DETERMINATION OF THE NATURAL RADIONUCLIDE CONTENT AND ASSOCIATED RADIATION HAZARDS IN SOIL SAMPLES COLLECTED FROM THE OHORONGO CEMENT PLANT NEAR OTAVI, NAMIBIA.

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INTRODUCTION

- The exposure of human beings to ionizing radiation from natural sources is a continuing and inescapable feature of life on earth.

- Man is exposed to different kind of natural occurring radiation. That includes radiation from outer space as well as radiation from natural sources on earth.

Sources of natural sources

  - ^{238}U
  - ^{40}K
  - ^{232}Th

- usually can not be seen or senses

- The higher the concentration, the more radiation emitted

•May have serious consequences

–cancers

- Many mineral resources in Namibia- radionuclides concentration may be higher

- Interest to determine the concentration of radionuclides in soil

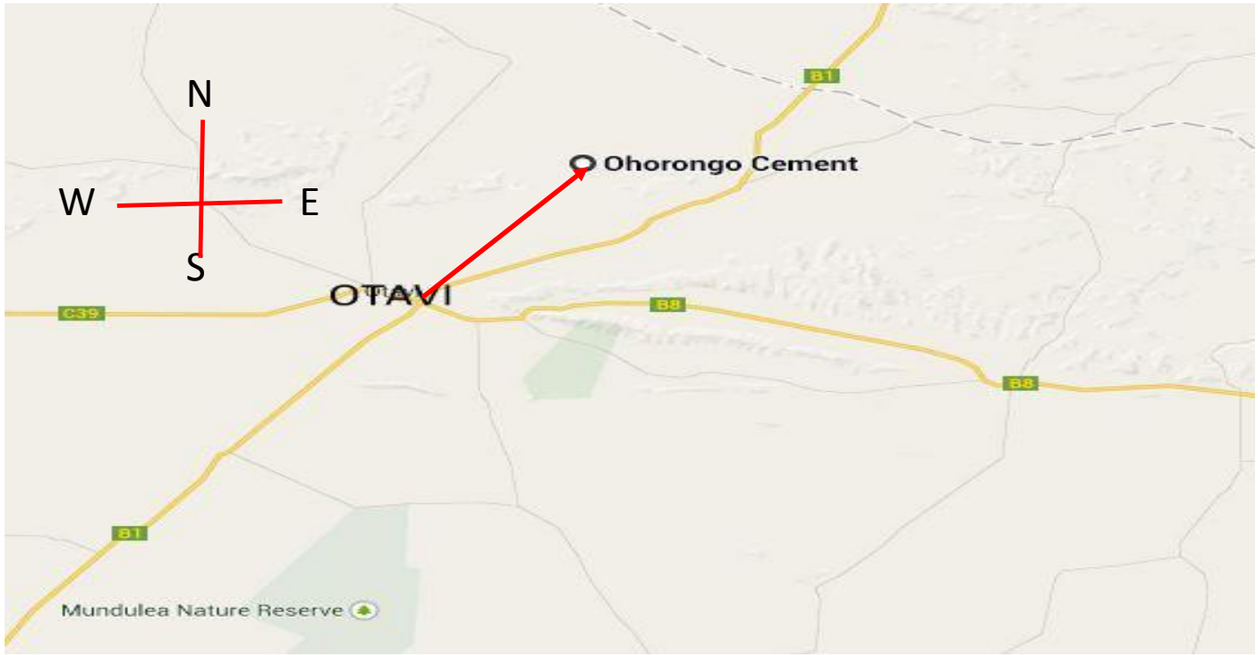
OBJECTIVES OF THIS STUDY

- Measure the concentration of the radionuclides ^{232}Th ,^{238}U and ^{40}K in the soil of the Ohorongo cement plant.
- Determine the distributions of the three radionuclides in the soil of the plant
- Find the background radiation level at the plant and determine if it is below the maximum permissible limits recommended by the ICRP
- Contribute to a national baseline data of radionuclides concentrations in the soils of Namibia

METHODOLOGY

Study area

farm Sargberg about 16-17 km North-east of Otavi in Otjozondjupa region



location of Ohorongo Cement Plant in Namibia

- 50 soil samples were collected

areas where soil samples were collected

- Drying of soil samples in nuclear physics laboratory

Processing of soil sample

METH. CONTINUE

- Weighting of 500g soil sample and left for 30 days for secular equilibrium to be achieved

- Soil samples were analyzed using HPGe-detector.

