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THE USE OF THE NUCLEAR DETECTOR EFFECT (CR -39) IN DETERMINING THE CONCENTRATION OF RADON IN A SAMPLES OF THE NASIRIYA CITY SOIL SOUTH OF IRAQ

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ABSTRACT

The research aims at measure the concentration of radon in the soil using nuclear detector effect (CR-39). The researcher took samples of five areas of Nasiriyah city by connecting the traces of alpha particles emitted by radon gas with concentrations compared with the information in the regular geological samples.

The results indicate that the concentration of radon gas was uneven and exceeded the allowable limit and log the overall rate for five different regions in terms of location and nature. The record was (1386.236±24.0186) where the limit is exceeded the allowable exposure which shows radiation contamination of the by radon gas.

KEYWORDS: Radon Gas, Soil, The City of Nasiriyah, Impact of Nuclear detector (CR-39)

INTRODUCTION

Radon gas is one of the elements of the periodic table and is a noble gas and the radioactive atomic gas and a radioactive atomic number is (86)boiling point (-61.8Cº), freezing point (-71.0Cº) and density (9.73 $Kg.m^{-3}$), and it is produced by the decay of the natural radioactive uranium series, which starts with uranium U^{238}. It is found as gas in nature. It is one of the heaviest gases in the nature. It is colorless, odorless and spreads from the soil into the atmosphere by the spread of the molecular, It consists of three isotopes.

- Radon Rn^{222} which belongs to the series of (U^{238}) and this isotope of the longest- lived isotope of radon its half life is (3.825) day and this age gives it the ability to spread in the air, It is also emitter to alpha particle with the energy of (5-4) Mev.
- Al thoron it is isotope Rn^{220} which belongs to Th ^{232} greater potential for exposure to a series of half- life is approximately (55) seconds, it is also emitter alpha particle with the energy of (6-5) Mev.
- Actinon it is isotope to Rn ^{219} which belongs to the series U ^{235}. It is half-life 4 seconds. It is found a ratio very few, and it the lack of availability U ^{235}, It is also because of the short half- life. [1].

Uranium is a very widely distributed element in the earth's crust, It is presented naturally everywhere in soil, Sand and rock in various concentration from one place to another. Radon is considered to be one of the most dangerous radioactive element in the environment.

The radioactive materials undergo generally in a natural cycle through the main elements of the environment represented by the air, soil, and water transmitted normally to humans, animals and plants through several mechanisms,

different carrier media of radioactive materials differ in their physical and chemical properties and a matter which is reflected defending in the time of stay of radioactive material in the media and transmission to humans [2].

The importance of soil belongs to being the ultimate future of radioactive materials is considered as repository for radioactive materials and BFS time as the source of these materials in air and water pollution and plant.

The risk of radon gas is that it can spread to large areas in addition to turning into polonium which is an alpha- particle emitter for (3-8) day period. Then the radon gas precipitates on plants in houses a matter that great danger to the population cause of nature in these areas.

The Un (UNSCEAR, 1983) report about the sources radiation confirmed that radon represents 50 % of the total materials of human dose of radiation resulting from natural radiation of radon. Radon portability to move through air from one place to another without any obstruction.

Studies also showed that is low porosity soil particles are close to each other. And when the radon atom emits from the particle the reflected energy will bury it in another particle. Thus cannot escape easily, and when the porosity of soil is high, the possibility non- movement of the radon atoms in the particle will be greater and they spread to the roof easily [3].

The research aims to determine the concentration of radon in the soil of the city of Nasiriyah because they had been bombed during the war on Iraq since year 1991 – 2003 and determining the contaminated areas using the technique of counting the effects of nuclear.

Town of Nasiriyah lies in southern Iraq to the west of the Euphrates river, it is the center of the province of Dhi qar and confined between longitude 46º3′.46º1′ east longitude 46º2′ west. [4]

The detector of nuclear effect (CR – 39) is one of the polymeric sensitive detectors used to measure the concentrations of alpha particles which work to generate the narrow path to the damage of radiation called the hidden impact which has the ability of skim more than the rest of the general surface of the detector when placed in a solution of alkaline suitable for skimming like a solution of sodium hydroxide to show the effects. [3]

A can technique which used in this study based on the registration of alpha tracks from R^{222}on alpha sensitive track detector that was developed for uranium or radon exploration. The detector is exposed to the soil gas for a specific period of time. The alpha tracks are registered on the detector and the tracks density gives a measure of R^{222}concentration in the soil. As it is a very simple technique it can be implemented easily for field studies, Since they do not require electronic system [5].

