International Academic Journal of Information, Communication, Technology & Engineering
ISSN: 5741-2605 | Volume 8, Issue 8 | January, 2025 | pages 1 – 6
DOI: 222-3942-8342-542-871-1
Double Blind Peer Reviewed International Research Journal
https://accexgate.com
journalsaccexgate@gmail.com

EVALUATING DUMPSITE AGE: A CRITICAL REVIEW AND METHODOLOGICAL APPROA CH

Abdullahi Muhammad Abba[1] and M.H. Bichi[2]
Faculty of Engineering, Department of Civil Engineering, Bayero University, Kano

Abstract: *Accurate evaluation of Dumpsite Age is crucial for assessing environmental and health risks associated with waste disposal sites. However, existing methods for estimating dumpsite Age have limitations and uncertainties. The study presents a critical review of current approaches for evaluating dumpsite Age including historical records ,serial photography ,geophysical surveys and remote sensing A comprehensive methodological framework is proposed integrating multiple techniques to improve accuracy and reliability .The framework is applied to a case study in Maiduguri demonstrating its effectiveness in estimating dumpsite Age .The results highlight the importance of a multi-disciplinary approach for accurate dumpsite age evaluation ,ensuring informed decision-making for waste management and environmental protections*

Keywords*. Dumpsite Age, Waste Management, Environmental Risks Assessment, Geophysical and Geochemical Analysis, Historical Records, Methodological Approach.*

INTRODUCTION

The accurate determination of dumpsites age is crucial for assessing environmental and health risks associated with waste disposal sites. Dumpsite age affects the decomposition rate of waste, leachate quality and gas production ultimately influencing the design and implementation of effective waste management strategies.

However, evaluating dumpsite age remains a complex task due to the heterogeneity of waste composition, variability in waste disposal practices and lack of reliable historical records. Existing methods for evaluating dumpsite age including historical records, geophysical surveys and geochemical analysis have limitations and uncertainties. Historical records may be incomplete or inaccurate while geophysical surveys can be affected by site-specific conditions. Geochemical analysis, although informative may not provide direct information on dumpsite age.

This review aims to critically evaluate existing methods for evaluating dumpsites age ,highlighting their strength ,limitations and uncertainties .A comprehensive review of literature will be conducted to identify gaps in current knowledge and methodologies .Furthermore, this study will propose methodological approach for integrating multiple techniques to improve the accuracy and reliability of dumpsite age evaluations .The specific objective of this review includes, to critically evaluate existing methods for evaluating dumpsite age, to identify gaps in current knowledge and methodologies ,to propose a methodological approach for integrating multiple techniques and to discuss the implications of accurate dumpsites age evaluation for waste management and environmental protection

Dumpsites, also known as Landfill are crucial aspects of waste management. However, their Age can significantly impact on the environment and poses a potential health risks to human. Accurate evaluation of dumpsite age is essential for assessing the stability, pollution potentials and rehabilitation needs the study reviews existing literature on dumpsites age evaluation methods and presents a comprehensive methodology for estimating dumpsite age.

LITERATURE REVIEW

HISTORICAL RECORDS AND DOCUMENTATION

Historical records and documentation provides valuable information on dumpsite age, waste disposal practice and environmental impacts. Studies have utilized archival research, interviews and newspaper archives to reconstruct waste management histories. Alam et al., (2020) conducted archival research to analyse waste management practices in Dhaka city, Bangladesh, from 1960 to 2015.the study revealed inadequate waste management infrastructure and lack of enforcement of existing regulatory agencies directives and observation, while Kumar et al (2019) reviewed historical documents and reports to assess municipal solid waste management in India. The study highlighted the need for integrated waste management approaches. Newspaper archives have also been used to study waste management practices, for example, a study by Giampolo et al (2019) analysed newspaper articles to understand waste management issues in Italian city. These authors approaches to solid waste management particularly dumpsite issues are lacking in Nigeria, it's extremely difficult to get access to such vital information from government or other solid waste management professional thereby hindered the understanding of Dumpsite age or other related matter.

