

**Radiation scanning of radon gas ^{222}Rn on Imam Ali holly shrine
للعتبة العلوية المقدسه ^{222}Rn . اجراء مسح اشعاعي لغاز الرادون**

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Abstract:

In this study radon gas concentration ^{222}Rn was measured in air inside building of Imam Ali shrine, the researchers chose 15 locations inside holly shrine which is represent the radiation scanning in the whole regions by using a new technique called durrige rad7. The results shows that radon gas ^{222}Rn is in normal level and allowed by international measurements according to Environmental Production Agency (EPA), It is found that there is an inverse relation between relative humidity and concentration.

Key wards: Radon gas, concentration, Imam Ali holly shrine.

الخلاصة:

تم في هذه الدراسة قياس تركيز غاز الرادون ^{222}Rn في الهواء داخل المرافق التابعة للعتبة العلوية المقدسة ، وقد اختير 15 موقعا من الصحن الشريف وتمثل تلك المناطق مسح اشعاعي كامل لهذا الغاز في العتبة العلوية المقدسة باستخدام تقنية جديدة تسمى durrige rad7 , و تبين ان تركيز غاز الرادون ^{222}Rn ضمن المستوى الطبيعي والمسموح به عالميا حسب منظمة الحماية البيئية (EPA) . ووجد ان العلاقة عكسية بين نسبة الرطوبة ومعدل التركيز .

1. Introduction

Radon (^{222}Rn) is a naturally occurring radioactive gas formed in the decay chain of uranium (^{238}U), as shown in Figure 1. It is a noble gas and has a half-life of 3.82 days. Also formed in this series is radium (^{226}Ra), Both ^{226}Ra and ^{238}U can be found in certain types of rocks, such as granites, gneisses, phosphatic rocks ,Uranium and radium concentrations in soil and rock vary by geographical region[1,2] Maine has many areas where granites and other types of rock can be found having high concentrations of radium, with granites that have up to 25 ppm of uranium ^{238}U decays into ^{226}Ra , which in turn produces. ^{222}Rn can enter homes through cracks in floors, walls, or foundations, and collect indoors. It can also be released from building materials, or from water obtained from wells that contain radon. Radon levels can be higher in homes that are well insulated, tightly sealed, and/or built on soil rich in the elements uranium, thorium, and radium. Basement and first floors typically have the highest radon levels because of their closeness to the ground[3]. The ^{222}Rn is chemically inert, radon gas will percolate through the soil and be released into the atmosphere causing a concentration of radon in outside air[4]. However, because the radon is mixing with large amounts of outside air, the concentration is small. The United States Environmental Protection Agency (EPA) estimates that the average value of ^{222}Rn in outside air in the United States is 148 Bq/m^3 . Senbud and Gesell note that radon in outside air varies by region, time of year, and meteorological conditions, with a range of 82 Bq/m^3 to 110 Bq/m^3 as average in the United States [1,4] . ^{222}Rn is known to be a health hazard. One of the earliest indications of the health risk that ^{222}Rn poses, was found in the 1940's, when it was linked to lung cancer in uranium miner, According to the Environmental Protection Agency ^{222}Rn is the second leading cause of lung cancer in the United States, smoking being the first. As radon in air decays, its progeny stick to dust

particles in the air and other aerosols. When this air is inhaled, the progeny sticks to lung tissue and the radon will be partially absorbed by lung tissue. In successive decays of the radon and its progeny, energetic alpha particles are produced from the decay of the polonium daughters. The alpha particles penetrate the lung tissue resulting in a radiation dose [5, 6]. Cigarette smoking is the most common cause of lung cancer. Radon represents a far smaller risk for this disease, but it is the second leading cause of lung cancer in the United States. Scientists estimate that 15,000 to 22,000 lung cancer deaths in the United States each year are related to radon according to EPA [7]. Exposure to the combination of radon gas and cigarette smoke creates a greater risk of lung cancer than exposure to either factor alone. The majority of radon-related cancer deaths occur among smokers. However, it is estimated that more than 10 percent of radon-related cancer deaths occur among nonsmokers[8].

