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RADON CONCENTRATIONS IN DRINKING WATER SAMPLES FOR SOME AREA AT AL-NAJAF CITY

Abstract: The radioactivity of radon gas in five samples of drinking water that manufactured in different regions of Najaf city have been measured by RAD7 detector. The results show that, radon concentrations were varied from (0.33) Bq/l to (1.2) Bq/l. This study, prove that the high value of radon concentrations was less than the allowed limit which it is equal (11.1) Bq/l.

Key words: Radon concentrations, drinking water, RAD7 and Al-Najaf, Iraq.

Language: English

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Introduction

Radiation is a fact of life. We live in a world in which radiation is naturally present every-where. Light and heat from nuclear reactions in the sun is essential to our existence. Radioactive materials occur naturally throughout the environment, and our bodies contain radioactive materials such as carbon-14, potassium-40 and polonium-210 quite naturally. All life on Earth has evolved in the presence of this radiation. Means radioactive contamination environmental presence of radioactive elements emitting particles and photons of radionuclide to the environment from various sources such as accidents and nuclear tests and these radionuclide transmitted to the ground, and causes vegetation to its appearance to the outside, and can be transmitted through the food chain to the human body [1]. Radon is the leading source of natural radiation exposure and the second leading cause of lung cancer. Where does it come from? Well, usually from soil, but it is

found everywhere. The ground that we all walk and build our homes upon contains varying levels of naturally occurring radioactive elements that decay into radon gas. Radon from chemically inert gases and radioactive naturally produced from the natural radioactive decay of uranium found in rocks and soil. Emit radon easily from the soil to spread in the air where dissolved to derivatives, short-lived, called the adad radon emission alpha particles and sticking with dust and other particles suspended in the air and when inhaled air accumulate those Aloledat in the cells that cover the bronchial tree where can alpha particles damage to those cells and cause lung cancer [2]. Radiates the human body from the inside by all of the air we breathe and the food and water that reaches the stomach. The air is the main source of dose Radioactive natural that reach inside the human body and their primary source of radon gas found in the earth's atmosphere. Moreover, some dust that falls on the plant contains traces of radioactive

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materials to those that are slightly radioactive our bodies from the inside because of some radioactive elements, such as carbon-14, potassium-40 [3]. Radon gas decays into radioactive particles that can get trapped in lungs when breathe. As they break down further, these particles release small bursts of energy. This can damage lung tissue and lead to lung cancer over the course of lifetime. Not everyone exposed to elevated levels of radon will develop lung cancer [4]. And the amount of time between exposure and the onset of the disease may be many years. Like other environmental pollutants, there is some uncertainty about the magnitude of radon health risks. However, know more about radon risks than risks from most other cancer-causing substances. This is because estimates of radon risks are based on studies of cancer in humans. Smoking combined with radon is an especially serious health risk. Stop smoking and lower your radon level to reduce your lung cancer risk. Children have been reported to have greater risk than adults of certain types of cancer from radiation, but there are currently no conclusive data on whether children are at greater risk than adults from radon [5]. The aim of the present study to find concentrations of radon gas in the drinking water samples for the city of Najaf in different places, using a solid-state detector stems RAD7 radon interest in being a source of danger to people's health because of the breadth of its spread in the water.

PRACTICAL PART:

Solid State Detector RAD7 The solid state detector as shown in Figure (1) was made of a semiconductor material (silicon) converts the energy of alpha radiation resulting from the decomposition of (^{218}Po or ^{214}Po) directly into an electrical signal which if RAD7 can filter the type of isotope discrimination electronic energy related with alpha particles and thus we can distinguish isotopes of radon (^{218}Po) fires the alpha card 6MeV ^{214}Po card or 7.97 MeV [6] . RAD7 has a cell size (0.7L) has

the form of a hemispherical possible that we observe in Figure (2) within the hemisphere coated electrical connector with high voltage equip shipments into the connector to the effort around (2000-2500) volt This creates an electric field across the cell urges the electric field of charged particles positive in the detector cell, degrade atoms ^{222}Rn inside the cell and leave behind a positive charge ^{218}Po which affix to the detector, the nucleus ^{218}Po has a life half a relatively short and when decomposed will have the opportunity (50%) to enter the detector produces an electrical signal and energies of alpha particles [7]. RAD7 a radon- in- air monitor of DurrIDGE Company of USA was used for monitoring radon concentration in 38 water samples collected from 38 regions different locations within Hilla City and adjoining area using the RAD H2O technique [7]. The RAD H2O is an accessory to the RAD7 that measures radon in water with high accuracy, over a wide range of concentrations, capable of obtaining a reading for radon concentration in water within an hour of taking the sample [10].

