Journal of Basic and Environmental Sciences 3 (2016) 75– 84 **ISSN 2356-6388**

Research Article *Open Access*

Occupational radiation dose estimation over radioactive waste of phosphoric acid purification and ore products projects

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Received; 4 May. 2016, In Revised form; 27 Jun. 2016, Accepted; 27 Jun. 2016, Available online; 1 July 2016.

ABSTRACT

Radioactive materials concentration of four studied waste samples resulted from Phosphoric acid purification project and ore products project were measured using gamma ray spectrometry (high purity germanium-HPGe detector). These concentrations were measured for U- 238 in range of (471.6-5.8×10^3) Bq/kg [(38.02-469.6) ppm] , Th-232 ranged between (34-1.33×10^3) Bq/kg [(8.4-326.9)ppm] Ra-226 (227-8346) Bq/kg [(18.4-699.1) ppm] and K-40 (263-1156) Bq/kg [(0.8-3.7) ppm].Measurement of radon daughter and uranium concentration in air consider by work level (WL) at indoor site for phosphoric acid purification and ore products projects equal 0.012 and 6.48×10^{-3} WL respectively. Also it observed that there is no uranium concentration in air. Although the U-238, Th-232 and Ra-226 concentration were higher than the recommended concentration for terrestrial radionuclide in waste samples but also the annual effective doses for workers were in the acceptable dose limit because the methods used for treatment and leaching process lead to separation the most of radioactive material.

Keywords: *Radioactive waste; HPGe detector; Absorbed dose; Annual effective dose*.

1. Introduction

The trend to deal with the naturally occurring radioactive material (NORM) in industry and mining increased recently with the urgent need to get the economic material. Chemical extraction activities that exploit these resources may lead to generate technologically enhanced naturally occurring radioactive material (TE-NORM). Uncontrolled activities associated with TE-NORM can contaminate the environment and pose a radiation risk to workers health. This risk can be reduced by the control on the TE- NORM storage places and cleaning the TE-NORM contaminated equipment and applied an adequate occupational radiation protection program. In Nuclear Material Authority (NMA) there are two projects deals with TE- NORM, the first is phosphoric acid purification project and the second is ore products project. The first project work in purification of phosphoric acid produced by Abo-Zaable company where the acid is treated with Ca-bentonite for removal the organic matter and clarification of the treated acid from the suspended solid and phosphogypsum which include uranium. While the second project deal with leaching of uranium from its ores using mineral acid such as sulfuric acid (H_2SO_4), nitric acid (HNO_3) and hydrochloric acid (HCl) where the secondary uranium minerals are easily dissolves while the primary uranium minerals e.g. zircon ,apatite, monazite and sphene not affected by these mineral acids and remain in the waste.

In most wet process phosphoric acid production, only about 80% of the uranium content is dissolved in the acid, while the remaining 20% is involved in the gypsum waste [1]. Phosphate rocks contain the decay products of uranium of which radium is the most risk because of its long half-life time of about 1600 year .The problem with radium is disintegration to give radon gas which has a short half-life of 3.8 days and this disintegration to yield radioactive polonium which is a solid [2]. Some leaching process of ore products contains economic rare earth elements [3]. The

radioactive elements are being redistributed within the environment via fertilizer products and related production processes and may present radiological and toxic risks to human health and the environment [4]. Phosphoric acid pretreatment is a very important process before the recovery of uranium because of the presence of humic matter and suspended solids in the acid. The majority of these humic matter and suspended solids removed using clay treatment and passing the acid through activated carbon [5].

The leaching process of ore products depend upon physical and chemical conditions such as temperature, time, particle size and chemical solution concentration. The presence uranium and thorium in the refractory minerals (heavy) as zircon ,apatite , monazite and sphene which not affected by different mineral acids during leaching process of uranium causing accumulation of uranium and thorium in the waste samples produced from the ore products projects. So that occupational workers with this industrial material exposed to ionizing radiation hazard.

