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Investigation of Occupational radiation Dose in the Mineral Separation Plant of Magarini Mineral Sands

INVESTIGATION OF OCCUPATIONAL RADIATION DOSE IN THE MINERAL SEPARATION PLANT OF MAGARINI MINERAL SANDS, KENYA.

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ABSTRACT

Mining and processing of Magarini mineral sands does not only produce the products of titanium dioxide (rutile and ilmenite) and zircon but also exposes the Naturally Occurring Radioactive Materials (NORM) due to association with uranium (U) and thorium (Th) bearing minerals. The concentration of the radioactive elements varies throughout the mining, processing and hauling operations. No study has been undertaken to determine the occupational exposure as all previous studies at Magarini mineral sands were done during pre-operational period to determine baseline or environmental radiation levels. This research intends to address this gap. The findings of this research indicate that the radiation concentration is the highest during mineral separation stage. NORM emit ionizing radiation in the form of gamma rays, alpha and beta particles which can be ingested, inhaled or absorbed by workers at various stages during mining operations, hence exposing them to radiation risk. The gamma rays contribute to the external radiation dosage whereas the alpha and beta particles influence the internal radiation dosage. In order to investigate this, alpha, beta and gamma radiation levels were measured using CSP Alpha/Beta probe (SAB- 100) and survey meter (Colibri VLD). Annualized dose indicated that zircon stream recorded highest level of radiation dose 1.63 mSv followed by rutile stream with 1.1 mSv and ilmenite stream with 0.63 mSv. The variation of trends of the relationships amongst the three streams was then compared with their respective annual metallurgical U and Th concentration. The results indicated that the highest concentrations of U and Th was recorded in Zircon (having an average of 256 ppm- U and 130 ppm-Th), followed by rutile (having an average of 31 ppm- U and of 24 ppm- Th) and lastly ilmenite (having an average of 8 ppm- U and 14 ppm- Th). The high radiation dose recorded in zircon stream is attributed to the presence of monazite.

Keywords: Radioactivity concentrations, heavy mineral sands, mineral separation plant, natural occurring radioactive materials (NORM)

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