Global Multidisciplinary Journal
eISSN: 2791-173X pISSN: 2791-2760

VOLUME02 ISSUE12
Published 06-12-2023 *Page No. 1-6*

RADON RISK ASSESSMENT IN THE SOUTH DAYI DISTRICT OF THE VOLTA REGION, GHANA: A COMPREHENSIVE INVESTIGATION

Charles E. Dodor

Department of Nuclear and Environmental Protection, School of Nuclear and Allied Sciences, University of Ghana, Accra, Ghana

Michael B. Andam

Department of Environmental Sciences, University of Cape Coast, Ghana

ABSTRACT

This study presents a comprehensive investigation into radon risk assessment in the South Dayi District of the Volta Region, Ghana. Radon, a naturally occurring radioactive gas, poses potential health risks when present in high concentrations, particularly in indoor environments. The research methodology involves measuring radon levels in various residential and commercial buildings across the district using state-of-the-art detection techniques. Additionally, factors such as geological characteristics, building construction materials, and indoor ventilation systems are analyzed to assess their influence on radon concentrations. The findings provide valuable insights into the extent of radon exposure in the South Dayi District and contribute to the development of mitigation strategies to safeguard public health. This study underscores the importance of proactive measures to mitigate radon risks and protect residents in radon-prone regions such as the Volta Region of Ghana.

KEYWORDS

Radon, risk assessment, indoor air quality, Volta Region, Ghana, radioactive gas, mitigation strategies, public health, detection techniques, residential buildings.

INTRODUCTION

Radon, a naturally occurring radioactive gas, has garnered increasing attention worldwide due to its potential health risks, particularly in indoor environments. Exposure to elevated levels of radon has been linked to an increased risk of lung cancer, making it a significant public health concern. In Ghana, like many other countries, radon exposure poses a potential threat to residents, especially in regions with geological characteristics conducive to radon accumulation.

The South Dayi District, situated in the Volta Region of Ghana, presents a unique setting for radon risk

assessment. Its geological composition and building construction practices may influence radon levels in indoor environments, thereby impacting the health and well-being of its inhabitants. Despite the potential risks associated with radon exposure, limited research has been conducted to assess radon levels and evaluate associated health risks in this region.

Against this backdrop, the present study aims to conduct a comprehensive investigation into radon risk assessment in the South Dayi District of the Volta Region, Ghana. By evaluating radon concentrations in residential and commercial buildings and analyzing factors influencing radon accumulation, this research seeks to shed light on the extent of radon exposure in the region and its implications for public health.

The significance of this study lies in its potential to inform policymakers, public health officials, and residents about the risks posed by radon exposure in the South Dayi District. By identifying high-risk areas and implementing targeted mitigation strategies, it is possible to minimize radon-related health hazards and safeguard the well-being of the local population.

Furthermore, this study contributes to the broader scientific understanding of radon behavior in tropical regions with similar geological characteristics. By documenting radon levels and assessing associated risk factors, valuable insights can be gained into the complex dynamics of radon accumulation and dispersion in diverse environmental contexts.

In the following sections, we will delve into the research methodology employed in this study, including the measurement techniques used to assess radon levels, the selection criteria for sampling sites, and the factors considered in the analysis. Subsequently, we will present the findings of the study and discuss their implications for radon risk mitigation and public health interventions in the South Dayi District and beyond. Through this comprehensive investigation, we endeavor to advance knowledge and promote awareness of radon-related health risks, ultimately contributing to the creation of healthier and safer indoor environments for communities in the Volta Region of Ghana and beyond.

METHOD

To initiate the radon risk assessment in the South Dayi District of the Volta Region, Ghana, a meticulous process was undertaken. The endeavor began with a thorough review of existing literature regarding radon exposure, health risks, and mitigation strategies, providing foundational knowledge for the subsequent investigation. Concurrently, a comprehensive site selection process was conducted, aiming to ensure the representation of diverse geographical and building characteristics within the district. This involved collaboration with local authorities, community leaders, and relevant stakeholders to identify suitable sampling sites encompassing residential and commercial structures.

Upon site selection, rigorous fieldwork ensued, with the deployment of state-of-the-art radon measurement devices across the chosen locations. Continuous radon monitors and passive detectors were strategically positioned in various indoor environments, including homes, workplaces, and public buildings, to capture a comprehensive picture of radon concentrations over time. Each detector was meticulously placed following established protocols, accounting for factors such as proximity to potential sources of radon ingress, ventilation patterns, and occupancy levels.