The present work aimed to investigate and measure the radioactivity in TE-NORM samples from phosphoric acid purification project waste and ore products project wastes to estimate the external and internal occupational radiation doses through measuring the activity concentrations of U-238, Th-232, Ra-226 and K-40.

2. Materials and methods

2.1. Radioactivity concentration measurements

The investigated samples were assembled from phosphoric acid purification project and ore products project in Inshas site .Samples were selected representative for the average exposure to project workers. In order to determine the concentration of radioactive materials (U-238, Th-232 and k-40) suitable amount of the solid waste samples were dried at 110^{o}C, to remove the humidity content. The dried waste samples were milled, soften and mechanically crushed, and sieved. The samples were homogenized and ground to fine particles less than 63 μm.300 gm of each waste sample put in a covered plastic cup. The samples were kept for at least three weeks before the measurement to reach secular equilibrium between thorium and radium and their decay products then the sample were subjected to gamma ray spectrometric analysis. The U-238, Th-232 and k-40 concentrations in samples were determined directly using High Purity Germanium (HPGe) detector. All concentrations are given in Bq/kg and ppm for samples.

2.2. Measurement of radon daughter and uranium concentration in air:-

2.2.1. Roll method

Radon is a cancer-causing radioactive gas produced by the natural decay of uranium in rocks and soils. Among ionizations radiation sources and natural radiation sources radon contributes the largest parentage to total average annual effective dose equivalent to occupational radiation worker inside the work site. Radon daughter measured inside the work site by Roll method [6].Air is sampled on a glass fiber filter paper for five minutes and after a delay period of (7.5 min.) the filter paper putted in the alpha counter to be counted. This obtained count number will be used to calculate data in working level. The working level was calculated by a simple formula involving count rate, detector efficiency, sample volume and a conversion factor. Counting was performed at the workplace.

The work level (WL) is calculated by equation (1) [6]:

$$WL = \frac{R}{EVTF}$$

Where

R = count rate at T minutes from the end of sampling (in counts/min)

E = counting efficiency, decimal fraction

V = volumetric sampling rate in L/min

T= sampling time in minutes

F = factor corresponding to the delay period, T

2.2.2. Measurement the airborne dust contamination

For measurements of ore dust, sample volumes of up to several cubic meters of air may be required. Air is sampled on a high-efficiency filter at a combination of flow rate from (10 L/min) and time from (10 min) depending on the desired sensitivity. The concentration of uranium in air is calculated by the following equation (2): [6]

$$\text{Dust} = \frac{R \times 2.2 \times 10^{-7}}{E \times V \times T} \quad (2)$$

Dust = uranium air concentration in $\mu Ci/cm^3$

R = alpha count rate in counts/min

E = counting efficiency

v = volumetric sampling rate in 1/min

T = sampling time in minutes

3. Calculation of the absorbed dose rate and annual effective dose equivalent:-

The contribution of natural radionuclide to the absorbed dose rate in air (D) depends on the natural specific activity concentration of U-238, Th -232 and K-40. If a radionuclide activity is known so its exposure dose rate in air at 1m above the ground can be calculated using the following three formula proposed by [7], [8]

$$\text{The dose rate}(nGy\ h^{-1}) = 0.427\ U\text{-}238 + 0.667\ Th\text{-}232 + 0.043\ K\% \quad (3)$$

$$\text{The dose rate } (nGyh^{-1}) = 5.476\ U\ (ppm) + 2.494\ Th\ (ppm) + 13.078\ K\% \quad (4)$$

$$\text{The exposure rate } (\mu R/h) = 0.653U\ (ppm) + 0.287Th\ (ppm) + 1.505\ K\% \quad (5)$$

The absorbed dose rate (nGy/h) in air at 1m above the ground determined at each location does not directly give the radiological hazard to which an individual is exposed. There are two additional factors that must be considered. The first is a factor which converts Gy to Sv that accounts for the biological effectiveness of the dose in causing damage in human tissue. The second is the occupancy factor that specifies the proportion of the total time spent outdoors [8]recommended 0.7 Sv Gy^{-1} for the conversion coefficient from absorbed dose in air to effective dose received by adults and 0.2 the fraction of time spent outdoors. Also annual effective dose is a useful concept that enables the radiation doses from different radionuclides and from different types and sources of radioactivity to be added. It is based on the risks of radiation induced health effects which the annual effective dose rate of (mSv/y) can be calculated using the following relations [8].

