out on 24 samples ( Surface water), alpha track detectors (type RAD7) were used for the estimations. the results of this project The average values for radon concentration of Surface water were variable from the district to another, and it was found to be  $(432 \pm 20.78461 \text{ Bq/m}^3)$  with a maximum in (SR.W24) and minimum in (SR.W8)  $(142 \pm 11.91222)$  And that the annual effective dose for all samples in The holy city of al-Qasim. When the results were compared with the internationally recommended reference levels (U.S Environmental Protection Agency limit 555. Bq/m, 1), there were no indications of existence of radon problems in the water sources in this survey, This is because most of the city of al-Qasim is an agricultural area and the presence of plants frequently prevents dust from one place to another transmission which reduces radon gas lingering dust values. therefore the Surface water in The holy city of al-Qasim is safe as far as radon concentration is concerned.

**Keywords:** Radon in water, RAD7, Health Effects

## 1. Introduction

### 1.1 Physical features

Radon- 222 is one of the periodic table elements located within the range noble elements of a radiant gas is colorless and odorless and is inert chemically not combine with any element or another in the nature of a compound is one of the natural atomic radiation generated in the decomposition of the uranium- 238 series is the only metal sources which is found in a gaseous state, which is heavier than air seven and a half times and there are almost in all places, at all times, It dissolves in water and can readily diffuse with gases and water vapor[1,2]. The earth's crust contains trace amounts of  $^{238}\text{U}$  and  $^{232}\text{Th}$  which decay to ( $^{222}\text{Rn}$ ) and ( $^{220}\text{Rn}$ ) respectively, thus building up significant concentrations from ( $^{222}\text{Rn}$ ) and two of its daughters, ( $^{218}\text{Po}$ ) and ( $^{214}\text{Po}$ ), are alpha emitters, while ( $^{214}\text{Pb}$ ) and ( $^{214}\text{Bi}$ ) are betagamma emitters, Radon  $^{222}\text{Rn}$  which is the daughter of uranium  $^{238}\text{U}$ , represents the most important radon isotope[3]. The  $^{222}\text{Rn}$  concentration in water is due to the decay of  $^{226}\text{Ra}$  associated with the rock and soil, seemingly the radon gas pouring down through the soil and rock, and dissolves in the water, consequently the concentration of radon in water is higher than we expect if was the activity just because supporting dissolved  $^{226}\text{Ra}$  in the water, radon gas it is easily lost from water when it is moved water flows over rocks or is moved by wind, surface water which currently accounts for approximately 70% of drinking water supplies in The holy city of al-Qasim[4]. using RAD7 detector to measure

radon concentrations in water, Radon measurement was made using Durrigde RAD-7, using RAD H<sub>2</sub>O technique, studied the distribution of radon ( $^{222}\text{Rn}$ ) activity concentration in surface water samples and their annual effective dose exposure[5,6].

### 1.2 Biological effect of radon

When radon gas is inhaled, the ionizing alpha particles emitted by the decay products of  $^{218}\text{Po}$  and  $^{214}\text{Po}$  can interact with the biological tissue in the lungs leading to DNA damage, and it refers to the ingestion of dissolved radon in water will result in a radiation dose to the lining of the stomach[7].

## 2. Materials and Methods

The study area is the city of the Holy al-Qasim, in Babylon Governorate[8]. Radon concentration in these samples ( samples surface water ) was measured with RAD7, an electronic radon detector connected to a RAD-H<sub>2</sub>O accessory for a period of one month, Figure(1) shows the device RAD7 and RAD-H<sub>2</sub>O, RAD7 is a device manufactured by the Durrigde Used to measure surface water samples. Water 250 protocol, which automatically configures RAD7 to perform a test according to the selected parameters, was chosen. RAD7 configured to count the samples for 30 min in four cycles of 5 min each. The choice of these parameters was to avoid the high relative humidity within the sensitive detector volume, resulting from the long-time aeration. During the 5 min of aeration[5,6].