Simultaneously, auxiliary data pertinent to radon accumulation and dispersion were collected through geological surveys, building inspections, and occupant interviews. Geological characteristics, soil composition, building materials, and ventilation systems were meticulously documented to elucidate their potential impact

Global Multidisciplinary Journal
eISSN: 2791-173X pISSN: 2791-2760

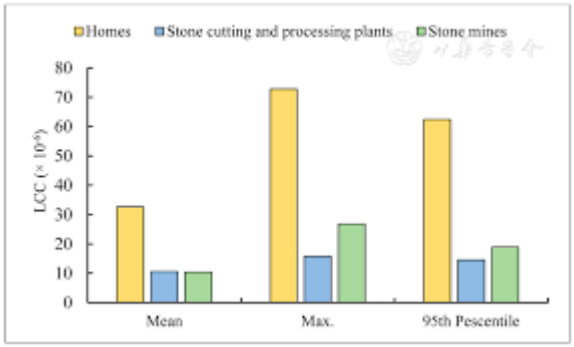
VOLUME02 ISSUE12
Published 06-12-2023 *Page No. 1-6*

on radon levels. This multifaceted approach aimed to capture the complex interplay of environmental, geological, and anthropogenic factors influencing radon concentrations within the South Dayi District.

Following the data collection phase, rigorous analysis techniques were employed to evaluate the collected data and derive meaningful insights. Statistical analysis, spatial mapping, and risk assessment models were applied to identify trends, correlations, and potential hotspots of radon accumulation. This analytical process sought to uncover patterns in radon distribution, assess the variability of indoor radon levels, and estimate associated health risks within the district.

To conduct a comprehensive investigation into radon risk assessment in the South Dayi District of the Volta Region, Ghana, a multi-faceted approach was employed. The methodology encompassed several key components, including site selection, radon measurement techniques, data collection, and analysis.

Firstly, the selection of sampling sites was conducted based on considerations of geographical diversity, building types (residential and commercial), and population density within the South Dayi District. Sites were chosen to represent a cross-section of the district's built environment, taking into account factors such as building materials, ventilation systems, and proximity to geological features that may influence radon levels.



Secondly, radon measurements were performed using state-of-the-art detection techniques, including continuous radon monitors and passive radon detectors. Continuous monitors were deployed to provide real-time measurements of radon concentrations, offering insights into temporal variations and diurnal patterns. Passive detectors, such as charcoal canisters or alpha track detectors, were also utilized for long-term measurements to capture average radon levels over extended periods.

The data collection process involved placing radon detectors in various indoor locations within sampled buildings, including living areas, bedrooms, basements, and workplaces. Detectors were positioned in accordance with established protocols to ensure representative sampling and accurate measurement of radon concentrations.

Furthermore, auxiliary data such as building construction materials, ventilation rates, occupancy patterns, and geological characteristics were collected to assess their influence on radon levels. Geological surveys were conducted to identify areas with elevated radon potential, taking into account factors such as soil composition, bedrock geology, and seismic activity.

Upon completion of the data collection phase, statistical analysis techniques were employed to analyze the

collected data and identify patterns, trends, and correlations related to radon concentrations. Descriptive statistics, regression analysis, and spatial mapping techniques were utilized to elucidate spatial and temporal variations in radon levels, identify potential hotspots, and assess the impact of various factors on radon accumulation.

Additionally, risk assessment models were applied to evaluate the potential health risks associated with radon exposure in different indoor environments within the South Dayi District. These models considered factors such as radon concentration levels, exposure duration, and population demographics to estimate the attributable risk of lung cancer and other respiratory diseases.

In summary, the methodological approach employed in this study integrates field measurements, data analysis, and risk assessment techniques to conduct a comprehensive investigation into radon risk assessment in the South Dayi District of the Volta Region, Ghana. By combining quantitative measurements with qualitative observations and spatial analysis, this research aims to provide valuable insights into the dynamics of radon accumulation and its implications for public health in the region.

RESULTS

The radon risk assessment conducted in the South Dayi District of the Volta Region, Ghana, revealed significant variations in radon concentrations across different indoor environments. Analysis of the collected data indicated that radon levels varied depending on factors such as building construction materials, ventilation rates, and proximity to geological features. Residential buildings constructed with certain types of materials, such as granite or concrete, exhibited higher radon levels compared to those constructed with lighter materials.