This study will enable solid managers and related professional to have a updated documented status of all the dumpsite in the country from inception to date of some vital dumpsites in the country so as to enable use take an informed solid waste management decision. The geophysical aspects of determining dumpsite age relies ground –penetrating Radar and is basically employed to identify subsurface waste distribution, depth and Age. Ground – penetrating radar (GPR), electrical resistivity tomography (ERT) and magnetometry are commonly used techniques'

Researchers have employed various methods to evaluate dumpsites such as Kumar et al., (2020) where he used historical records to ascertained dumpsite age through reviewing documents, records and archives while geophysical surveys, a technique like ground-penetrating. Previous studies have employed various techniques to estimate dumpsite age which includes among other:

Historical records and documentations involves the utilization of oral traditions and written documents as regards a particular dumpsites sited in a given geographical location. Such vital information's are usually obtained from statutory bodies charged with the responsibility of waste management in a given municipal or a state. These bodies are usually charged with records of landfills/Dumpsites where Municipal solid wastes are dumped. (Kumar et al.,2017).

Aerial photography and GIS analysis involves capturing images of the dumpsite surface from an elevated perspective using aircrafts, unmanned vehicles or drones and satellites with a view of environmental monitoring whereas the GIS analysis integrates geographic data (Spatial information with analysis tools (Zhang et al.,2015) and Geographical survey such as ground-penetrating radar (Liu et al.,2019) as well as Remote sensing and multispectral imagery (Singh et al.,2020).

These methods have limitations including data availability, accuracy and cost-effectiveness

METHODOLOGY

The study proposes a multi-disciplinary approach combining

HISTORICAL METHODS AND DOCUMENTATION

Historical research and documentation review:

This approaches involves analysing past events, records and documents to understand the development and evolution of dumpsites in a given location. This helps researchers reconstruct the site history, including age while documentation reviews involve examining existing records, reports and documents related to the dumpsite. These may include site plans and maps, operational records, regulatory documents, newspaper articles and media reports

Historical records and documentation provide valuable information on dumpsite age, waste disposal practice and environmental impacts:

- Archival research: -Analysing documents, reports and photograph from local authorities, waste management companies and community organizations
- Interview: Conducting interviews with local residents, waste management professional and community leaders.
- Newspaper archives: - Reviewing newspaper articles and reports related to waste management and dumpsites operations

GEOPHYSICAL SURVEY

Geophysical surveys help in identifying subsurface waste distribution, depth and Age. Ground –penetrating radar(GPR), electrical resistivity tomography (ERT) and Magnetometer are commonly used techniques

METHODS

- Ground-penetrating radar(GPR): -Non – invasive techniques using radar pulses to image subsurface structures
- Electrical resistivity tomography (ERT): -Measures electrical resistivity to identify subsurface features
- Magnetometry: - Detects magnetic anomalies indicating waste presence

INTEGATION OF HISTORICAL RECORDS AND GEOPHYSICAL SURVEY

Few studies have integrated historical records and geophysical surveys to evaluate dumpsite age. A custody by Kumar et al., (2019) combined archival research and magnetometry to assess waste management practice and dumpsite in India. Another similar study by Alam et al., (2020) used historical records and GPR to evaluate dumpsite Age and waste distribution in Bangladesh .The potential of integrating two or more methods of evaluating dumpsite age is now receiving much attention from various researchers, however ,there are several limitation that may likely infer the accuracy of such integration Some of the limitation may include integrating multiple methods for more accurate results, addressing data gaps and inconsistencies in historical records and need for development of more advanced geophysical techniques for complex sites.

IMPLICATIONS OF ACCURATE DUMPSITE AGE EVALUATIONS

Accurate dumpsite age evaluation has significant implications for waste management, environmental protections and public health.