The Aim of Research

The research focuses on the elements of radioactive contaminants in the environment specially radon gas in the soil which results from the spread of radioactive materials in the soil of the city of Nasiriyah because first: radiation activity and the fact that the city of Nasiriyah was bombed, second: the environmental neglecting and third: the population density of the region.

Materials and Methods of Work

The samples were taken from 5 areas within the city of Nasiriyah, then skimmed 5 cm of soil were skimmed.

The samples were kept in nylon bags and numbered. Then the samples were transferred examination, Conducting a description of the sample and determining the nature of the region.

Samples were prepared based on the contexts in the depended of the general company for geological Survey and Mining

- Homogenization of each sample and then fragmenting and taking about (12 gm) to represent the total sample and placed in closed plastic boxes.
- Leaving on the samples for 22 days for getting radiation balance.
- After 22 days replacing the lid of plastic box by another on which the detector is installed (CR- 39) by an area of (1 *1 cm^2) Also placed is paper a filter in front of the detector to block gas TH^{220} with the lid closed tightly in order that radon gas Rn ^{222} would not leak to the outside, Finally recording the effects of alpha particles resulting from the decay of radon during thirty days. [6]

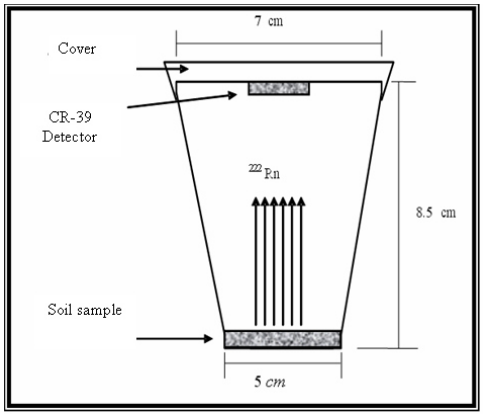

Figure 1: Radon Gas (222Rn) Estimation by Using (CR-39) Detector for Soil Sample [7]

- After the exposure time, the detectors were etched in a 6.25N aqueous solution of NaOH maintained at 60 ˚C for 5 hr, which was the normal employed etching time. The detectors were rinsed with distilled water and dried in air2 The track density was recorded using an optical microscope with (400x)[7].

  The density of the tracks (ρ) in the detectors, was calculated according to the following relation:

  $P_X = N_{ave} / A$

  Where

  ρ: Track density.

  N: Average of total tracks.

  A: Area of field view.

  Figure (2), according to the concentrations of radon models from the following relationship:

  $C_X / \rho_X = C_S / \rho_S$

  Where

C_S, C_X: radon exposure (Bq/m3) for standard and sample respectively.

ρ_S, ρ_X: track density (Trtack/mm2) for standard and sample respectively.

And $C_{X=} C_S \rho_X / \rho_S$

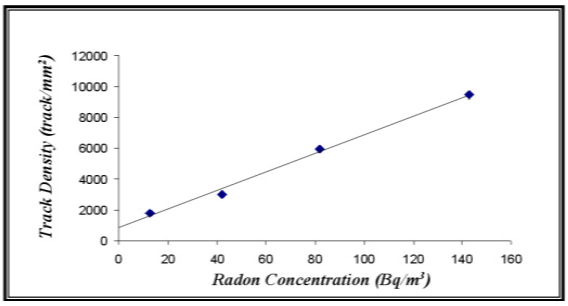

Figure 2: Shows this Relation, When (slope = ρ_S/ C_S). [7]

RESULTS AND DISCUSSIONS

The results of the study showed that the concentration of radon scored higher than the allowable limit in all samples of the soil of the city of Nasiriyah and recorded the lowest value in the AL-Eskan al-senaee sc (1143.36 Bq/ m^3) and the highest value in the AL-Askary city (1698.312 Bq / m^3)the despite differing areas of study between residential, The desert and the agricultural it is observed that the concentrations of radon rises in areas that were bombed in the Gulf war in 1991 – 2003. [8]

