Measurements of the natural radioactivity from Baghdad city soils using NaI (TI) detector

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Abstract. In the present investigation, twenty examples of soils were taken from numerous locales from Baghdad governorate. These samples were gathered from numerous spots. These examples were put away for one month under ordinary research center conditions. This time is important to get a radiological equilibrating to the examples, before tallying the movement of normal radioactive material for the examples. There are six radionuclides were showed up in soils tests: (Bi-214, Ra-226, TI-208, Bi-212, Pb-212, K-40), these radionuclides included; two radionuclides (Bi-214, Ra-226) have a place with the U-238 arrangement, three radionuclides (TI-208, Bi-212, Pb-212) have a place with Th-232 series and one is the common radionuclide K-40, the most minimal normal explicit exercises of the radionuclides in all examples utilizing NaI(TI) finder was TI-208 and equivalent to (0.735Bq/kg) however the most astounding explicit exercises of the radionuclides in all examples was K-40 and equivalent to (21.276 Bq/kg). The outside portion of the nature radioactivity for all Baghdad soils was 0.325 mSv.y-1 is very low contrasted and as far as possible1 mSv.y-1 UNSCEAR.

1. Introduction
Radiation can reveal the whole body (arrange presentation) or uncover tissue inside the body when taken in or ingested. Particular sorts of radiation change in their ability to hurt different kinds of tissue. [1] A wide scope of ionizing radiation can cause tumor and various effects. The essential refinement in the limit of alpha particles, beta particles, gamma-bars and x-bars to cause prosperity effects is the proportion of essentials they have, their imperativeness chooses how far they can penetrate into tissue, it also chooses how much imperativeness they can transmit director in an indirect manner to tissues and the resulting hurt [2]. The common damage coming about as a result of a given absorbed imperativeness may be exceptional one of a kind of different tissues, therefore, it is critical to measure the radiation with an instrument and after that make a translation of it into the response of tissue. Since different discoverers don't have a comparable capability or affectability for a wide scope of radiation and at all energies, there is no single instrument that can be used for alpha, beta and gamma [3].

The point of this examination is tallying the action of characteristic radioactive material for the dirt’s tests of the Baghdad governorate utilizing NaI (TI) finder.

2. Method and study design
The wake of social affair the precedents from a couple of regions of Baghdad city, they were taken to the exploration focus, to be evaluated. The majority of the tests were set in standard Marinelli estimating glass, weight and fixed and set away for one month before counting. To diminish the effect of establishment depends on the results, the locator was put on a low establishment with a lead shield. Going before the precedents estimation, the environmental gamma establishment at the exploration
office site had been settled with release Marinelli holder under indistinct estimation conditions. It had been subtracted later from the conscious gamma-pillar spectra of every model.

3. Collection of Samples
Twenty samples of soils were taken from numerous districts from Baghdad city, the cod of samples are appearing Table 1.

| Code of sample | region              |
|---------------|---------------------|
| A1            | Bayaa area          |
| A2            | Al-Huriya           |
| A3            | Baghdad aljadida    |
| A4            | Al-Amil District    |
| A5            | Yarmouk area        |
| A6            | Taji area           |
| A7            | Al-Washash area     |
| A8            | Dora area           |
| A9            | Talbieh area        |
| A10           | Abu Ghraib Area     |
| A11           | Al-Shaab            |
| A12           | Karrada area        |
| A13           | Jadriya area        |
| A14           | Mansour area        |
| A15           | Al-Jamaa district   |
| A16           | Al-shurta           |
| A17           | albaldeyat          |
| A18           | Harthy area         |
| A19           | Bab Al Ma'amam area |
| A20           | Bab-al-sharjee      |

4. Experimental details
The radiation survey called here an area review with the locator is held inside around 5cm of the outside of the domains. Soils tests were crushed and sieved, by then secured for one month to get a radiological equilibrating. (1kg) was taken from every model; these precedents were having a go at using NaI(Tl) identifier with checking time (3600 sec). The NaI(Tl) discoverer is shown up in Figure (1). NaI(Tl) finder is a touchy technique for investigation that can yield logical information for a few diverse radionuclides in a solitary example examination, which need to shield the identifier with reasonable material as appeared in Figure (2).

Gamma-shaft overflowing from a radionuclide commonly continued by the particles discharges from radioactive beta ruin (either β- or β+), and all over by alpha rot. The rot leaves the middle in either a ground or animated state [4]. On the off chance that the middle is in an enabled express, the ruin to ground state more often than not is developed by gamma discharge; focus may have a wide extent of vitality levels through which it must go before achieving a ground state strategy [5].
The intensity of the gamma radiation per unit time can be used to measure the measure of radionuclide molecule's that have experienced rot. The model had tallied at an obscure geometry from the standard point of reference and a dimension out productivity turn got. Each radionuclide produces gamma bars in any occasion one significance trademark to that nuclide [6].

