

# Measurement Radon Gas Concentration in Selected Soil Samples of The of Al-Nada District in Najaf

ShahadFadel Kadim<sup>1</sup>, HeiyamNajy Hady<sup>2\*</sup>

<sup>1</sup>Department of Physics, Faculty of Education for Girls, Iraq.

<sup>2</sup>Department of Physics, Faculty of Education for Girls, Iraq.

## Abstract

In this study fifty (50) of soil samples of AL-Nada district-Najaf Governorate –Iraq have been collected randomly and studied using solid state nuclear track detectors (CR-39) to determined <sup>226</sup>Ra through counting the number of radon tracks by using CR-39 plastic nuclear track detector ,a long- term measurement technique has been considered using special tube of mean (2.5cm) diameter .The detector was placed at (5cm) height and irradiated for 90 days. The chemical etching performed by using (NaOH) solution of 6.25 normality at etching temperature (70C°)for etching period of (7 hrs ).Concentration of radon <sup>222</sup>Rn has ranged from (171.237±0.0062) Bq/m<sup>3</sup> to (31.982±0.0027) Bq/m<sup>3</sup>with average value (99.222±0.2476) Bq/m<sup>3</sup> while the specific activityof radon has been ranged from (0.471±1.794) Bq/kg to (0.090±7.682) Bq/kg with average value (0.277±1.320)Bq/kgThe results were found to be comparable or lower than similar global reporting data. Accordingly, this area of soil can be considered to have normal levels of natural background radiation.

**Keywords:** Soil, radon, concentration, (CR-39), AL-Nada district-Najaf Governorate.

## 1. Introduction

Radon is normal, unscented, dreary, scentless dormant gas that is lackluster difficult to identify our inclination. It is continually delivered by normally happening radionuclide's, for example, rot 238U, 235U, 232Th. The isotope 222Rn delivered by the rot of 238U is the primary source(approximately 55%) inward radiation presentation to human life[1] Radon from The characteristic rot of uranium found in all dirt. It as a rule moves upPass the breaks and different openings in the establishment into the quality of the house.[2] Everythingis fine Building materials contain distinctive measures of uranium fundamental common radionuclide's (238U) And Thorium (232Th) arrangement, and additionally potassium (40K) radioisotopes, thoseradionuclides are Wellsprings of outside and inner radiation presentation of the home. Radon (half-life3.824 d)It is a radioactive gas created by the deterioration of 226Ra, and 226Ra is a rot item of238U. The Inward breath of radioactive dormant gas radon (222Rn, a sub-result of 226Ra) and Thoron(220Rn, a sub-result of 224Ra, and the beneficiary's brief item may store on the respiratory tract Breathed in tissue. Resulting alpha rot may wreck cells close to the statement siteLead to an expanded danger of lung disease and furthermore help treat lung growth Malignanttumors(medical uses of sputum) [3,4] Thusly, building materials are viewed as our second real wellspring of plutoniumparticles, it produces pores Gas or liquid, at that point moves a long separation from the stone, soil or soil development sitesBuilding materials into the environment before radioactive rot in exhalationprocess [3,5,6] The expiratory rate gives a proportion of the arrival of helium from within the example Past the example. Its esteem relies upon the focus angle between the dissimilarity and the pores And encompassing air [3,7] Plastic locator CR-39 or LR-115 and Gamma spectrometer can be utilized for estimation The convergence of radon in the dirt [8,7] The motivation behind this work is to decide the grouping of radon in soil.

## 2. Experimental technical& calculation

In this work, the 50-Iraq map (1) of various soil samples in the AL-Nada-Najaf province was studied, which is 5 cm deep from the ground. The study area is located in Najaf and is divided into the first area. There is no camp in the Al-Nada community. In the region, 35 samples were collected from different places. The second part represents the camp area, 15 samples were randomly collected, then taken out in a clean plastic container, and the sample was dried in an oven at 50 ° C to obtain a net weight, and the diameter of the sieve was 1 mm to obtain the same size. Then remain free of moisture (30) minutes before radioactivity measurement in the oven to achieve a constant weight and avoid any moisture adsorption samples ready to use solids to measure radon concentration state nuclear track detectors (CR-39) to determined <sup>226</sup>Ra through counting the number of radon tracks by using CR-39 plastic nuclear track detector .