Table 1: Radon Concentration in Soil Samples

NO.	The Study Area	Average Concentration of Radon Gas Bq/m^3
1	AL-Askary city	*1698.312*
2	AL-Thowraa city	*1563.61*
3	AL-Sader city	*1327.953*
4	AL-Hussainat city	*1197.643*
5	AL-Eskan al-senaee	*1143.36*
The Overall Rate		*1386.23*

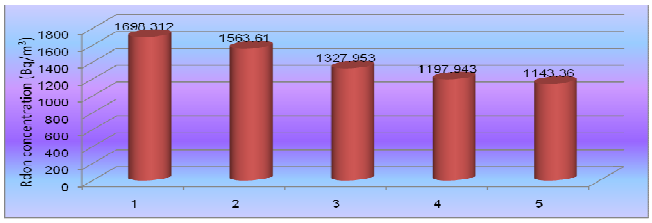

Figure 3: Shows the Average Concentration of Radon in Soil Samples for Study Areas

It is noticed that concentrations of radon decreased with increasing depth and the reason that radon gas emitted from the source rocks and the ratio of penetrating depends on depth in which the gas was formed and on the permeability of the ground to radon and usually leaks gas which is formed close to the earth, s surface in the depth of one meter of soil as it stems from the cracks and crevices of rock and through the pores of the soil to reach the surface of the soil. [9]

It is also noticed that the overall rate for the concentration of radon in the soil sample for the city of Nasiriyah has

exceeded the allowable limit of World Health Organization (800 Bq /m^3) which shows the region radiation contamination of radon gas. [10]

Table 2: A Comparison of the Results of Some Studies of Global and Local

NO.	Location	Radon Concentration Bq/m^3	Searcher and Year
1	Pakistan	*376*	Munazza et al (2008)[11]
2	Turkey	*3.4-138*	Muslim et al (2011)[12]
3	Southern Lebanon	*1774-291*	Kobeissi et al (2008)[14]
4	Baghdad	*7.11*	Bashaer (1998)[10]
5	Central and Northern Iraq	*33-100*	Donya (2000)[15]
6	Southern Iraq-Karma Bani said	*1146.227*	Mahsar (2009)[13]
	Southern Iraq-ALdarwisa station	*18329.47*	
7	Kut	*583.594*	Jabaar (2011)[16]
8	Nasiriayh	*1386.236*	The current study
9	Limit global	*800*	Who(1993)[17]

The table shows a comparison of the results of some global studies and local. The results of Bashaer (2008) recorded higher than, Munazza *et al* [11], Muslim *et al* (1998)[12], [10] Bashaer worked of in the soil of Pakistan, Turkey, Baghdad respectively, and approach to the record Mahsar of (2009) in the soil of southern Iraq – Karma Bani said in the province of Dhi qar [13], and less than the record in Koboissietal (2008)[14] and (2009) Mahsar in the soil of southern Lebanon, southern Iraq- Aldarwisa station in Dhi Qar.

CONCLUSIONS

- The appearing of a significant increasing in the concentrations of radon in soil samples belonging to the areas under study ranged from (1143.36-1698.312)Bq/m^3compared with the normal limit represented by back ground radiation (800Bq/m^3). This increase was high in the average of more than one and half of the normal limit, This is shown in the sample area (AL-Askary city) an obvious sing to an outbreak of apparent radiation contamination with in the province.
- The existence of regions were diagnosed cases of radioactive contamination by approved scientific methods is considered a source of threat for the population of these areas and the areas around them. The wind factor is the beast carrier for all types of pollution, if the area of the neighborhood was known to be suffering from deterioration of health aspect and the emergence of cancer and infertility since 1991. Till this day because of reminds of wars during that period. Thus, consideration should be taken to work the radiation contamination to avoid the recurrence of these case in the rest of areas.
- The detection of the existence of radon gas contamination refers to the existence of high rates of depleted uranium in the sites under study, this refers to the continuity of exposure to this polluter gas, especially if it is known the half –life of depleted uranium (source of radon) is 4.5 million years old.

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