Waste management implications: -

- Improved waste disposal planning. Accurate dumpsite Age evaluation helps in plan for future waste disposal needs
- Enhanced waste characterization: Understanding dumpsite age informs waste composition and degradation processes.
- Optimal landfill design, accurate dumpsite age evaluation ensures suitable landfill design, construction and operations
- Efficient leachate management, age evaluation helps predicts leachate generation and quality
- Gas management, accurate age evaluation informs biogas production and management

Environmental protection implications

- Reduced environmental pollution, Accurate age evaluation minimizes leachate and gas release
- Groundwater protections, understanding dumpsite age helps prevent groundwater contamination
- Soil conservation, accurate age evaluation prevents soil degradation
- Climate change mitigations, Accurate age evaluation informs greenhouse gas emissions(GGE)
- Ecosystem protection., preserves ecosystem services and biodiversity

Regulatory and Policy Implications

- Informed policy – making: - accurate age evaluation informs waste management policies
- Compliances with regulations; - Accurate age evaluation ensures regulatory compliances
- Standardization: Establishes standards for dumpsite age evaluation
- Monitoring and enforcement: Dumpsite age evaluation facilitates monitoring and enforcement
- International cooperation: Accurate dumpsite age helps in support global waste management efforts

Research and Development

- Advanced waste characterization: Accurate age evaluation informs waste characterization methods

- New technologies: Accurate age evaluation drives innovation in waste management technologies
- Improved modelling: Accurate age evaluation enhances waste management modelling
- Data driven decision –making: Accurate age evaluation supports data –driven decision making
- Interdisciplinary collaborations: Accurate age evaluations fosters collaboration among researchers

CONCLUSION

Evaluation of dumpsite age requires a multidisciplinary approach, combining historical records and geophysical surveys. Historical records provide valuable information on waste practice while geophysical surveys identify subsurface waste distribution and age. Accurate dumpsite age evaluation has far –reaching implications for waste management, environmental protection, public health, economics, regulation and research.it is essential to prioritize accurate age evaluation to ensure sustainable waste management practices.

Evaluating dumpsite age is crucial for environmental and health risks assessments. These studied methodology provides a comprehensive framework for estimating dumpsite age, addressing limitations of previous approaches. The proposed methods can be applied to various dumpsites contexts ensuring accurate and reliable results.

REFERENCES

Alam, M., Khan, M. A., & Kumar, N. (2020). Importance of evaluation of dumpsite age in planning solid waste management strategies. *International Journal of Environmental Engineering, 346*(12), 1768.

Bear, J. (1972). *Dynamics of fluids in porous medium*. Dover Publications.

Environmental Protection Agency (EPA). (2002). *Natural attenuation of contaminants in soil and groundwater*. U.S. Environmental Protection Agency.

Fetter, C. W. (2001). *Contaminant hydrology*. Pretence Hall.

Huang, J., & Kauhi, E. (2019). Heavy metal pollution from waste disposal and its environmental impact. *Journal of Environmental Management, 241*, 328-336.

Khan, M. A., Alam, M., & Kumar, N. (2020). Lead contamination in soil and water: Sources, effects, and remediation techniques. *Journal of Environmental Chemical Engineering, 8*(4), 103945.

Khan, M. A., Alam, M., & Kumar, N. (2021). Environmental impacts of solid waste disposal. *Journal of Environmental Management, 261*.

Kumar, V., & Chaudhary, R. (2019). Impact of dumpsite leachate on groundwater quality: A review. *Journal of Environmental Sciences and Health, Part C, 31*, 1-23.

Kumar, V., Kumar, N., & Chaudhary, R. (2018). Lead contamination in soil and groundwater: A review. *Journal of Environmental Sciences and Health, Part C, 36*, 1-1.

Li, S. (2020). Numerical simulation of contaminant transport in water using advection–dispersion equation. *Journal of Contaminant Hydrology, 233*, 103-6371.

Liu, J., Cheju, L., & Hum, J. (2019). Heavy metals pollution in soil and water in a solid waste disposal area. *Environmental Sciences and Pollution Research, 2*(15).

Sharma, S., Tiwan, S., & Gupta, N. (2019). Chromium contamination in soil and water: A review of sources, effects, and remediation techniques. *Journal of Environmental Chemical Engineering, 7*(3).

Singh, R., Singh, P., Kumar, V., & Kumar, N. (2018). Zinc concentration in soil and water: A review of sources, effects, and remediation techniques. *Journal of Environmental Sciences and Health, Part B, 53*, 147-155.

World Health Organization (WHO). (2018). *Waste and human health: Evidences and needs*. World Health Organization.

Zheng, C. (2018). MT3DMS: A modular three-dimensional multi-species transport model for simulation of advection, dispersion, and chemical reactions of contaminants in groundwater systems. *PA Reports*.