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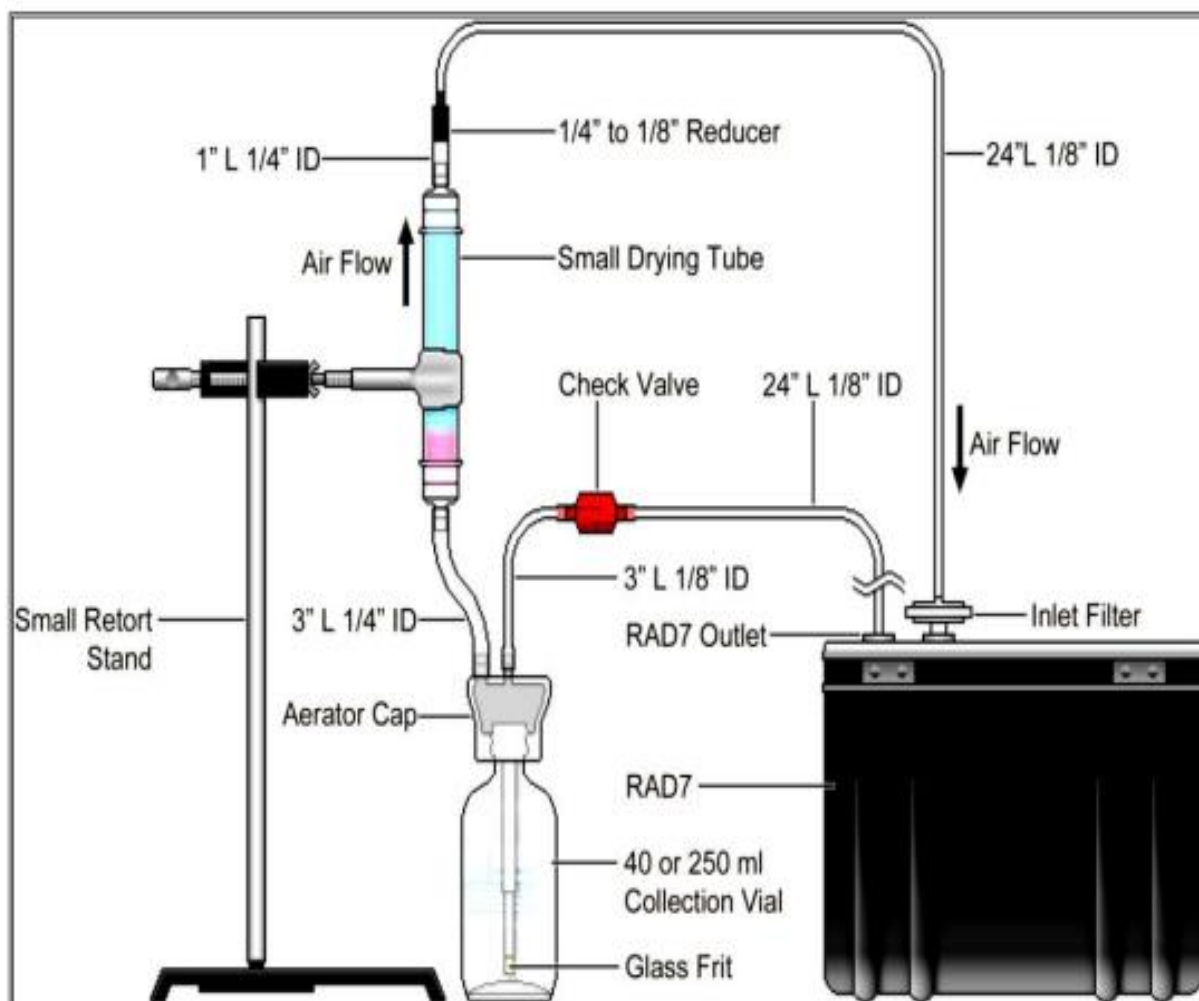


Fig. 1. Schematic presentations of radon-in-air monitor RAD7. Adapted from reference with permission [8].

The RAD H₂O makes use of standard, pre - set protocols, built into the RAD7, which furnish a direct reading of the radon concentration in the water sample, itself. The RAD7 detector has the capability to calculate the concentration of radon in water sample by multiplying the concentration of radon in

the air loop by a fixed conversion coefficient. For a 250 mL vial of water sample conversion coefficient of 4 has been derived from the volume of the air loop, the volume of the sample and the equilibrium radon distribution coefficient at room temperature.

