بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In The Name Of Allah, The Beneficent The Merciful

# Dedication

To my mother

Father

Sisters

Brothers

Colleagues

To all those whom I love

# Acknowledgment

All praises are for ALMIGHTY ALLAH, the most Benevolent, the most Compassionate, whose blessings and graciousness flourished my ideas and endowed me with the strength required to complete this work. My humble respects are for the Holy Prophet (Peace Be Upon Him) who enlightened our scruples with the essence of faith in ALMIGHTY ALLAH and emphasized to seek knowledge, from cradle to the grave, for betterment of oneself and the humanity at large.

The work reported in this thesis has been carried out in Nuclear Instrumentation at the Seiberdorf, Vienna under the external supervision Mr.Ian Darby through the financial support of International Atomic Energy Agency (IAEA). I am extremely grateful to Mr.Ian Darby accepting to act as my external supervisor, encouragement, fruitful suggestion generous support throughout the course of this work.

I would like to express my sincere thanks and appreciation to my home supervisors Prof. Isam Salih Mohamed Musa and Dr.Ahamed Alhassen Elfaki for his useful guidance, encouragement and advice throughout the course of this thesis, without which this work would be extremely difficult.

I also place on record, my sense of gratitude to one and all, who directly or indirectly, have l met their hand in this venture.

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## ABSTRACT

The aim of this study is to assess of the natural environmental radioactivity level and evaluation doses calculations .Total 114 Samples were collected contain soil، rock and some foodstuff from different locations around South and North Kordofan states. The radioactivity concentration of $^{238}$U، $^{232}$Th، $^{40}$K and $^{137}$Cs have been determined using γ-ray spectrometry NaI(Tl) detector .moreover، the absorbed dose rates ate in air at a height of 1m from the ground was calculated using four sets of dose rate conversion factors and the corresponding annual effective dose were estimated، the average value of $^{238}$U، $^{232}$Th، $^{40}$K and $^{137}$Cs in the soil samples from South Kordofan were found to be 22.83، 25.11، 284.31and 0.28Bq.k$^{-1}$ respectively.

For South Kordofan. Activity concentrations $^{238}$U، $^{232}$Th، $^{40}$K and $^{137}$Cs in the soil samples, were came out to be 22.08، 28.99 ،319.16 and 1.38Bqkg$^{-1}$ respectively. Predictive maps were constructed for both area for $^{238}$U، $^{232}$Th، $^{40}$K and absorbed dose using GIS program which showed a trend of increase to the Maintains area for soil Sample. Corresponding, for Foodstuff the average activity concentration of natural nuclides $^{238}$U، $^{232}$Th and $^{40}$K fallout nuclide$^{137}$Cs was 4.6، 4.4 and 326Bqkg$^{-1}$ respectively. Also activity concentrations of $^{238}$U، $^{232}$Th and $^{40}$K in rocks samples was 23.56، 29.57 and 330.58 Bqkg$^{-1}$ respectively. The obtained results were found to be less than the corresponding global values reported in the UNSCEAR publications for normal background areas.

The absorbed dose rate in air at a height of 1m from the ground was calculated using four sets of dose rate conversion factors and the corresponding annual effective dose was estimated. On the average, the values obtained were: 25.60، 25.26، 26.57 and 29.61 nGy.h$^{-1}$ for soil samples North Kordofan ، 26.08، 28.05، 32.88 and 31.00 nGy.h$^{-1}$ for soil samples South Kordofan ، 28.80، 28.42، 33.95and 33.34 nGy.h$^{-1}$ for rock samples، 5.53، 5.48،5.00 and 6.16 nGy.h$^{-1}$ for Foodstuff samples، and annual effective dose were: 31.20، 30.99،32.60 and 41.72μSv.y$^{-1}$ for the soil samples North Kordofan، 37.16، 34.42، 38.53and 39.81μSv.y$^{-1}$ for the soil samples South Kordofan 38.19، 34.88،39.60 and 40.92μSv.y$^{-1}$ for rock samples and 7.89، 6.72، 6.13 and 7.56 μSv.y$^{-1}$ for Foodstuff samples، respectively for DRCFs (MC، MCNP، GEANT and UNSEAR).These values lie within the areas very close worldwide range for high background radiation. The obtained data can be used in baseline data for any future studies for the establishment of radiation map for Sudan.

