NATIONAL RADIATION PROTECTION AUTHORITY

Established pursuant to Section 33(1) of the Atomic Energy & Radiation Protection Act, Act No 5 of 2005

Ministry of Health and Social Services
P/ BAG 13198
Cnr. Dr W Culz & Tienert Streets
Windhoek 9000.
Namibia
Tel: + 264 (61) 2032458/20/21
Fax: 264 (61) 230 424
e-mail:aerpr@mhss.gov.na
Website: aebofnamibia.org

Enquiries: Mr. G Amakali **Ref:** 3/6/6/2/2/4-1/17 **Date:** 21 July 2017

Summary on the study to determine the radioactivity concentration of the natural occurring radionuclides materials (NORMs) in the soils collected from Namibia Marble and Granite Mine (NAMAGRA).

INTRODUCTION

The purpose of the study was to characterize and establish the extent of exposure at facilities (other than uranium mines) that extract or process mineral ores that may contain natural occurring radioactive materials (NORM) and to assess the potential radiation risk to the environment.

The activity concentration for 238U, 232Th and 40K form 10 locations on the mine territory were determined by ORTEC gamma ray spectrometry and Gamma Vision 32 was used to process the obtained spectra. The quantification of K-40 was via its 1460.83 keV line, Thorium-232 was quantified via its decay radionuclides of Ac-228 and Ti-208 assuming that these radionuclides are in radioactive equilibrium with each other and with 232Th. This is due to very low emission probability of thorium. Uranium-238 was quantification via the lines of Pa-234 at 1001.03 KeV and Bi at 609 keV due to their higher energies, although albeit low emission probabilities, radioactive equilibrium was assumed. Since 238U cannot be measured by gamma spectrometry but only via its decay radionuclides (ISO, 2007).

Based on the activity concentrations of investigated radionuclides, the absorbed gamma dose rate in air at 1 m above ground level was calculated and the annual estimated average effective dose to human with an outdoor occupancy 20% and 80% for indoors.

RADIOACTIVITY AND ANNUAL EFFECTIVE DOSE

The mean values of activity concentrations were found to be 39.28±2.62)Bq kg-1 for 40K, 3.72±0.66Bq kg-1 for 232Th and 16.73±1.81Bq kg-1 for 238U. The mean value of 11.62± 3.39 nGy/h was lower than the world average value. The description of activity concentration in the 10 soil samples analysed are presented in table 1.

Table 1: The values of 238U, 232Th and 40K activity content in the soil samples from Namagra.

Sample code	**Radionuclide concentration [Bq Kg^{-1}]**			**Absorbed dose rate [$nGyh^{-1}$]**	**Annual effective dose [mSv] (Outdoor)**	**Annual effective dose [mSv] (Indoor)**
	^{40}K	**^{232}Th**	**^{238}U**			
CR7	69.94 ± 3.43	6.31±0.72	18.65±1.84	15.35± 3.91	0.018	0.075
CR8	36.49 ± 2.53	4.60±0.71	16.77±1.74	12.05± 3.47	0.014	0.059
DS2	37.77± 2.56	4.64±0.84	21.60±2.20	14.36± 3.79	0.017	0.070
DS7	18.55 ± 1.78	2.02±0.70	16.61±1.68	9.66± 3.10	0.011	0.047
MA1	39.52± 2.57	4.94±0.65	17.62±1.75	12.77± 3.58	0.015	0.062
QR1	33.18±2.53	3.67±0.80	15.65±1.67	10.82±3.29	0.013	0.053
QR2	35.75±2.59	3.41±0.57	14.38±1.75	10.19± 3.19	0.012	0.050
QR10	38.28±2.71	2.56±0.75	15.32±1.70	10.22± 3.19	0.012	0.050
RE1	44.05±2.82	1.35±0.17	13.99±1.50	11.62± 3.02	0.011	0.044
mean	39.28±2.62	3.72±0.66	16.73±1.81	11.62± 3.39	0.014	0.056
Range	18.55±1.78 to 69.94± 3.43	1.35±0.17 to 6.31±0.72	13.99±1.50 to 21.60±2.20	9.66±3.10 to 15.35± 3.91		

CONCLUSION

The obtained activity concentrations and total gamma dose rates are lower than the world average values. The results obtained in this study may be used for the preliminary estimation of the exposure to public due to natural radionuclides. Further investigation is needed before definite conclusions on this issue are drawn.

Acknowledgement: This work was done as a project by UNAM physics student Bernardo Tomás in July 2016.