5. Results
There are six radionuclides were had a go at using NaI(Tl) identifier, the particular exercises of Baghdad soils tests subsequent to subtracting the foundation are appeared Table (2).
Table 2. The particular exercises of Baghdad soils tests

| Code of sample | Bi-214 Bq/kg | Ra-226 Bq/kg | Tl-208 Bq/kg | Bi-212 Bq/kg | Pb-212 Bq/kg | K-40 Bq/kg |
|----------------|--------------|--------------|--------------|--------------|--------------|------------|
| A1             | 1.25         | 1.55         | 0.56         | 1.52         | 0.62         | 22.35      |
| A2             | 0.66         | 1.25         | 0.59         | 1.65         | 0.50         | 25.36      |
| A3             | 1.75         | 1.47         | 1.02         | 1.68         | 0.55         | 20.58      |
| A4             | 1.55         | 0.98         | 1.08         | 1.77         | 0.58         | 19.36      |
| A5             | 0.74         | 0.95         | 1.22         | 1.55         | 0.61         | 18.22      |
| A6             | 1.22         | 1.89         | 1.13         | 1.59         | 0.51         | 19.88      |
| A7             | 1.15         | 1.77         | 0.69         | 1.62         | 1.22         | 20.32      |
| A8             | 0.84         | 1.85         | 0.57         | 1.66         | 1.52         | 22.69      |
| A9             | 0.79         | 1.45         | 0.85         | 1.74         | 1.68         | 23.66      |
| A10            | 1.54         | 2.01         | 0.81         | 1.76         | 1.39         | 24.98      |
| A11            | 1.44         | 1.33         | 0.81         | 1.56         | 1.58         | 20.66      |
| A12            | 0.96         | 1.28         | 0.98         | 2.11         | 1.44         | 20.84      |
| A13            | 0.92         | 1.49         | 0.69         | 2.12         | 1.47         | 19.37      |
| A14            | 0.88         | 1.95         | 0.92         | 2.30         | 1.58         | 19.33      |
| A15            | 1.14         | 1.84         | 0.84         | 2.50         | 1.85         | 18.37      |
| A16            | 1.66         | 1.89         | 0.43         | 2.17         | 1.82         | 22.94      |
| A17            | 1.24         | 1.55         | 0.36         | 2.08         | 1.84         | 21.97      |
| A18            | 0.68         | 1.53         | 0.45         | 1.65         | 1.77         | 22.00      |
| A19            | 0.90         | 1.64         | 0.55         | 1.58         | 1.66         | 21.09      |
| A20            | 1.47         | 1.39         | 0.47         | 1.44         | 1.35         | 21.55      |
| Average        | 1.139        | 1.553        | 0.735        | 1.787        | 1.277        | 21.276     |

The particular exercises for Bi-214 in the examples are appearing in Figure (3).

![Figure 3. The particular exercises for Bi-214 in the samples](image)

The particular exercises for Ra-226 in the examples are appeared in Figure (4).
Figure 4. The particular exercises for Ra-226 in the samples

The particular exercises for Tl-208 in the examples are appeared in Figure (5).

Figure 5. The particular exercises for Tl-208 in the samples

The particular exercises for Bi-212 in the examples is appeared in Figure (6).

Figure 6. The particular exercises for Bi-212 in the samples
The particular exercises for Pb-212 in the examples is appeared in Figure (7)

![Figure 7. The particular exercises for Pb-212 in the samples](image)

The particular exercises for K-40 in the examples is appeared in Figure (8)

![Figure 8. The particular exercises for K-40 in the samples](image)

The midpoints of explicit exercises in the radionuclides in all Baghdad tests are appeared in Figure (9).

![Figure 9. The normal of movement in the radionuclides](image)
6. Discussion
In Figure (3), the least explicit exercises of Bi-214 was (0.66 Bq/kg) for the example (A2) while, the most elevated explicit exercises were (1.75 Bq/kg) for the example (A3), the normal was (1.139 Bq/kg). In Figure (4), the most minimal explicit exercises of Ra-226 was (0.95 Bq/kg) for the example (A5) while, the most astounding explicit exercises were (2.01 Bq/kg) for the example (A10), the normal was (1.553 Bq/kg). In Figure (5), the most minimal explicit exercises of Tl-208 was (0.36 Bq/kg) for the example (A17) while, the most astounding explicit exercises were (1.22 Bq/kg) for the example (A5), the normal was (0.735 Bq/kg). In Figure (6), the most minimal explicit exercises of Bi-212 was (1.44 Bq/kg) for the example (A20) while, the most astounding explicit exercises were (2.30 Bq/kg) for the example (A14), the normal was (1.787 Bq/kg). In Figure (7), the most minimal explicit exercises of Pb-212 was (0.5 Bq/kg) for the example (A2) while, the most elevated explicit exercises were (1.85 Bq/kg) for the example (A15), the normal was (1.277 Bq/kg). In Figure (8), the most minimal explicit exercises of K-40 was (18.22 Bq/kg) for the example (A5) while, the most elevated explicit exercises were (25.36 Bq/kg) for the example (A2), the normal was (21.276 Bq/kg). In Figure (9), the most reduced normal explicit exercises in every one of the examples were (Tl-208) and equivalent to (0.735 Bq/kg) yet the most astounding normal explicit exercises in all examples was (K-40) and equivalent to (21.276 Bq/kg).

The outside portion for all the radionuclides is estimated utilizing this equation.

\[ D (\mu Sv.h^{-1}) = 0.0007 (0.462CRa + 0.604CTh + 0.0417Ck) + 0.034 \]

\[ D = 0.325 mSv.y^{-1} \]

7. Conclusions
The external dose of the natural radioactivity of soils was (0.325 mSv.y-1), the soils samples are contained sand, and clay that comes from nature and air pollution such as smoke of cars, generators, refineries, and factories. The external doses of the natural radioactivity of soils are quite low compared with the allowed limit (1 mSv.y-1) UNSCEAR [8].

8. Recommendations
The presented study is a part of the long-term ongoing project on the health risk assessment of humans in the region. The collected data should provide a base for the human risk assessment as well as an estimate of the general pollution status of the environment in Iraq

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