## المستخلص

اجريت هذه الدراسة لتقيم مستوي النشاط الاشعاعي الطبيعي وحساب الجرعات في بعض المناطق من ولايتي شمال وجنوب كردفان ، تم جمع عدد 114عينة من التربة والصخور والغذاء الرئيسي . قيس تركيز النشاط الاشعاعي لكل من اليورانيوم 238، الثوريوم 234، البوتاسيوم 40 والسيزيزم137 باستخدام مطياف قاما.و من ثم قيست الجرعة الاشعاعية الممتصة وذلك باستخدام اربعة اطقم من تحويل معدل الجرعة الفعالة وكما تم حساب الجرعة المؤثرة السنوية. ووجد متوسط التراكيز للعينات التربة في شمال كردفان لكل من اليورانيوم238،الثوريوم234 ،البوتاسيوم40والسيزيزم137تساوي22.83، 25.11، 284.31 ،0.28بيكريل/ كجم علي التوالي .و بالنسبة للعينات التربة في جنوب كردفان وجد متوسط التراكيز لكل من اليورانيوم 238، الثوريوم234 ، البوتاسيوم 40 والسيزيزم137علي النحو التالي :22.08 ، 28.99 ، 319.16، 1.38بيكريل/ كجم علي التوالي .

وباستخدام نظام المعلومات الجغرافية (GIS) تم إعداد خرائط توضيح التراكيز يورانيوم ، ثوريوم ، بوتاسيوم وكذلك الجرعة الاشعاعية الممتصة التي أظهرت ازدياد في اتجاه المناطق الجبلية .ايضاً بالنسبة للعينات الغذاء الرئيسي وجدت تراكيز العناصر يورانيوم ، ثوريوم ، بوتاسيوم وخالي من سيزيزم علي التالي 4.67، 4.49 و326 علي التوالي وكذلك للعينات الصخور وجد 28.56، 29.57 و330.58 علي التوالي .من هذه النتائج وجد أن التركيز الاشعاعي لتلك النظائر هو اقل من متوسط العالمي ، كما في أدبيات لجنة الامم المتحدة العلمية للوقاية من أثار الإشعاعات الذرية .

تم حساب الجرعة الاشعاعية الممتصة في الهواء علي ارتفاع 1م من سطح الارض وذلك باستخدام مجموعة من ثوابت تحويل معدل الجرعة (DRCFs) ، كما تم حساب الجرعة الفعالة السنوية ، حيث وجد ان متوسط النتائج الجرعة الممتصة هو:25.60 ، 25.26 ،26.57 و29.61 لعينات التربة شمال كردفان ،26.08، 28.05، 32.88 و31.00 لعينات التربة جنوب كردفان ، 28.80 ، 28.42، 33.95 و33.34 لعينات الصخور و 5.53 ، 5.48 ، 5.00 و6.16 نانوغراي/الساعة لعينات الغذاء الرئيسي و الجرعة الفعالة السنوية هي : 31.20 ، 30.99، 32.60 و 41.72 لعينات التربة شمال كردفان 37.16 ، 34.42، 38.53 و39.81 لعينات التربة جنوب كردفان ، 38.19 ، 34.88، 39.60 و 40.92 ولعينات الصخور 7.89، 6.72، 6.13 و 7.56 ميلي سفرت/السنة لعينات الغذاء الرئيسي ،علي التوالي للثوابت ( MC ,MCNP, GANT and UNSEAR . وجدت ان هذه النتائج تقع من ضمن المناطق القريبة جداً لنطاق المدي

العالمي ذات الخليفة الاشعاعية.نتائج البحث التي تم الحصول عليها يمكن استخدامها كبيانات اساسية لبناء خرطة اشعاعية للسودان مستقبلا.