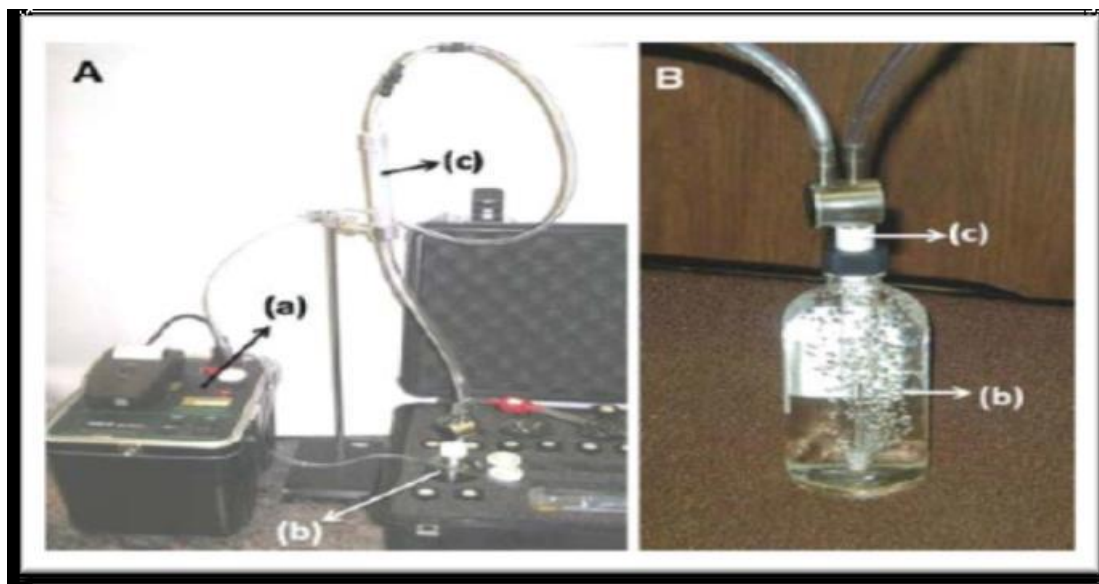


Figure 1: Shows A. RAD7 Driver and B. RAD7H<sub>2</sub>O Driver

### 3. Sampling

A sample of water was taken from the river by tight reagent bottle of 250 mL and use a glass bulb containing calcium to absorb the moisture, the rad7 contains a small compartment which act as scintillator to detect alpha activity. air was then circulated in a close circuit for a period of 5-10 min until the radon was uniformly mixed with the air and the resulting alpha activity was recorded and it directly gives the radon concentration. The radon concentration of Surface water is an important issue from the dosimeter aspect, So it requires a great attention from researchers to control the amount of radiation to which the public is exposed. Radon is soluble in water and this route of exposure is important if high concentrations are found in drinking water[9]. On some occasions, water is consumed immediately after leaving the faucet before its radon is released into the air, This water goes directly into the stomach and in this period, the alpha particles generated from the dissolution of radon stick to the wall of the stomach, During that process, During that process, These cells can receive a radiation dose from alpha particles emitted by radon and radon decay products that are created in the stomach wall, After passing through the wall, radon and decay products are absorbed in blood and transported throughout the body[10].

### 4. Results and Discussion

This is the first study that indicate of its kind to measure the radon in The holy city of al-Qasim, For the measurement of radon gas in surface water were used solid-state detector (rad7) as in Figure(1). is a highly flexible instrument as it can form a an entire system for measuring radon. It can be used for various purposes, The RADH<sub>2</sub>O is an accessory for RAD7 that enables you to measure radon in water with high accuracy, a wide range of concentrations For your reading within half an hour of taking a sample. The results obtained to conduct radon measurement in surface water could be clarified through the table(1). which shows the radon concentration in surface water for 25 samples as well as the annual effective dose for each sample with surrounding coordinates of the sample. The maximum concentration of 222Rn in The holy city of al-Qasim at the location sample SR.W24 was (432±20.78Bq/m<sup>3</sup>) and the minimum concentration of 222Rn at the location sample SR.W8 (142± 11.92). The allowed maximum concentration level in Surface water which (555 KBq.m<sup>-3</sup>) proposed by USEPA, therefore all results that its obtained in this study are less than the allowed maximum concentration level. The annual effective dose for Surface water is less than of the allowed maximum concentration level in Surface water.

Table 1: The concentration of (222Rn) in (Bq.m<sup>-3</sup>) and the rate annual effective dose of 222Rn in μSv.y<sup>-1</sup> in Surface water samples.

Sample Point	Mean (Bq/m <sup>3</sup> )	S±D	Effective dose(mSv.y <sup>-1</sup> )	Samples location
S.R.W1	145	12.04159	0.000529	N=32.19.45.9 , E=44.38.23.6
S.R.W2	144.67	0.577735	0.000528	N=32.18.50.6 , E=44.40.17.5
S.R.W3	146	12.03129	0.000532	N=32.28.03.8 , E=44.39.41.7
S.R.W4	144	12	0.000526	N=32.14. 03.0 , E=44.40.22.6
S.R.W5	144. 7	0.6666	0.0005282	N=32.12.15.1 , E=44.40. 21.3
S.R.W6	144.5	0.707107	0.000527	N=32.75.12.2 , E=44.37.48.9
S.R.W7	240.67	15.51344	0.000878	N=32.54.35.9 , E=44.53.75.7
S.R.W8	142	11.91222	0.000518	N=32.78.54.8 , E=44.12.63.8
S.R.W9	147.77	0.77735	0.000539	N=32.18.05.2 , E=44.39.39.3
S.R.W10	217.5	14.75	0.000794	N=32.66.62.4 , E=44.84.28.8
S.R.W11	191.333	0.000698	0.000698	N=32.78.29.2 , E=44.11.72.5
S.R.W12	144	12	0.000526	N=32.10.90.8 , E=44.47.02.5
S.R.W13	251	14.6	0.0008	N=32.22.41.9 , E=44.36.23