Annual effective dose equivalent= absorbed dose rate in air ×dose conversion factor × outdoor occupancy factor × time

$$E_{eff} = D \times 2000 \times 0.7 \times \frac{10^{3}\, mSv}{10^{9}\, nGy} \times 0.2$$

A dose conversion factor (DCF) of 0.7 μSv/Gy and outdoor occupancy factor (OF) of 0.2 and were used as recommended by the [14], and T is the time (2000 h /y).

2.3. The radium equivalent activity

The combined specific activity of Ra-226, Th-232, and K-40 develop a numerical indicator of an external dose of publicity. Suggested the equation to calculate radium equivalent and stated the value of 370 Bq/kg as the maximum allowed dose occupants [9].

$$\text{Ra-eq} = A_{Ra} + 1.43\, A_{Th} + 0.077\, A_K \leq 370 \quad (7)$$

Where, A_{Ra}, A_{Th} and A_K are the specific activities of Ra-226, Th-232 and K-40, in Bq/kg, respectively.

2.3.1 External hazard

The external hazard index (H_{ex}) was measured through the emitted gamma radiation which considered harm human health [10].It was calculated by the equation from (8)

$$H_{ex} = A_{Ra}/370 + A_{Th}/259 + A_K /4810 \leq 1 \quad (8)$$

Where H_{ex} is the external hazard index and A_{Ra}, A_{Th} and A_K are the specific activity of Ra-226, Th-232 and K-40, in Bq/kg, respectively .

2.3.2. Internal hazard

In addition to external hazard index, radon and its short-lived products are also hazardous to the respiratory organs. So, the internal radon and its daughter products are quantified by the internal hazard (H_{in}) given by [11], [12]

$$H_{in} = A_{Ra}/185 + A_{Th}/259 + A_K /4810 \leq 1 \quad (9)$$

Where, A_{Ra}, A_{Th} and A_K are the specific activities of Ra-226, Th-232 and K-40, in Bq/kg, respectively.

2.4. Determination of intake

When radioactive aerosols are inhaled, parts of the respiratory system are irradiated both by radiations originating from the lungs and as a result of translocation of the inhaled material to body tissue from the respiratory system. It is recognized that after inhalation of radioactive aerosols the doses received by various regions of the respiratory system will differ widely, depending on the size distribution of the inhaled material. The potential alpha energy of an atom of radon -222 is the total alpha energy emitted during the decay of the atom to stable Pb-210. The potential alpha energy exposure of workers is often expressed in the historical unit Working Level Month (WLM). [13].

The equivalent system international unit is the mJh m^{-3}. The conversion is as follows:

1 WL = 2.10 x 10^{-5} joules.m^{-3}
1 WLM = 3.54 mJh m^{-3}
1 mJh m^{-3} = 0.282 WLM
Annual limit on intake (ALI) for radon daughters (for occupational radiation workers) 0.02 joules.
Breathing rate = 0.02 m^3 per minute = 0.02 x 60 m^3 per hour = 1.2 m^3 per hour.
The volume of the breathed air in a year is equivalent to 0.02 x 60 x 2000 = 2,400 m^3

Derived air concentration (DAC) = $\frac{ALI}{V}$ (10)

V:is the volume of the inhaled air during working hours.
The unit of the Derived Air Concentration is Bq/m^3.
When the inhalation rate of a person engaged in light work is about 1.2 m^3/hour, the value obtained for V is approximately 2400 m^3.
DAC = 8.3 micro joules per cubic meter
But 1 WL = 2.10 x 10^{-5} joules m^{-3}
DAC = 0.4 WL
Annual Exposure Limit is the concept of the annual limit on exposure, meaning the exposure to airborne radionuclide, specified at time integral of the concentration which may cause a reference man to inhale the annual limit on intake (ALI) for that particular radionuclide [13].
Annual Exposure Limit (AEL) = 0.017 J.j.m^{-3} (5 WLM).