Measurements are taken after 30 days Achieve radiation balance. Lighthouse cover is Remove quickly to prevent outside air from entering and Change the atmosphere of the can. Nuclear detector Place CR-39 with dimensions 1cm<sup>2</sup> and 1mm thick In the middle of the cover and affix one tape the edge of the lid is taped and sealed Prevent cockroaches from leaking. Recorded CR -39 detector The existence andinfluence ofthegenerated alpha particlesDissolved from hernia the distance between The surface of thesampleand reagent is5cm and the sample The height of sample is2 cm, as shown in Figure(2),We applied long Terminology method for removing the previous90 days of exposure The reagents expose them to a chemical extraction procedure. Sample by They were dried at 50 ° C for 30 minutes to remove absorbed moisture and obtainactual drying weight then Place the sample in the container. Before use, the container is Wash with dilute hydrochloric acid and rinse with distilled water and assign codes specific to each individual sample. Remove the

detector and etch it in a 6.25N aqueous solution NaOH solution. The detector is placed in Pyrex and Connected to the wire. Put Pyrex in a water bath Follow the standard plan to keep them in the bath Hold at 70 ° C for 7 hours, rinse the detector with distilled water And allow to air dry instead of in a plastic box [9]. The trajectory records the influence of alpha particles By observing the surface of the CR-39 nuclear detector Use a new optical microscope to magnify 400 times as shown in Figure(2) .Radon concentration and effectiveness of selected soil samples shown in table (1) and figures (3&4) .

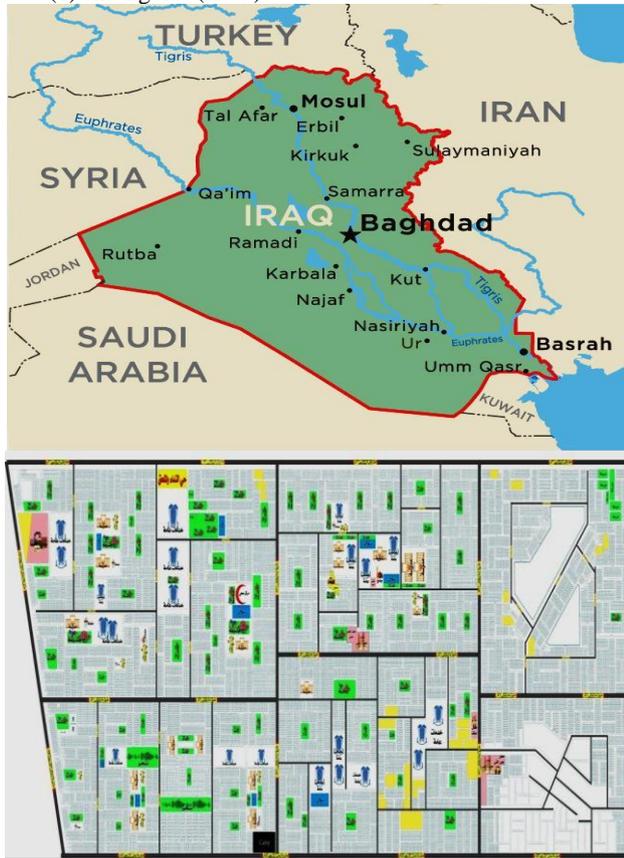


Figure 1: Iraq's & AL-Nada district-Najaf Governorate –Iraq map

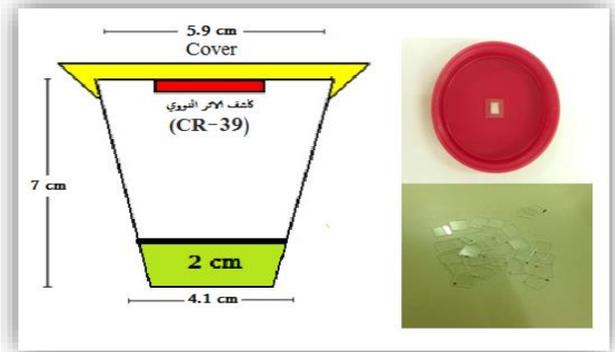
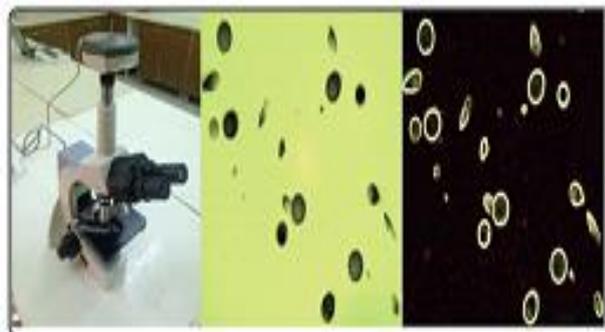