S.R.W14	144.75	12.03	0.0005	N=32.19.16.2 , E=44.39.17.5
S.R.W15	214.5	14.7	0.0008	N=32.18.50.0 , E=44.40.19.1
S.R.W16	290	17.03	0.001	N=32.18.33.9 , E=44.41.06.8
S.R.W17	146	12.08	0.0005	N=32.18.09.3 , E=44.42.13.6
S.R.W18	287.25	16.9	0.001	N=32.17.22.5 , E=44.42.56.6
S.R.W19	143	11.9	0.0005	N=32.56.14.8 , E=44.72.91.7
S.R.W20	144	12	0.000526	N=32.20.23.1 , E=44.40.50.6
S.R.W21	144.75	12.03	0.000528	N=32.22.47.3 , E=44.33.03.1
S.R.W22	143.3	11.97	0.000529	N=32.21.50.9 , E=44.32.59.7
S.R.W23	143	11.9	0.001	N=32.20.44.5 , E=44.33.16.9
S.R.W24	432	432	0.001577	N=32.20.06.6 , E=44.32.27.2

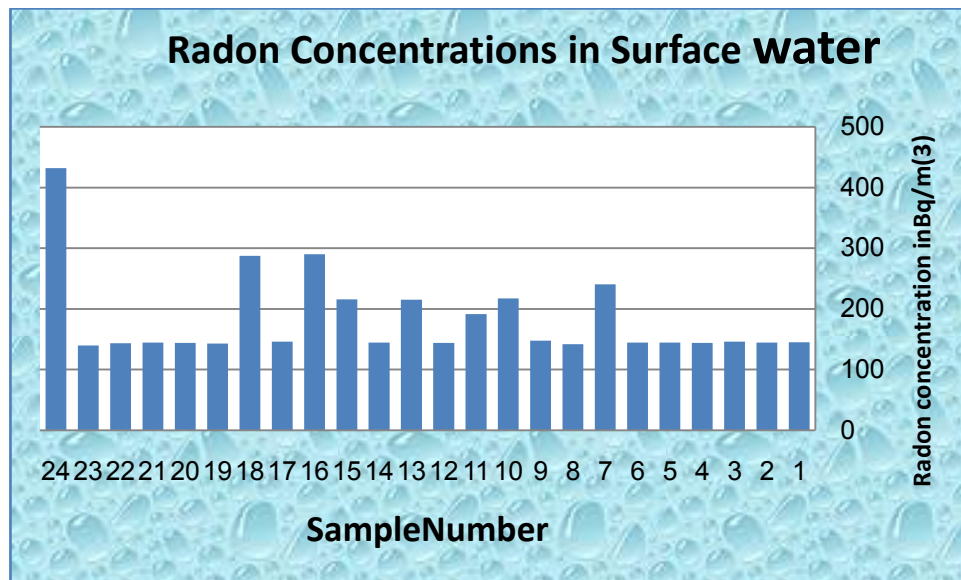


Figure 2: Shows radon concentration in Surface water.

Through this form we noticed the presence of elevated values as in the sample (S.R.W8) and low values as in the sample (S.R.W8) There are mean values in the samples (S.R.W10) and (S.R.W15).