2.4.1. Assessment of internal radiation dose:-

Committed Effective Dose = E.R.F (11)

Where E = occupational radiation work exposure (i.e. mean airborne radioactivity concentration x hours worked) in $Bq.h.m^{-3}$.

R = breathing rate in $m^3 h^{-1}$.

F = dose conversion factor in mSv Bq^{-1} or mSv/ α dps^{-1}.

Note: E.R = Annual intake in Bq.

Airborne contamination leads to hazard occupational radiation worker

3. Results and discussion

The waste samples which analyses by High Purity Germanium (HPGe) detector are given by table (1) and (2), while figure (1) shows the activity concentration of U-238, Th-232, Ra-226 and K-40 in(Bq/kg) for waste samples.

Table (1): Analysis by (HPGe) detector for waste samples

Sample Number	U-238 Series Bq/kg					Th-232 Series Bq/kg		K-40 Bq/kg
	Pa-234	Ra-226	Pb-214	Bi-214	Pb-210	Ac-228	Tl-208	
Phosphogypsum waste (1)	941±29.6	227±2.7	195±1.4	176±1.3	819±0.9	34±1.1	34±0.8	263±3.9
Ore product waste (2)	2968±50	2670±10	2062±3.5	2048±3.4	2140±10	1346±4.4	1308±4.4	1156±7.3
Ore product waste (3)	7455±79	8634±15	6543±5.5	6472±6.2	5625±17.8	172±3.4	159±1.8	648±7.1
Ore product waste (4)	7248±80	8346±16.4	6441±6.8	6374±6.6	5651±19	162±3.2	162±1.9	630±7.8
Range samples	941-7455	227-8634	195-6543	176-6472	819-5625	34-1346	159-1308	263-1156

Table (2): The waste samples analysis by (HPGe) detector

Sample Number	Specific activity			
	U-238 Series	Th-232 Series	Ra-226	k-40
	Bq/kg	Bq/kg	Bq/kg	Bq/kg
Phosphogypsum waste (1)	471.6±7.2	34±0.95	227±2.7	263±3.9
Ore product waste (2)	1.95×10^3±15.4	1.33×10^3±4.4	2670±10	1156±7.3
Ore product waste (3)	5.8×10^3±24.7	165.5±2.6	8634±15	648±7.1
Ore product waste (4)	5.7×10^3±25.8	162±2.6	8346±16.4	630±2.6
Range samples	471.6-5.8×10^3	34-1.33×10^3	227-8634	263-1156
Average	18.3±2.05×10^3	2.6±422.9	4969.3±11.1	674.3±5.2

The tables (1) and (2) gives value of activity concentration for U-238, Th-232, Ra-226 and K-40, in Bq/kg for some studies waste samples. Also it is clear that the concentrations of U-238 for product waste samples are too higher than the recommended limit, which equal to 33 Bq/kg [8], [14]. Ranging from (471.6-5.8×10^3) Bq/kg [(38.02-469.6) ppm] with an average of (18.3± 2.05×10^3) Bq/kg.From these tables, the concentrations of Th-232 for these samples are too high than the recommended limit of the concentrations of terrestrial radionuclide in soil, equal to 45 Bq/kg [8], [14] .Ranging from (34-1.33×10^3) Bq/kg [(8.4-326.9)ppm] and the sample number one it lowers than ambient soil activity because the formation of phosphate rock mixes two place the Sebaiya ore and Abu-Torture ore. And average of (2.6±422.9) Bq/kg for product waste samples. The main important radionuclide product waste samples the isotope of Radium, which found during this analysis. Ra-226 is seen to be higher than the mean ambient soil activity concentration, equal to 32 Bq/kg [8], [14] for product waste samples ranging from (227-8346)