Figure 2: Schematic showing a plastic container CR-39 detector position and test samples

Table1: Radon Concentration and Effectiveness of Selected Soil Samples

Bq/kg	Bq/m <sup>3</sup>	Location Latitude(°E)Longitude(°N)	Sample code
0.227±1.170	87.654±0.0045	044 -18.164E 32 -03.238N	1
0.290±1.391	100.380.0048	E 044 -18.617 32 -03.434N	2
0.242±1.258	85.877±0.0044	044 -18.294E 32 -02.921N	3
0.349±1.511	123.7820.0053	044 -18.332E 32 -03.364N	4
0.337±1.500	116.675±0.0051	E 044 -18.517 N 32 -04.230	5
0.27±2.25	99.222±0.24	044 -17.727E 32 -04.076N	6
0.3054±1.427	105.718±0.0049	044 -18.816E 32 -04.090N	7
0.242±1.271	83.804±0.0044	044 -17.430E 32 -03.213N	8
0.301±1.388	108.976±0.0050	044 -18.055E 32 -04.014N	9
0.366±1.529	132.370±0.0055	044 -18.411E 32 -04.009N	10
0.299±1.447	99.203±0.0047	E 044 -17.666 N 32 -03.034	11
0.324±1.506	107.495±0.0049	044 -18.826E 32 -04.712N	12
0.090±7.682	31.982±0.0027	044 -17.792E 32 -03.053N	13
0.102±8.5506	36.246±0.0028	E 044 -18.842 32.05.929N	14
0.228±1.183	86.173±0.0044	044 -17.842E 32 -05.181N	15
0.225±1.201	81.620±0.0043	E 044 -18.191 32.05.491N	16
0.1867±1.092	67.517±0.0039	044 -18.539E 32 -05.745N	17
0.209±1.144	77.290±0.0042	044 -18.978E 32 -03.583N	18
0.246±1.229	92.984±0.0046	044 -18.167E 32 -03.727N	19
0.226±1.177	85.285±0.0044	E 044 -18.122 32 -04.825N	20
0.220±1.150	84.693±0.0044	044 -18.289E 32 -04.901N	21
0.3411.4315	131.185±0.0055	E 044 -18.386 32 -04.274N	22
0.1781.0456	67.221±0.0039	044 -18.318E 32 -04.040N	23
0.359±1.663	107.791±0.0049	E 044 -17.874 32 -04.177N	24
0.327±1.478	113.417±0.0051	044 -18.178E 32 -04.227N	25
0.287±1.289	115.1942±0.0051	044 -18.415E 32 -04.387N	26
0.351±1.482	129.705±0.0054	044 -18.764E 32 -04.371N	27
0.1847±1.110	63.964±0.0038	044 -18.576E 32 -04.072N	28
0.457±2.178	102.165±0.0048	044 -19.134E 32 -05.590N	29
0.271±1.345	93.873±0.0046	044 -18.924E 32 -03.754N	30
0.177±1.101	60.114±0.0037	0444 -19.051E 32 -03.691N	31
0.173±1.063	61.299±0.0037	044 -18.901E	32