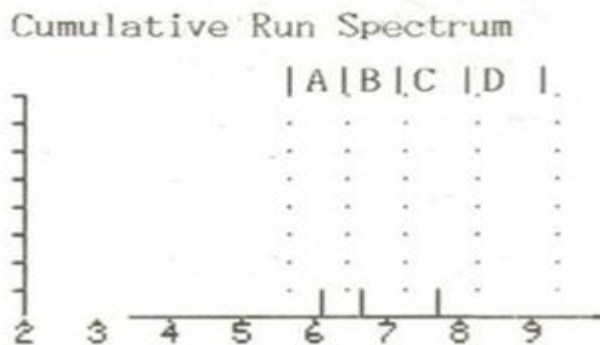


Figure 3: Alpha energy spectrum of location sample surface water for S.R.W8

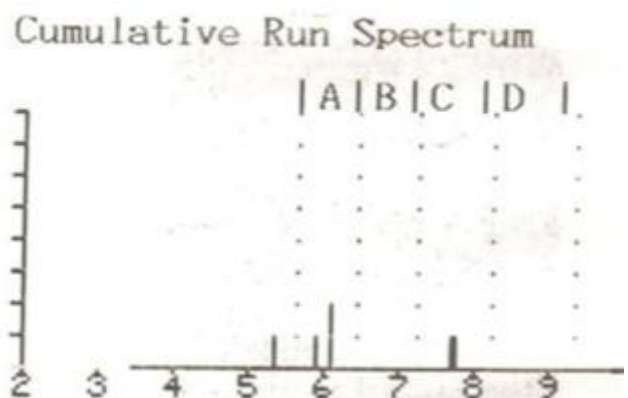


Figure 5: Aalpha energy spectrum of location sample surface water for S.R.W10

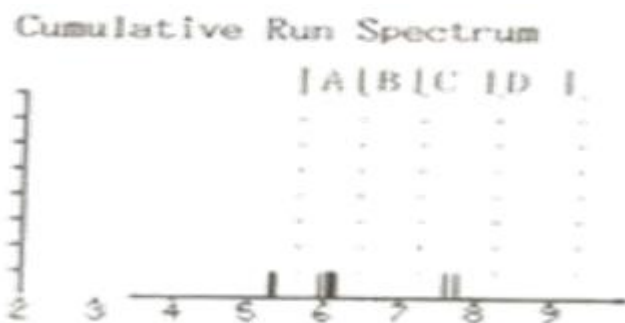


Figure 4: Aalpha energy spectrum of location sample surface water for S.R.W24

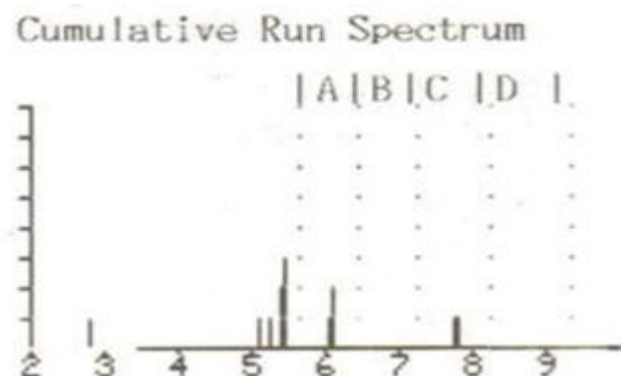
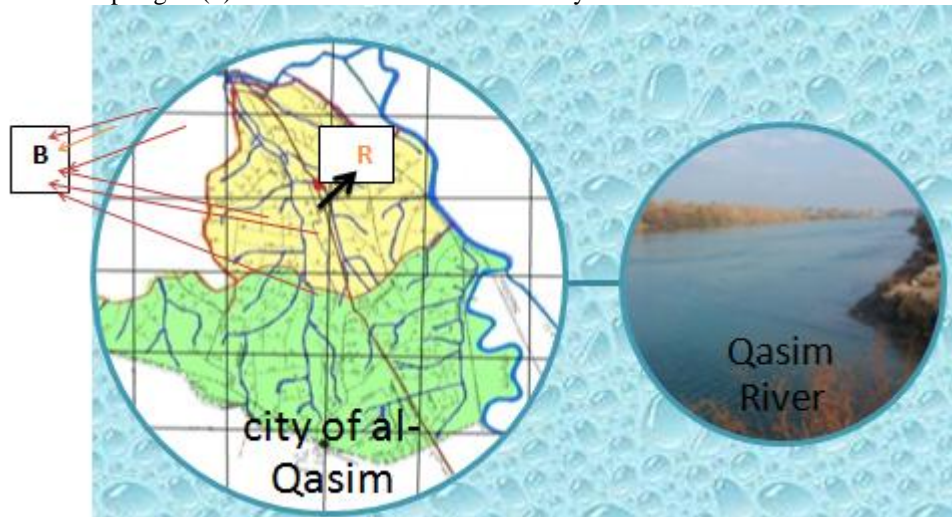


Figure 6: Aalpha energy spectrum of location sample surface water for S.R.W15

Can be noted many branches of Hilla River, in the city of al-Qasim as shown in the map Figure(3). indicates where

the letter (R) to the main river of Hilla, crafts branch (B) to secondary branches.



**Figure 7:** shows the map and the Qasem River City

## 5. Conclusion

The discussion of the result , which are obtained from this study leads to the following conclusion:

- 1) All the values of surface water is allowed under level.
- 2) Results show that the annual effective dose for all samples are below the allowable level.
- 3) Since all results with concentrations less than the specified level does not have the global impact of negative Baalogi in surface water to these samples.

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