Bq/kg [(18.4-699.1) ppm. The samples are higher than the mean ambient soil activity concentration. The concentration of K-40 for these samples also is insignificant compares with, U-238, Th-232 and Ra-226 but still higher than the recommended limit of the concentrations radionuclide in soil, equal to 420 Bq/kg [8], [14]. Ranging from (263-1156) Bq/kg [(0.8-3.7) ppm] with an average of (674.3±5.2) Bq/kg for product waste samples. Figure (1) shows the activity concentration of U-238, Th-232, Ra-226 and K-40 in (Bq/kg) for projects waste samples. From table (3) represents the radionuclide concentrations in waste samples by Bq/kg convert to ppm.

Table (3): Conversion of Radioelement Concentration to Specific Activity.

Radio-element	Chemical concentration	Specific activity
K -40	1 % K in rock	313.0 Bq/kg
U-238 and Ra-226	1 ppm U in rock	12.35 Bq/kg
Th -232	1 ppm Th in rock	4.060 Bq/kg

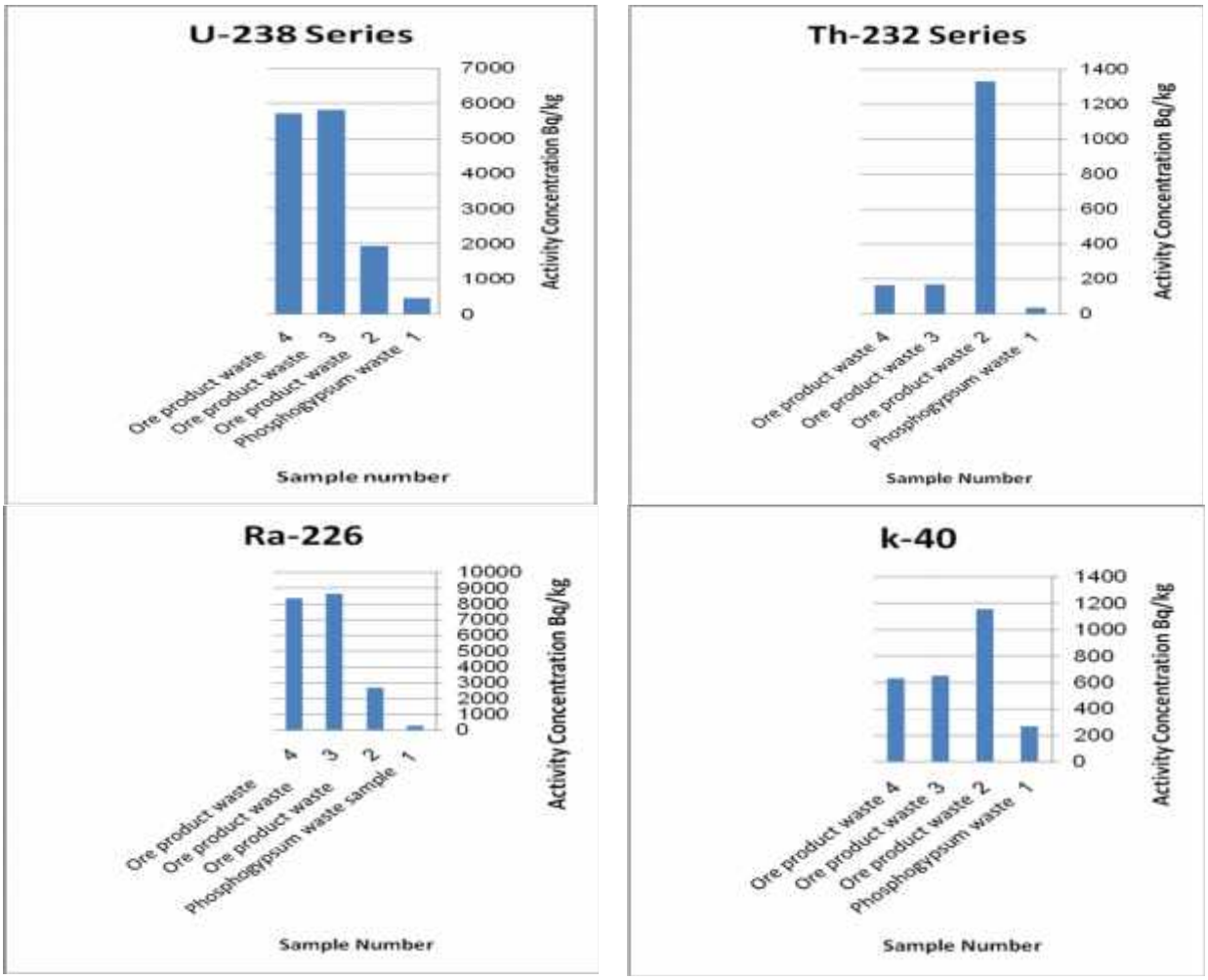

Figure (1) Activity concentration of U-238, Th-232, Ra-226 and K-40 in (Bq/kg) for projects waste samples

Table (4): Calculated absorbed dose rate from equation (1) by $nGyh^{-1}$

Sample Number	Specific activity			Absorbed dose rate ($nGy\ h^{-1}$)	Annual effective dose mSv/y
	U-238 Series	Th-232 Series	K-40	Calculated (Terrestrial)	Calculated (Terrestrial)
	Bq/kg	Bq/kg	Bq/kg		
Phosphogypsum waste (1)	471.6±7.2	34±0.95	263±3.9	235.1	0.1
Ore product waste (2)	1.95×10^3±15.4	1.33×10^3±4.4	1156±7.3	1.8×10^3	0.5
Ore product waste (3)	5.8×10^3±24.7	165.5±2.6	648±7.1	2.6×10^3	0.7