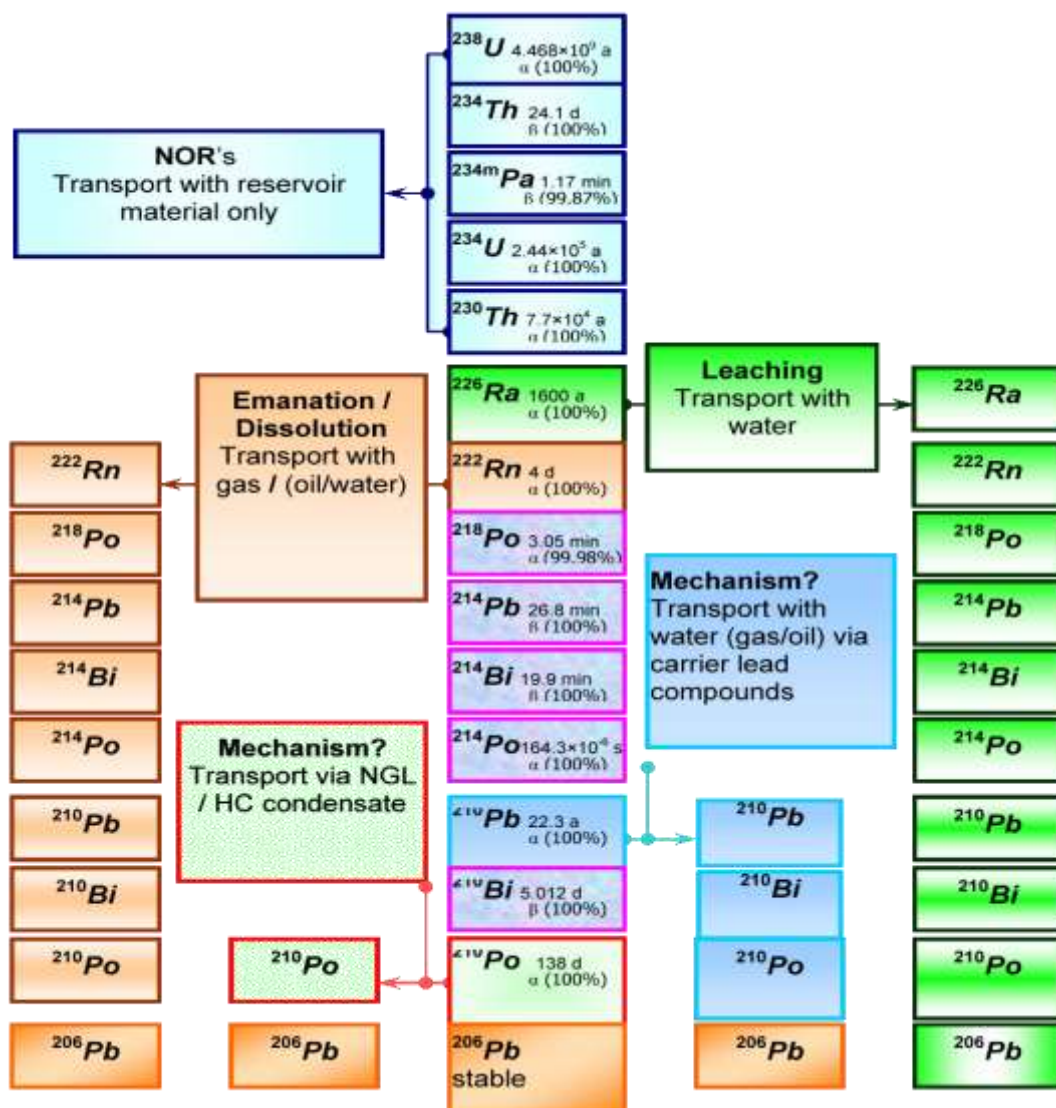


Fig.(1) Uranium decay chain.

2.Experimental Part

Imam Ali holly shrine located with geographical coordinates $31^\circ 59' 24''$ North $44^\circ 18' 56.83''$ East positioned center of Al-Najaf Al-Ashraf city, The present work aims to investigate indoor Radon levels in imam Ali holy shrine –Alnajf -Iraq. The study sites covered most part of the holly

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shrine, total of 15 places were tested by Durrige Company (USA) RAD 7 detector (model 711 ,serial 02610,vers2.5f 991128,printer). RAD7 detector converts alpha radiation directly to an electric signal and has the possibility of determining electronically the energy of each particle, which allows the identification of the isotopes (^{218}Po , ^{214}Po) produced by radiation, so it is possible to instantaneously distinguish between old and new radon, radon from Thoron, and signal from noise An average value of Radon Activity in Bq/m^3 was calculated for each sampling point. The measurements lasted for two week from 10^{nth} November, 2012 to 17^{nth} November, 2012, The detailed results are presented in tables [1] in which the average concentrations are calculated in units of $\text{Bq}\cdot\text{m}^{-3}$.

3. Result and Discussion:

table (1) shows the measurements varied from ($2.42\pm 2.74 \text{ Bq}/\text{m}^3$) in location 15 to ($20.7 \pm 13.7 \text{ Bq}/\text{m}^3$) in location 5 . The concentrations and rates for different study areas in unit ($\text{Bq}\cdot\text{m}^{-3}$).

From the comparison between the results one can observe the following points:

- The results from this study suggest that the radon concentration in Imam Ali holy shrine region lies within range $10.66 \pm 6.2 \text{ Bq}\cdot\text{m}^{-3}$ fig(2).
- No radon concentration dependency on height is observed in this study.
- The rooms insulation are very efficient (concrete floor) since the

radon concentration in the soil is high while those measured indoor are low.

