plant that once provided tires for much of Iraq. The plant is currently active; Al-Diwaniyah is the headquarters of the Iraqi Army's 8th Division (Iraq).

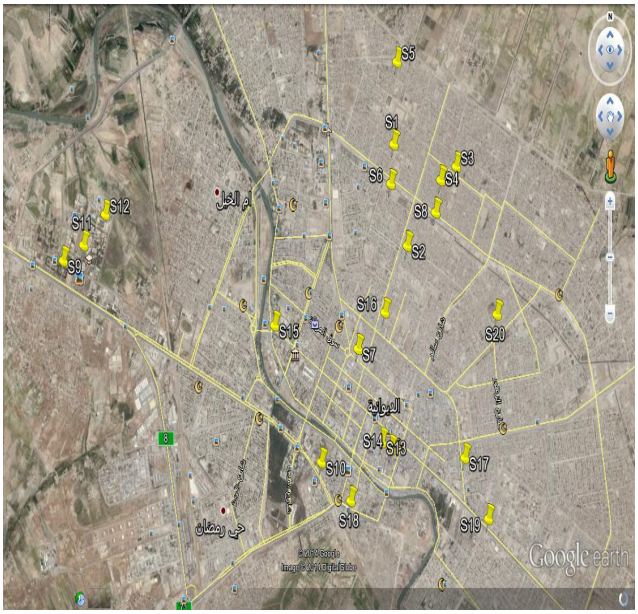

Figure 1: determine Location of sample in Diwaniya City by using GPS.

2.2 Sample Analyses

The soil samples measured at (5-20) cm depth level were collected from sampling points located at religious and historical places. The location of the samples is shown on table (1) and figure (1) after collection, samples are crushed into fine powder by grinder, and fine quality of the sample is obtained using scientific sieve. before measurement samples are dried in an oven at a temperature of 60 Cº for 72 h, each sample is packed and sealed in an airtight PVC container and kept for about (6) weeks period to allow radioactive equilibrium among. To measured the specific activity we used NaI(Tl) a system which consist of a scintillation detector NaI(Tl) of (3"×3") crystal dimension, supplied by (Alpha Spectra, (Inc), and measured Heavy metals (HMs) by Flame Atomic Absorption Spectrophotometer 6300AA - Shimadzu, Japan. and measured The Hydrogen Ion Concentration (pH), Salinity (Sal)by Multi meter, Digital Inolab 720, WTW – Germany, Electrical Conductivity (EC)by E.C.-meter, Digital multi meter Model 340i/SET, WTW – Germany, of soil samples.

The specific activity of each radionuclide is calculated using the following equation [9].

$$A = \frac{N_{net}}{\varepsilon . I_{\gamma} . m . t} \pm \frac{\sqrt{N_{net}}}{\varepsilon . I_{\gamma} . m . t} [Bq.kg^{-1}] \quad \ldots\ldots\ldots (1)$$

Where N_{net} is the net count (area under the specified energy peak after back ground subtraction) in (c/s), $\sqrt{N_{net}}$ is the random error in (c/s), ε is the efficiency of the detector, Iγ is the transition probability of the emitted gamma ray, t is the time (in sec)for spectrum collected and m is the sample weight (in kg).

3. Result and Discussion

3.1 Specific Activity

The specific activity values of 238U, 232Th and 40K radionuclide s for 20 soil sample are tabulated in table (1) and Figure (2). It has been found to lie in the range of (6.80 ± 1.98;S4 to 35.57 ± 4.31;S5) Bq/kg with an average of 21.97 ± 3.30 Bq/kg, from (5.29 ± 1.87;S20 to 39.68 ± 5.12;S16) Bq/kg with an average 22.78 ± 3.75Bq/kg and (103.14 ± 4.73;S14 to 162.64 ± 5.94;S13) Bq/kg with an average 127.12 ± 3.56 Bq/kg for 238U, 232Th and 40K respectively. The result shows that all values of 238U, and 40K specific activity for all soil sample are in the worldwide average (35Bq/kg for 238U, 30 Bq/kg for 232Th and 400 Bq/kg for 40K) [10]. But 232Th is slightly higher than the limit because of the global nature of the soil Jalogih.