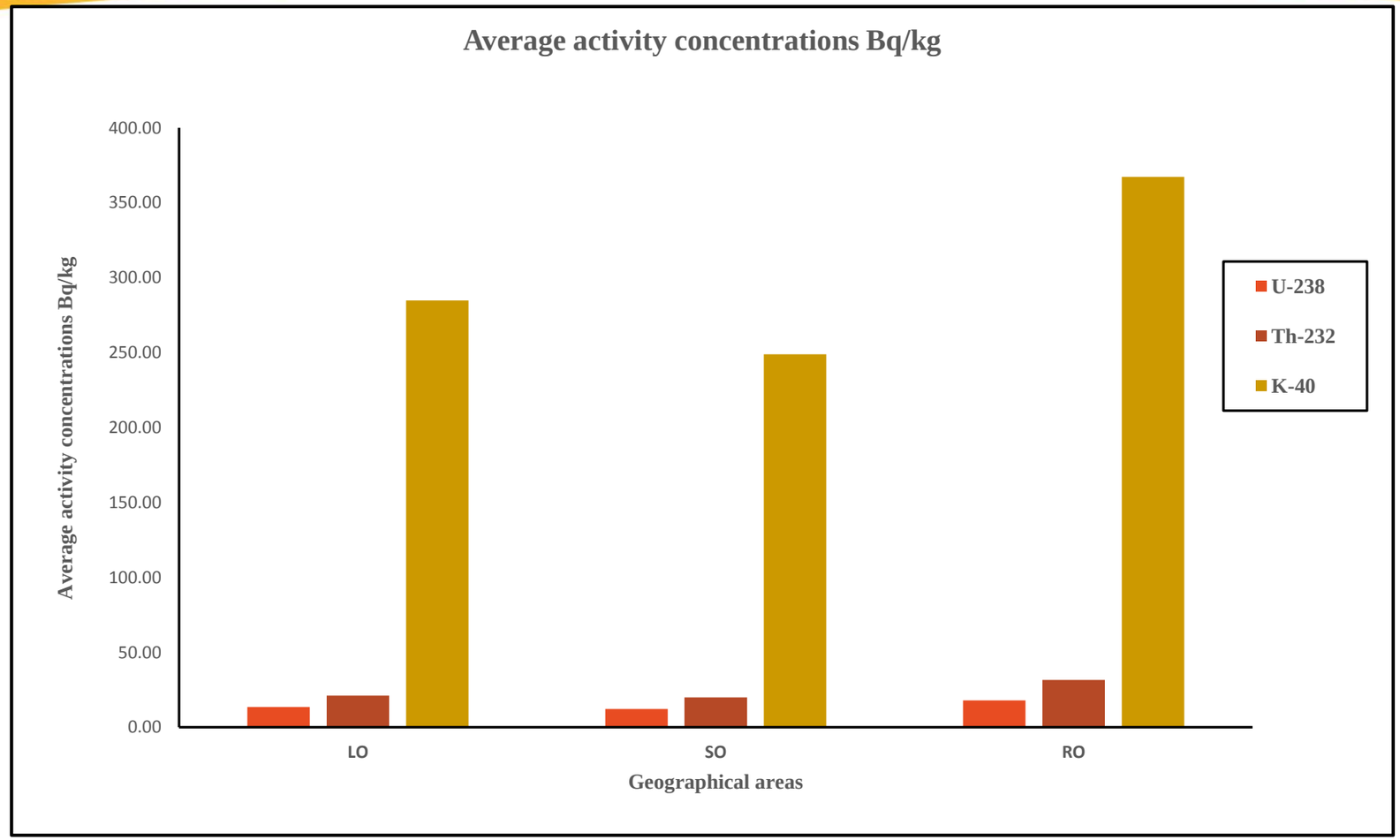
The activity concentrations in the samples was determined from the intensities of the gamma lines of 0.911MeV for ^{232}Th, 0.609MeV for ^{238}U and 1.465MeV for ^{40}K