- This result is within the limit set by the Environmental Protection Agency (EPA-USA) at $148 \text{ Bq}\cdot\text{m}^{-3}$.
- There are inverse relation found between radon concentrations and humidity

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Table (1) Radon concentration indoor of imam Ali holy shrine samples.

No. of location	Name of location	Radon concentration in (Bq.m ⁻³)		
		Min.	Max.	Mean
1	Maintenance of manuscript	5.53	19.4	12.4±9.78
2	Image of manuscript	8.29	11.1	9.67±1.95
3	Storage no.2	8.3	30.4	19.35±10.22
4	Store office	2.76	8.29	5.53±3.91
5	Luster Maintenance	11.1	30.4	20.7±13.7
6	Basement	2.77	30.4	14.9±9.91
7	Qarwya school	8.29	11.1	9.68±19.6
8	Security office	5.53	8.29	6.91±1.95
9	Alqebbla door	2.76	5.53	4.15±1.95
10	Management room	2.76	2.76	2.76±7.22
11	Head of maintenance	2.29	11.1	9.68±1.96
12	Cooling office	0.00	5.53	2.76±3.91
13	Cooling control	5.53	8.30	6.91±1.96
14	Library	19.4	19.4	19.4±0.00
15	Maintenance of trouser	2.7	8.29	5.49±6.22

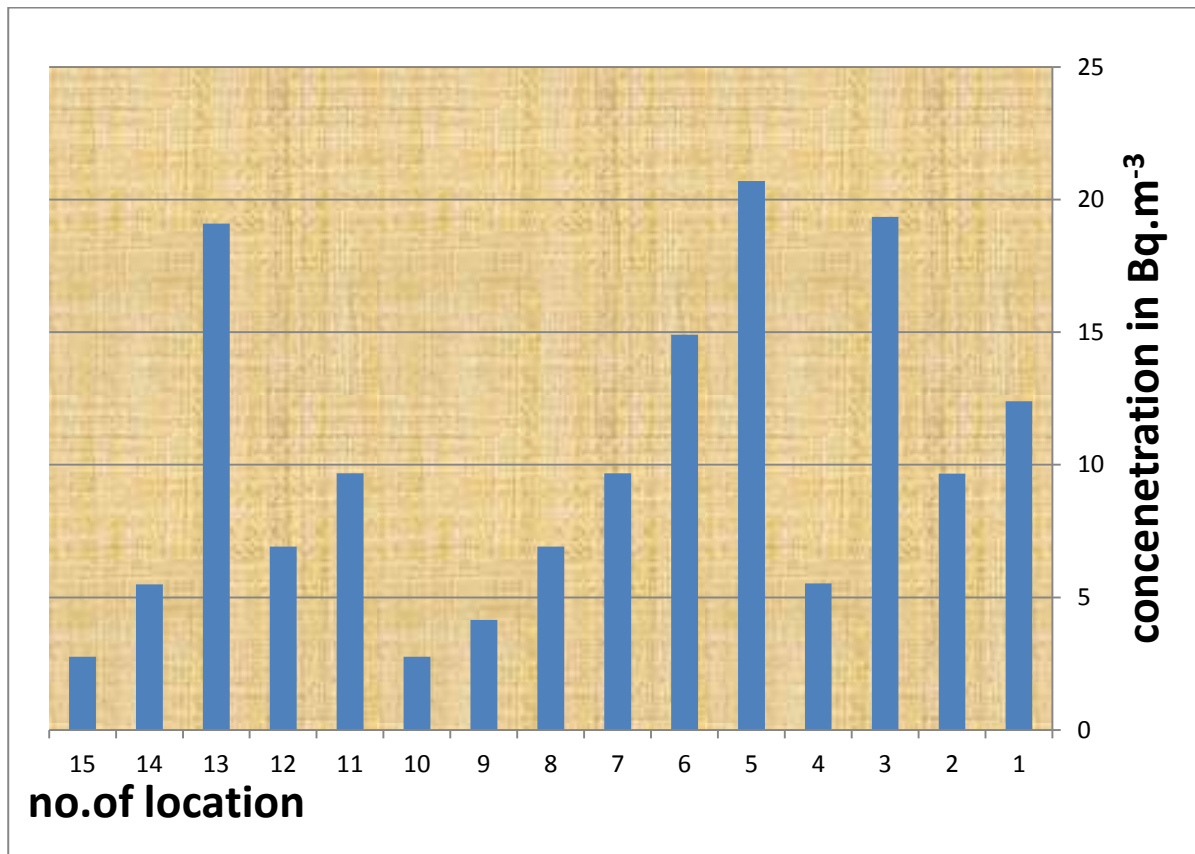


Fig. (2) Shows the average concentration of radon indoor of imam Ali holy shrine samples for study areas

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