The radium equivalent activities was calculated and listed in table (1).Ra eq values vary from (26.71 ± 3.72;S20 to 91.63 ± 11.23;S16) Bq/ kg with average value of (64.33 ± 8.94) Bq/kg. It can seen be that the Ra eq values for all samples are lower than the recommended value 370 Bq/ kg[11]. Gamma Dose Rate (D) range from (12.89 ± 2.23;S40 to 42.79 ± 4.92;S16) nGy/h with average (20.691) nGy/h. the Indoor Annual Effective Dose rang are from (0.0632±0.0109;S40 to 0.2099±0.0241;S16)(mSv/y) with average 0.1468±0.0198 (mSv/y)and Outdoor Annual Effective Dose rang are from (0.01581±0.0027;S40 to 0.05248±0.0060;S16)(mSv/y) with average 0.0367±0.0049 (mSv/y) all the soil samples have the annual effective dose less than the world average [17, 18], Representative level index (Iγr) range from (0.198945;S20 to 0.654073;S16) with average 0.458991, External hazard index (Hex) range from (0.072169;S20 to 0.247468;S16) with average 0.173759 and Internal hazard index (Hin) range from (0.019677;S20 to 0.042002;S16) with average 0.033098. External and internal hazard and gamma activity concentration were lower than unity according to the Radiation Protection 112 [10] as shown in Table (2).

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3.2 Heavy Metals

The study also measure the rate of the concentrations of heavy metals using Atomic Absorption Flame (AAS), including (Zn, Cr, Cd, Co, Cu, Mn, Pb) study showed that the concentration of lead ranged from (2.33 ;S15 to 24.23;S5), and the rate of in total (8.71)ppm. The cadmium concentration of (0.25) ;S4 to 9.78 ;S3) and the average of the year amounted (3.34)ppm, and the concentration of manganese (29.39;S8 to 877.07;S10)ppm and the rate of the year amounted (403.96)ppm, and the concentration of chromium from (6.98;S11 to 76.2;S10) ppm and the average of the year amounted (27.83) ppm, and the concentration of

zinc from (17.9;S5 to 161;S10) ppm and the average of the year amounted (88.76)ppm, and the concentration of cobalt from (3.2 ;S17 to 25.6 ;S9) ppm and the average of the year amounted (36.31) ppm, The concentration of copper (10.37;S9 to 82.03;S14) ppm and the rate reached in (57.64) ppm, As shown in Table(3) and Figure (3). Compared with the global determinants found that most of the concentrations of these elements of the models studied exceeds these limits, except element manganese concentrations were models are within the permissible limits[12].

3.3 Physicochemical Parameters

The study also included measurement of some physicochemical properties of the soil, the function of the hydrogen (pH), which values ranging from (6.78; S18 to 7.55; 18) and the rate reached in (7.11). and electrical conductivity EC values ranging from (3.16;S15 to 8.97;S17) dS / m and the average of the year amounted to (5.92) dS / m. and salinity which values ranging between (1.5 ;S9 to 7.6 ;S17) mM / Cm and the average of the year amounted to (3.98) mM / Cm, As shown in Table(3) and Figure (4) comparing the results of the analyzes physiochemical models studied with the World Health Organization found to be within the limits recommended by the World Health Organization[13, 14].

3.4 Figures and Tables

Table 1: Concentrations of Specific activity, Radium equivalent and Gamma Dose for samples.

Gamma Dose Rate ($nGy.h^{-1}$)	Radium equivalent (Bq/Kg)	(Bq/Kg) Specific activity			S.No.
		^{232}Th	^{238}U	^{40}K	
29.92 ± 4.04	64.33 ± 8.94	22.78 ± 3.75	21.97 ± 3.30	127.12 ± 3.56	Average
42.79 ± 4.92	91.63 ± 11.23	39.68 ± 5.12	35.57 ± 4.31	162.64 ± 5.94	Max.
12.89 ± 2.23	26.71 ± 3.72	5.29 ± 1.87	6.80 ± 1.98	103.14 ± 4.73	Min.

Table 2: Concentrations of Indoor and Outdoor Effective dose rate, Internal and External Hazard Index, Representative level index for samples.

Representative level index (Iyr)	Hazard Index		Effective dose rate $mSv.yr^{-1}$		S.No
	≤Internal (H_{in} 1)	External (H_{ex}≤1)	(Indoor)	(Outdoor)	
0.458991	0.033098	0.173759	0.1468±0.019	0.0367±0.0049	Averag
0.654073	0.042002	0.247468	0.2099±0.024	0.05248±0.006	Max.
0.198945	0.019677	0.072169	0.0632±0.010	0.01581±0.002	Min.