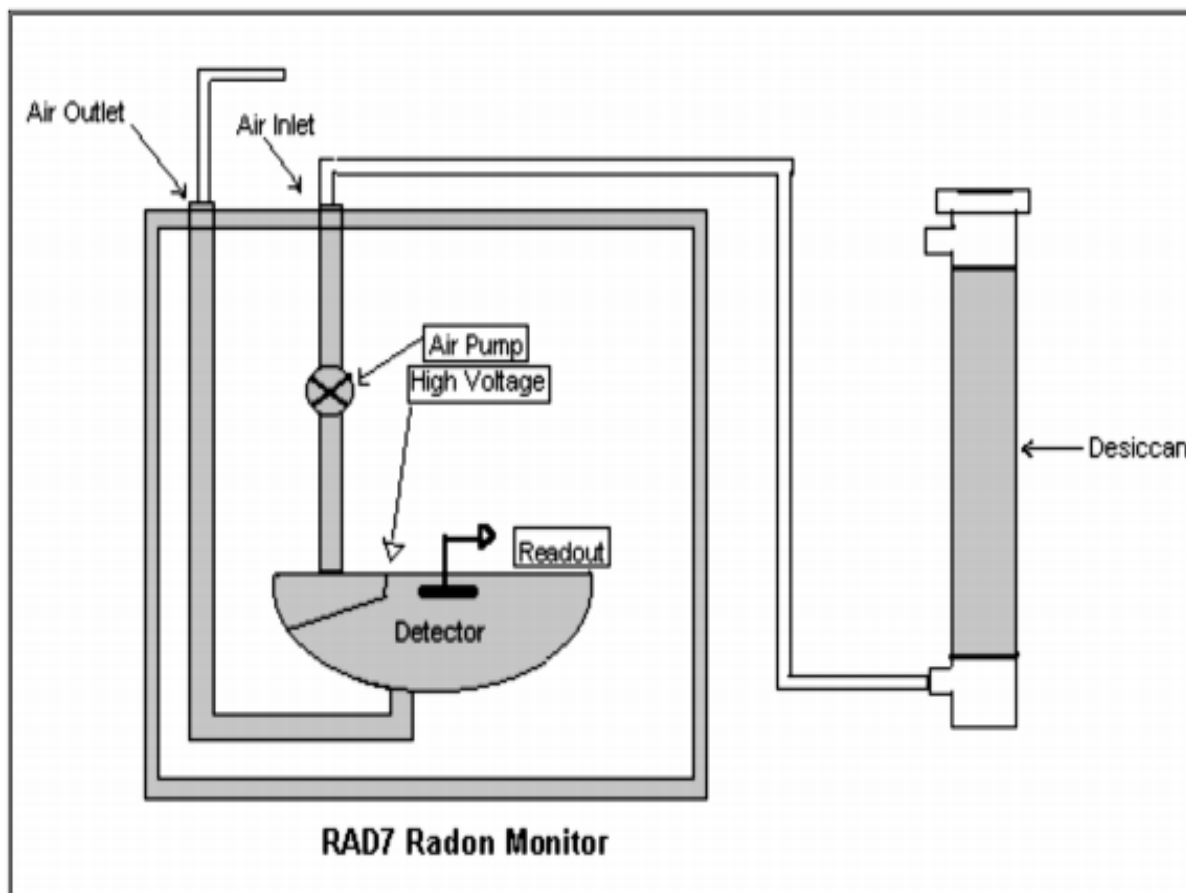


Figure 2. Scheme device RAD7 [9]

The method makes use of a closed loop aeration design in which the air volume and water volume are kept constant and are independent of the flow rate [7,8]. A water test in a pre - set Wet 250 protocol is normally completed in 30 min time. At the beginning of a test the inbuilt pump of RAD7 starts running automatically for 5 min duration, aerating the sample and delivering the degassed radon to the RAD7 measuring chamber. During the 5 min of aeration, more than 94% of the available radon is removed from the water. After 5 min operation the pump stops automatically and the system then wait for a further 5 min interval. After that the system then starts counting. After 5 min, the system prints out a short form report for a 5 min cycle [8,11]. The same thing happens again 5 min afterward, and for two more 5 min periods after that. At the end of the run (30 min after the start), the RAD7 prints out a summary, showing the average radon concentration in four counted cycles each of 5 min duration, a bar chart of

the four readings, and a cumulative spectrum. The radon concentration shown is that of the water, and is calculated automatically by the RAD7 [8,12].

Results and discussion:

Table (1) shows the results obtained in this study. Where (A) refers to the area, Mean represents the average value of concentration, High represents higher-value, Low represents less valuable and all measurements by (Bqreal / liter) Bq/L. To ensure the quality control and reliability of the sampling and measurement methods, Each sample was analyzed in 4 cycles where we calculated the mean of these 4 readings and finally we calculated the mean for the 5 samples' means.

Table (1) show there is difference in measurement results for water according to locations samples, Where the radon concentrations ranged from (0.33 to 1.2) Bq/L .

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Table 1. Samples measurements of sites in Najaf city.

| No. | Location Name | Radon concentrations (Bq/L) |
|-----|---------------|-----------------------------|
| 1 | Al-Ameer | 1.2 |
| 2 | Al-Adalla | 1.0 |
| 3 | Al-Forat | 0.9 |
| 4 | Al-Hussain | 0.67 |
| 5 | Old City | 0.33 |

The main Study finding points that all the readings for wells and springs were lower than the maximum contaminated level (MCL) of 11.1 Bq/L [14,15]. These generally low concentration levels of radon in water tap could be explained from the geological context of the surrounding rocks. Indeed and environmental conditions [16]. As there is no absolute safe value of radiation from radon on general public. Although there are few studies on radon level in the water in Iraq [17,18] no water radon level reference has been established and

therefore, there has been no specific safe limit value for radon until now in Iraq. Even in the neighbor countries, no standard safe level has been developed and they still depend on the U.S or European standard safe levels.

Conclusions

The concentration of radon ^{222}Rn in water samples under study in the city of Najaf reached 0.33 to 1.2 Bq/L, which it is lower than the maximum contaminated level (MCL) of 11.1 Bq/L.

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