RESULTS

Area	Radionuclides concentration (Bqkg^{-1})			R_{eq} (Bqkg^{-1})
	^{238}U	^{232}Th	^{40}K	
LO	13.6 ± 3.6 (7.7-20.1)	21.1± 6.0 (12.7-33.1)	284.9 ± 51.5 (204.8-381.8)	65.8 ± 15.4 (44.1 – 96.9)
SO	12.2 ± 3.4 (8.4-18.6)	20 ± 7.0 (12.7-35.6)	248.9 ± 87.2 (132.2-390.2)	59.9 ± 19.6 (38.7 – 99.5)
RO	17.9 ± 4.5 (7.3-25.6)	31.7± 10.8 (13.8-43.1)	367.4 ± 109.6 137.9-507.8)	91.5 ± 27.8 (40.3 – 124.2)
All sample	**15.0 ±4.7 (7.3-25.6)**	**25.1 ± 9.9 (12.7-43.1)**	**(310.7 ± 97.2) (132.2-507.8)**	**74.9 ± 25.6 (38.7 -124.2)**

- Radium activity equivalent (R_{eq})= C_U + 1.43C_{Th} +0.077C_K

Table 1: Average radionuclide concentration and R_{eq} activity in different geographical areas in Ohorongo cement plant

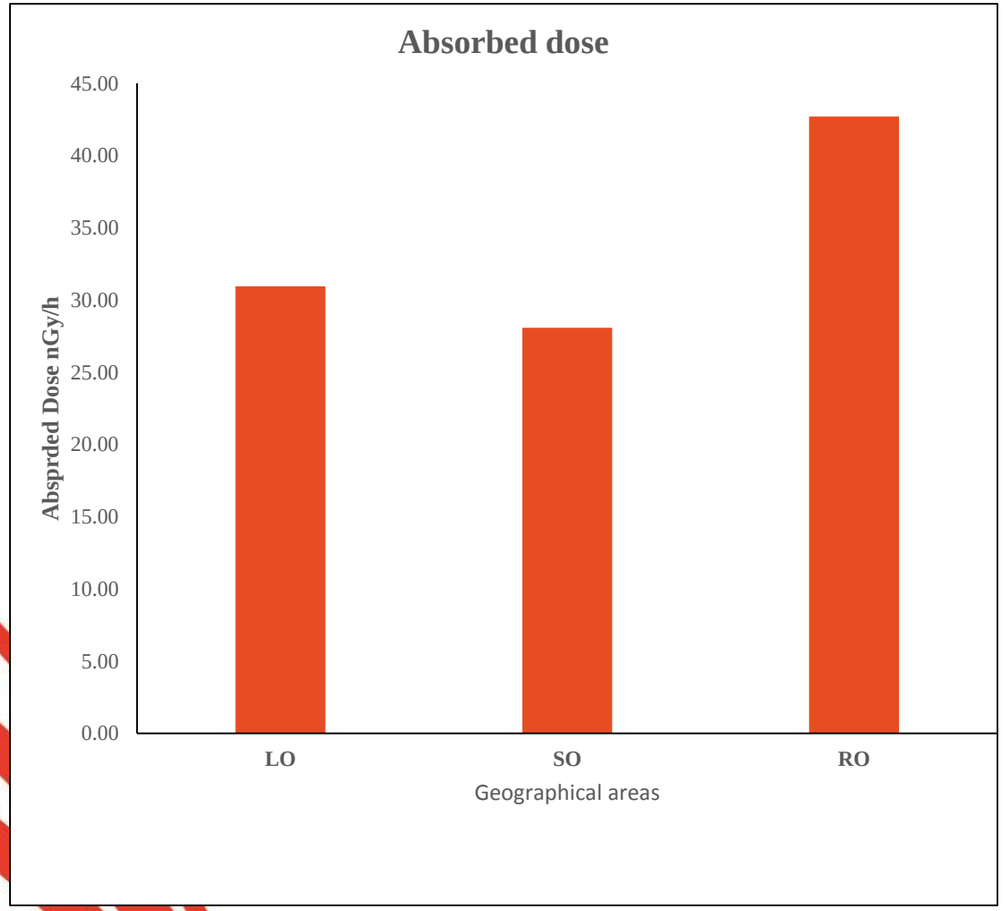

Average activity concentrations Bq/kg
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Average activity concentrations Bq/kg
LO
SO
RO
Geographical areas
U-238
Th-232
K-40