Ore product waste (4)	5.7×10^3±25.8	162±2.6	630±2.6	2.5×10^3	0.7
Range samples	5.8×10^3-471.6	1.33×10^3-34	263-1156	325.1- 2.6×10^3	0.1-0.7
Average	$18.3 \pm 2.05 \times 10^3$	2.6±422.9	674.3±5.2	1.8×10^3	0.5

Table (5): Calculated absorbed dose rate from equation (2) by $nGyh^{-1}$

Sample Number	Chemical concentration			Absorbed dose rate ($nGy\ h^{-1}$)	Annual effective dose mSv/y)
	U-238 Series	Th-232 Series	K-40	Calculated (Terrestrial)	Calculated (Terrestrial)
	ppm	ppm	ppm		
Phosphogypsum waste (1)	38.02±2	8.4±0.3	0.8±0.01	239.6	0.1
Ore product waste (2)	157.9±1.2	326.9±1.1	3.7±0.02	1.72×10^3	0.5
Ore product waste (3)	469.6±2	41.2±0.6	2.1±0.02	3.3×10^3	0.9
Ore product waste (4)	461.5±2.1	39.9±0.7	2.01±0.02	3.1×10^3	0.7
Range samples	38.02-469.6	8.4-326.9	0.8-3.7	3.3×10^3-239.6	0.1-0.9
Average	281.2±1.8	104.1±0.7	2.2±0.02	2.1×10^3	0.6

Table (6): Calculated absorbed dose rate from equation (3) by µR/h

Sample Number	Chemical concentration			Absorbed dose rate (µR/h)	Annual effective dose mSv/y
	U-238 Series	Th-232 Series	K-40	Calculated (Terrestrial)	Calculated (Terrestrial)
	ppm	ppm	ppm		
Phosphogypsum waste (1)	38.02±2	8.4±0.3	0.8±0.01	28.4	0.1
Ore product waste (2)	157.9±1.2	326.9±1.1	3.7±0.02	202.5	0.6
Ore product waste (3)	469.6±2	41.2±0.6	2.1±0.02	0.3×10^3	0.8
Ore product waste (4)	461.5±2.1	39.9±0.7	2.01±0.02	0.3×10^3	0.8
Range samples	38.02-469.6	8.4-326.9	0.8-3.7	0.3×10^3-28.4	0.1-.08
Average	281.2±1.8	104.1±0.7	2.2±0.02	0.9×10^3	0.6

