Novelty Journals

ISSN 2394-9694

International Journal of Novel Research in Humanity and Social Sciences
Vol. 10, Issue 5, pp: (56-62), Month: September - October 2023, Available at: www.noveltyjournals.com

Review of Environmental Impact Assessment of E-Waste Activities in the Greater Accra Metropolitan Area of Ghana

[1]Louis Dogbatsey, [1]Peter Billson Obour, [1]Alex Owusu Barima, [2]Cyril Schandorf

[1] University of Ghana Department of Geography, Legon, Ghana

[2] School of Nuclear and Allied Sciences, University of Ghana, Legon, Ghana

DOI: https://doi.org/10.5281/zenodo.8371706

Published Date: 23-September-2023

Abstract: **Introduction: The growing generation of electrical and electronic waste poses a global threat to public health and the environment. These wastes, comprising 4.5-6% of total waste, contain toxic and hazardous substances of health and safety concerns in the African region including Ghana.**

Aim: To evaluate and identify the health and safety and environment impacts on the e-waste dealers during recycling, collection, and dismantling of e-waste devices at two selected sites in Ghana.

Method: E-waste dealers in Ashaiman and Agblogbloshie sites burn electrical and electronic appliances, exposing people to toxic chemicals and causing environmental pollution. Sampling and sample size estimation were used to select a representative sample of workers to provide situation dada using structured questionnaires, interviews, and focus group discussions to collect operational data. SPSS is used to analyze the collected data.

Results: Most of the e-waste dealers are unaware of the health and health risks associated with burning circuit boards and batteries. These activities many cause skin burns, lung infections, and eye itching among workers exposed.

Conclusion: There is significant progress in the Health and Safety assessment and risk mitigation infrastructure in Ghana but more effort is needed to ensure that the environment and e-waste workers are adequately protected from the risks associated with e-waste waste management practices in Ghana.

Keywords: **E-waste, risk, regulatory control, education and training.**

1. INTRODUCTION

E-waste (electrical and electronic waste) workers are contributing are contributing to the socio-economic development their collection, dismantling, disposal and recycling work. The e-waste workers are exposed to many safety and health hazards and risks arising from their work. Such as carrying heavy waste materials, exposure to heat, dust, and hazardous chemical working in narrow workplaces, in strenuous postures.

According to the World Health Organization (WHO), several adverse health effects are caused by exposure to e-waste like negative birth outcomes like premature birth, changes in lung functions, and respiratory issues (Rosina Khattah,2023). