RESPONSE TO THESIS REVIEW QUESTIONS

Thank you for the opportunity to respond to the review comments on my thesis titled "***The role of geology formation and anthropogenic activities in radionuclide distribution in selected regions in Ghana***". I appreciate the time and effort invested in evaluating my work and for the insightful feedback, which has helped improve the quality and clarity of the thesis. Below, I provide detailed responses to each of the comments raised.

1. Please clarify the process of gamma and radon sample preparation, particularly in relation to the minimization of radon losses during the setup for exhalation rate measurements.

Answer: Soil samples were collected in pairs, one for radon exhalation measurement and the other for gamma ray spectrometry analysis. In the laboratory, all samples were air-dried for about a week and oven-dried Soil samples for gamma ray spectrometry were pulverized, homogenized and sieved to a consistent particle size of 2 mm. They were weighed into labelled Marinelli beakers and hermetically sealed for 28 days to achieve radioactive equilibrium with the short-lived progenies while also preventing radon gas escape.

For radon samples, soils were also air-dried for a week and oven-dried at 60 ℃ for 24 hours. The samples were not pulverized to prevent the loses of radon during that process. A CR-39 detector was firmly placed on the cover of the exhalation chamber. 300 g of the soil samples were weighed into cylindrical vessels and the chamber was tightly closed immediately.

2. What is the scientific basis for choosing a 3 cm soil depth in the exhalation chamber? How does this depth affect the results and their comparability to global standards?

Answer: Soil samples were placed at 3 cm of the chamber to allow for only Rn-222 tracks to be detected on the CR-39 detector while preventing the detection of Rn-220. This is because Rn-220 has a half-life of 55 seconds and hence placing samples very low at the bottom of the chamber extends the distance (22 cm) the radionuclide must travel before reaching the surface of the CR-39 detector of which by then it would have decayed. If not, Rn-220 tracks may be detected and counted as Rn-222 tracks giving an inaccurate Rn-222 concentration estimation. This might increase the concentrations and lead to wrong comparison with global standards.

3. Based on your findings, what concrete steps would you recommend to Ghanaian environmental or health authorities to mitigate public exposure to environmental radiation?

Answer: First, there is the need to enact and strengthen regulatory framework for radiation protection. Also, there should be national radiation safety standards/ reference levels specific to Ghana's geology and environmental situations as practiced in other countries. Second, there should be national radiation monitoring programmes e.g. for mining activities, indoor radon, building materials, industrial areas, etc. Third, a need for radiation risk assessments in hotspot areas for workers and the public. Field surveys and geospatial tools can also be used to estimate risk exposures. Fourth, the government can launch public education campaigns on radiation sources, risks and safety practices. And finally, the need to build institutional capacity, collaborations and trainings for radiation detection, monitoring and regulatory enforcement.

By

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