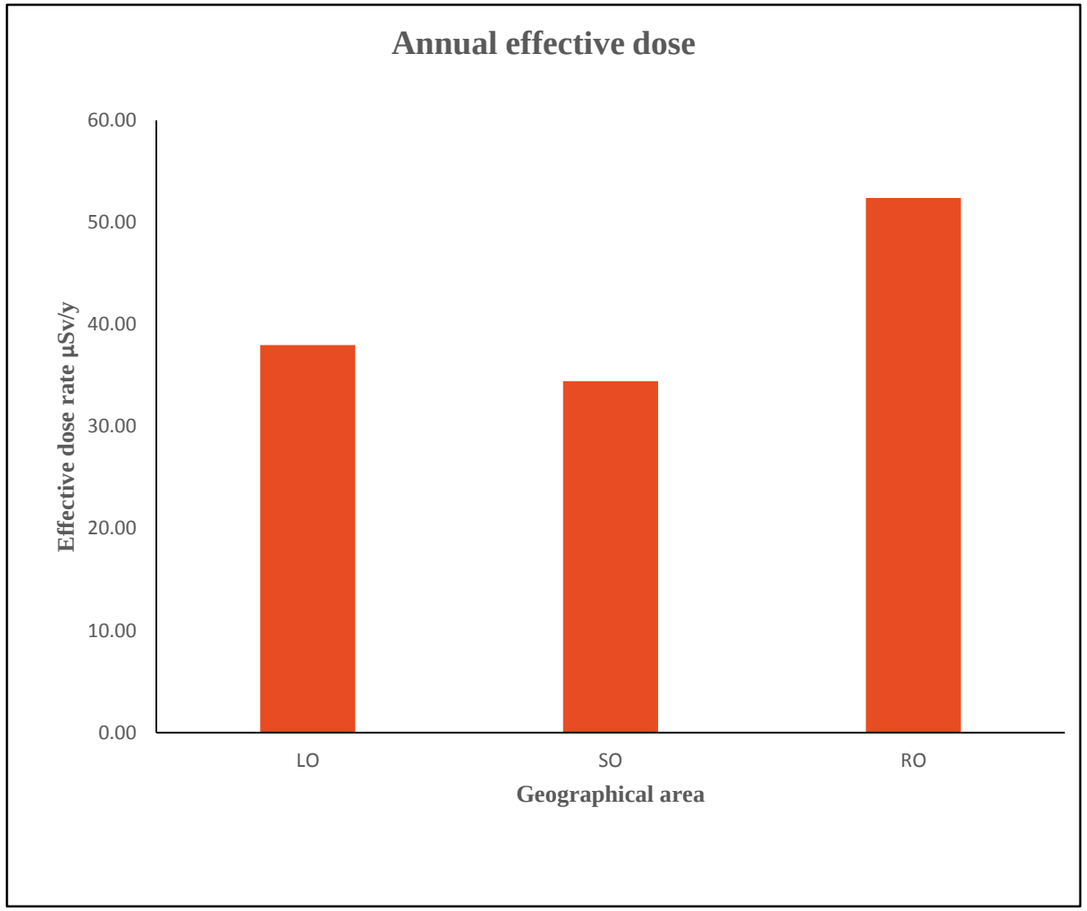
Area	Absorbed dose rate (nGy h^{-1})	Annual effective Dose (µSv)	Hazard indices	
			H_{in}	H_{ex}
LO	31.0 ± 7.1 (20.9-45.2)	38.0 ± 8.7 (25.6-55.5)	0.21 ± 0.05 (0.15 – 0.32)	0.18 ± 0.04 (0.12 – 0.26)
SO	28.1 ± 9.2 (18.1-46.3)	34.4±11.3 (22.2- 56.8)	0.19 ± 0.06 (0.13 –0.32)	0.16 ± 0.05 (0.10 – 0.27)
RO	42.7 ± 12.9 (18.8-58.0)	52.4 ±15.8 (23.1 – 71.2)	0.30 ± 0.09 (0.13-0.40)	0.25 ± 0.07 (0.11 – 0.34)
All sample	**35.1 ± 11.8 (18.1-58.0)**	**43.0 ± 14.5 (22.2-71.2)**	**0.24 ± 0.08 (0.13 – 0.40)**	**0.20 ± 0.07 (0.10 – 0.34)**

- $D_T(nGyh^{-1}) = 0.462A_U + 0.604A_{Th} + 0.0417A_K$

  Eff.Dose (mSv)$= D_T * 0.008760 * 0.7 * 0.2$

Table 2: Average absorbed dose rates and annual effective doses at different geographical areas in Ohorongo cement plant


Absorded dose
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Absprded Dose nGy/h
LO
SO
RO
Geographical areas


Annual effective dose
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Effective dose rate µSv/y
LO
SO
RO
Geographical area

CONCLUSION

- This values are all below their corresponding recommended maximum permissible values.
- Thus the radiological hazards are negligible and plant has a normal background radiation

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Thank You