Table (7): Calculated the radium equivalent activity from waste samples by equation (7):-

Sample Number	Ra-eq Bq/kg
Phosphogypsum waste (1)	292.9
Ore product waste (2)	4.7×10^3
Ore product waste (3)	8.9×10^3
Ore product waste (4)	8.6×10^3

Table (8): Calculated external hazard index from all samples waste by equation (8):-

Sample No.	A_{Ra}	A_{Th}	A_k	Result
Phosphogypsum waste (1)	34	263	1.4	0.8
Ore product waste (2)	1327	1156	19.76	12.6
Ore product waste (3)	168	648	47.5	24.01
Ore product waste (4)	162	630	45.85	23.4

Table (9): Calculated internal hazard index from all samples waste by equation (9):-

Sample No.	A_{Ra}	A_{Th}	A_k	Result
Phosphogypsum waste (1)	227	34	263	1.4
Ore product waste (2)	2670	1327	1156	19.76
Ore product waste (3)	8634	186	648	47.5
Ore product waste (4)	8346	162	630	45.85

Table (10): Total value of the hazard parameters in waste product samples

Sample No.	Absorbed Dose Rate ($nGyh^{-1}$)	Effective Dose (mSv/y)	Ra-eq (Bq/kg)	H_{ex}	H_{in}
Phosphogypsum waste (1)	235.1	0.1	292.9	0.8	1.4
Ore product waste (2)	1.8×10^3	0.5	4.7×10^3	12.6	19.76
Ore product waste (3)	2.6×10^3	0.7	8.9×10^3	24.01	47.5
Ore product waste (4)	2.5×10^3	0.7	8.6×10^3	23.4	45.85
Range samples	325.1- 2.6×10^3	0.1-0.7	292.9 - 4.7×10^3	0.8-23.4	1.4-45.85
Average	1783.8	0.5	3.4×10^3	15.2	28.6

From tables (4), (5) and (6) consider the value of the average absorbed dose rate in the waste samples were ranged from (325.1- 2.6×10^3) nGy/h with an average 1.8×10^3 nGy/h ,(3.3×10^3-239.6) nGy/h with an average 2.1×10^3 nGy/h and (0.3×10^3-28.4) µR/h with an average 0.9×10^3 µR/h respectively for waste samples . It obvious that the calculated total absorbed dose rates for these waste samples were highly larger than the recommended international limit 59 nGy/h [8]. It is known that the recommended limit of the annual effective dose to a worker form occupational exposure which is not exceed 20 mSv/y [15]. From the same tables the annual effective dose in the studied waste samples ranged from (0.1-0.7) mSv/y with an average 0.5mSv/y, (0.1-0.9) mSv/y with an average 0.6 mSv/y and (0.1-.08) mSv/y with an average 0.1respectively which were lower than the recommended limit. From tables (7) and (10) the value of the radium equivalent activity in the waste samples is ranging from (292.9-8.9×10^3) Bq/kg with an average.4×10^3Bq/kg. It obvious that the calculated radium equivalent activity for these waste samples were highly larger than the recommended international limit; 370 Bq/kg exemption Phosphoric acid waste sample because the waste produced from the phosphoric acid purification project contain the phosphogypsum solids added to the material of treatment (Ca. bentonite) which partially decrease the radio action effect . It is clearly appear from the same tables (8) and (10) the value of the external hazard index (H_{ex}) in the waste samples were range from (292.9 - 4.7×10^3). It is obvious that the calculated external hazard indexes (H_{ex}) for these waste samples are highly larger than unity. This indicated that there was an external exposure risk due to γ-rays arising from these materials. Also from these tables (9) and (10), the value of the internal hazard index (H_{in}) in the waste samples were range from (1.4-45.85) with an average 28.6 for product waste samples, are highly larger than unity. The values of internal hazard index (H_{in}) must be less than unity to have negligible hazardous effects of radon and its short lived progeny to the respiratory organs [8]. The figure (2) was represented the annual effective dose from waste samples.