			32-03.886N	
0.420±1.658	148.953±0.0058	044-19.154E	32-04.026N	33
0.221±9.819	117.563±0.0052	044-18.677E	32-03.975N	34
0.1251±8.192	53.895±0.0035	044-19.817E	N 32-04.670	35
0.222±1.245	73.440±0.0041	044-18.155E	N 32-04.255	36
0.253±1.300	87.654±0.0045	044-19.149E	32-04.255N	37
0.282±1.372	97.723±0.0047	044-19.144E	32-04.254N	38
0.1507±9.332	60.299±0.0037	044-18.18E	32-04.029N	39
0.385±1.478	157.245±0.0060	044-18.916E	32-04.035N	40
0.432±1.699	149.842±0.0058	044-18.912E	32-04.044N	41
0.428±1.572	171.237±0.0062	044-18.911E	32-04.046N	42
0.104±8.431	35.239±0.0028	044-18.870E	32-04.055N	43
0.4168±1.551	166.721±0.0062	044-18.905E	32-04.660N	44
0.189±1.1259	65.740±0.0038	E 044-18.912	32-04.069N	45
0.1983±1.1381	70.182±0.0040	044-18.913E	32-04.069N	46
0.401±1.672	132.370±0.0055	044-18.915E	32-04.180N	47
0.2987±1.339	114.898±0.0051	044-18.920E	32-04.085N	48
0.470±1.752	166.425±0.0062	044-18.921E	32-04.089N	49
0.471±1.7943	159.6143±0.0060	E 044-18.921	32-04.026N	50
0.277±1.320	99.222±0.2476		average	
0.471±1.7943	171.237±0.0062		Maximum	
0.090±7.682	31.982±0.00271		Minimum	
	400		[10] World Wide average	

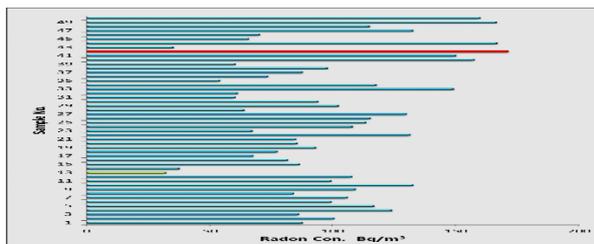


Figure 3: Concentration of radon gas in selected soil samples figure

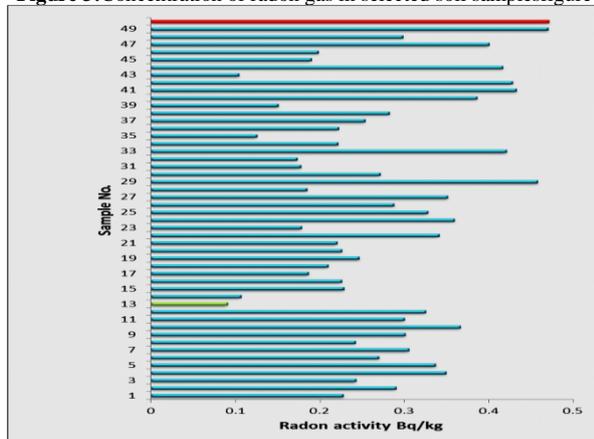


Figure 4: Effectiveness of radon gas in soil selected samples figure

### 3. Discussion

In the present study, solid state nuclear track detectors (CR-39) has been used to study (50) soil samples collected from AL-Nada district-Najaf Government –Iraq. After collecting the specific effectiveness and concentration of radon, the results were compared with the universal value. It was noted that:

- The highest concentration of radon <sup>222</sup>Rn in the sample air is  $(171.237 \pm 0.0062) \text{Bq/m}^3$ , which is the sample 42 and the lowest value is  $(31.982 \pm 0.0027) \text{Bq/m}^3$ . Values  $(99.222 \pm 0.2476) \text{Bq/m}^3$
- The highest value of the quality of the <sup>222</sup>Rn radon inside samples was  $(0.471 \pm 1.7943) \text{Bq/kg}$ , which is a sample of 50 and the lowest value was  $(0.090 \pm$

$7.682) \text{Bq/kg}$  in a sample number 13 which represents barren land and the average values were  $(0.277 \pm 1.320) \text{Bq/kg}$

- The radiation effectiveness of the studied models varies due to the geological nature of the studied area and the variation in population activity in terms of planting the parks, constructing the buildings, throwing the building waste and mixing it with the soil extensively.

### 4. Conclusion

The active concentration of radon is lower than the world average. The data provided can be used for comparisons in future surveys and can be used to develop radiographs of the area. The results can also be used as reference data for monitoring possible future radioactive contamination.

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