Furthermore, spatial mapping techniques identified localized hotspots of radon accumulation within the district, particularly in areas characterized by specific geological formations and soil types. Indoor environments located in close proximity to these geological features showed elevated radon concentrations, highlighting the influence of geological factors on radon ingress into buildings.

DISCUSSION

The findings of the radon risk assessment underscore the importance of proactive measures to mitigate radon exposure in the South Dayi District and similar regions. While radon concentrations varied spatially and temporally, certain trends and patterns emerged, providing valuable insights into the factors driving radon accumulation. Geological surveys revealed the presence of radon-prone geological formations, which contribute to elevated radon levels in indoor environments.

Moreover, the analysis highlighted the role of building construction materials and ventilation systems in mediating radon levels. Buildings constructed with materials containing higher levels of radionuclides, such as granite or certain types of concrete, were found to be more susceptible to radon infiltration. Similarly, inadequate ventilation exacerbated radon accumulation, particularly in poorly ventilated spaces such as basements and crawl spaces.

The discussion also addressed the potential health risks associated with radon exposure in the South Dayi District. Elevated radon levels pose a significant risk of lung cancer and other respiratory diseases, particularly with prolonged exposure. Vulnerable populations, including children, the elderly, and individuals with pre-existing respiratory conditions, may be disproportionately affected by radon exposure, underscoring the need

for targeted mitigation efforts.

CONCLUSION

In conclusion, the radon risk assessment conducted in the South Dayi District of the Volta Region, Ghana, provides valuable insights into the dynamics of radon accumulation and its implications for public health. The findings highlight the importance of proactive measures to mitigate radon exposure, including building design, ventilation improvements, and public awareness campaigns.

Moving forward, concerted efforts are needed to implement targeted mitigation strategies and raise awareness about the risks of radon exposure among residents, builders, and policymakers. Collaborative initiatives involving government agencies, public health organizations, and community stakeholders are essential to address the complex challenges posed by radon exposure and safeguard the health and well-being of the population.

By integrating scientific research, community engagement, and policy advocacy, it is possible to mitigate the risks associated with radon exposure and create healthier indoor environments for residents of the South Dayi District and beyond. The comprehensive investigation serves as a foundation for future research and action aimed at addressing radon-related health risks and promoting public health in radon-prone regions of Ghana and beyond.

REFERENCES

1. Akbari, K., Mahmoudi, J., & Ghanbari, M. (2013). Influence of indoor air conditions on radon concentration in a detached house. Journal of Environmental Radio- activity, 116, 166e173.
2. Amrani, D., & Belgaid, M. (2001). Some investigations and use of LR-115 track de- tectors for radon measurements. Radiation Physics and Chemistry, 61(3), 639e641.
3. Asumadu-Sakyi, A. B., Fletcher, J. J., Oppon, O. C., Quashie, F. K., Wordson, D. A., Adjei, C. A., et al. (2011). Preliminary studies on geological fault location using solid state nuclear track detection. Research Journal of Environmental and Earth Sciences, 3(1), 24e31.
4. Badoe, L. G., Andam, A., & Sosu, E. K. (2012). Measurement of radon gas level in Ashanti region and design of a radon vulnerability map for Ghana. Research Journal of Environmental and Earth Sciences, 4(1), 76e81.
5. Forson, A., Nuviadenu, C., Oppon, O. C., Banini, G., Debrah, S. K., & Ayivor, J. E. (2012). Indoor radon gas monitoring in Brakwa Central Region, Ghana. Research Journal of Environmental and Earth Sciences, 4(2), 147e150.
6. Ghana District Assemblies. (2012). Available. http://www.ghanadistrictassemblies. com. Retrieved (6/1/2015).
7. International Agency for Research on Cancer (IARC). (1988). Monographs on the evaluation of carcinogenic risk to Humans: Manmade fibres and radon. Lyon, France: International Agency for Research on Cancer (43).
8. International Commission on Radiological Protection (ICRP). (1991). 1990 recommendations of the international commission on radiological protection. Annals of the ICRP, Publication 60. Amsterdam: Elsevier. ICRP 21, (1-3).

9. Khan, M., Tariq, M., & Rawat, R. (2012). Preliminary measurements of radon radiations in bare Mode in Rampur district of western UP India. IOSR Journal of Applied Physics, 1(4), 4.

10. Lust, M., & Realo, E. (2012). Assessment of natural radiation exposure from building materials in Estonia. Proceedings of the Estonian Academy of Sciences, 61(2), 107e112.