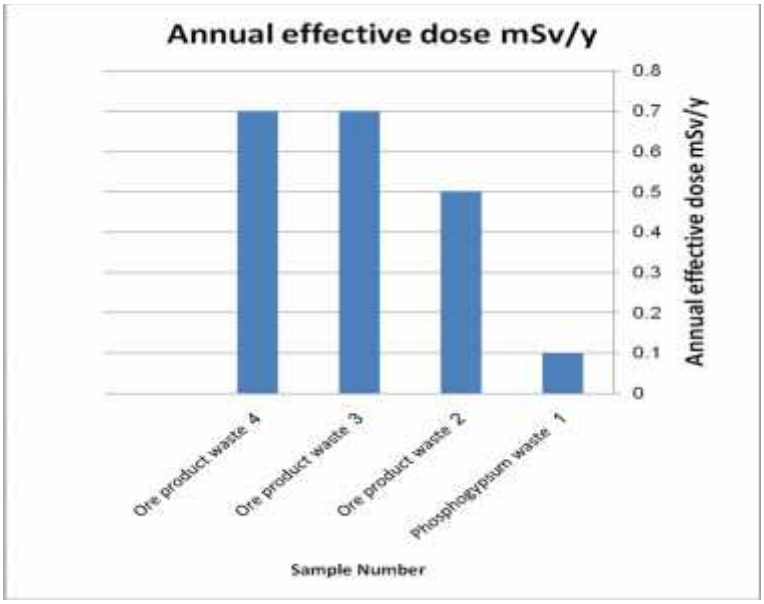

Figure (2) the annual effective dose of waste samples

3.1. Gamma exposure dose rate measurements by survey meter

The RDS-100 universal survey meter used for measurement, dose rate in gamma air at 1 m above ground calculated outdoor terrestrial gamma radiation and the measured outdoor gamma radiation (terrestrial plus cosmic) at 1m above the ground in ore products project waste is γ-dose rate in air is ranging from [0.42 -0.98] µSv/h and Purification of the phosphoric acid waste project is [0.067 – 0.076] µSv/h.

3.2. Radon daughter and uranium concentration in air measurements by alpha scintillator

Radon daughter was measured by Roll method and dust [6] Calculated work level by equation (1) . Radon daughter was lower than the 0.3WL indoor work place site. Because the place work site was ventilation, natural good air it is equal range indoor site 0.012 and 6.48×10^{-3} WL respectively. The uranium concentration in air (dust) was

lower than limit international it is blank because the waste of projects in wet all the time.

3.3. Assessment of internal occupational radiation dose

The internal occupational radiation dose invalid calculated in the phosphoric acid purification and products ore projects because the waste of projects in wet all the time and good ventilation air inside projects.

4. Conclusions

Four waste samples were collected from phosphoric acid purification project and ore products project in Inshas site. Radioactivity concentrations were measured using HPGe (High purity germanium detector system) .The annual effective dose from phosphoric acid purification projects is very low because most of uranium (80%) present in phosphoric acid and about (20%) of uranium in phosphogypsum waste which may be decreased during washing of the waste during the recovery process of P_2O_5 the phosphogypsum waste .While the annual effective dose from the ore products project increased according to ratio of heavy minerals that include uranium and thorium which remain in the waste sample .Generally the annual effective dose from purification phosphoric acid and products ore wastes are very low because the several chemical process treatment extraction and segregation the radioactive material so that the occupational radiation dose is low and cancer risk factor no effect in the occupational and surround environmental so the chemical process treatment and leaching is the rather and best method to extraction and segregation this method may be is very important in some natural radioactive material such as petroleum and gas waste Attendant the Extraction and refining the crude oil . The waste must be restoring back to the extraction areas to maintain the ecological balance.

Acknowledgments

The authors thank Dr. Hady Gado project leader for phosphoric acid purification to contribute assistance and scientific guidance in the art of scientific research.

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