Table 3: Status of physiochemical parameters and heavy metals in soil samples

Parameters	Average	Max.	Min.
Cr(ppm)	27.83	76.2	6.98
Zn(ppm)	88.76	161.57	17.9
Co(ppm)	12.47	25.6	3.2
Cu(ppm)	36.31	82.03	10.37
Cd(ppm)	3.34	9.87	0.25
Pb(ppm)	8.71	24.23	2.33
Mn(ppm)	403.96	877.07	29.39
Sal(Mm/cm)	3.98	7.6	1.5
E.C.(ds/m)	5.92	8.97	3.16
pH	7.11	7.55	6.78

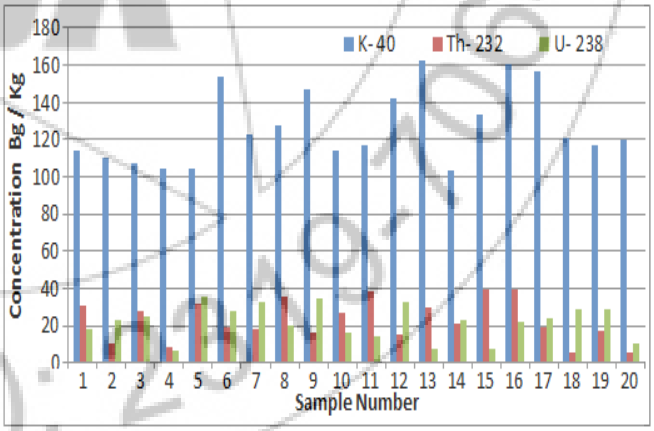

Figure 2: Concentrations of radionuclide for each sample

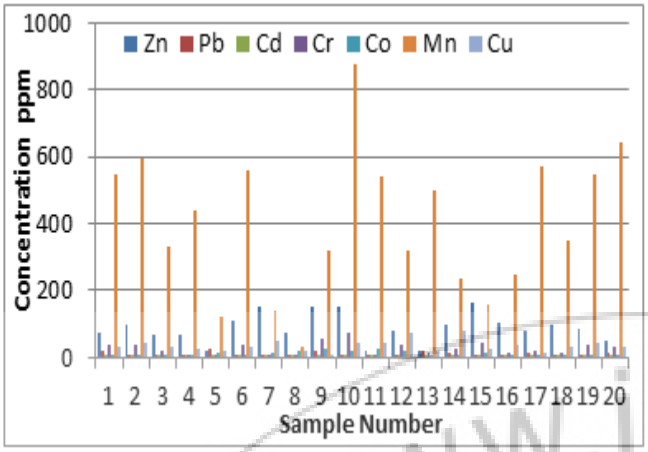

Figure 3: Concentrations of heavy metals in soil samples

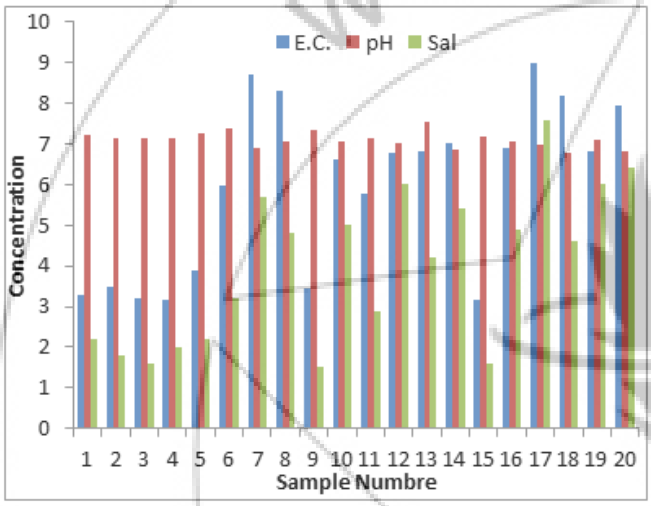

Figure 4: Concentrations of physiochemical parameters in soil samples

4. Conclusions

(1)The activity concentrations of 238U, 232Th and 40K for (20) soil sample from the City of Diwaniya. The activity concentrations were measured using Na (Tl) detection. The value of the Radium equivalent activity and annual effective dose was less than the world average. External and internal hazard and gamma activity concentration (representative level index) indexes were lower than unity.(2) Physiochemical properties than limits recommended WHO guideline values, these refer to inefficiency for drinking water. (3) Concentration of some toxic HMs such as Cr, Cu, Zn, Co, Cd and Pb were higher the maximum permissible levels recommended by world health organization (WHO) for the soil.

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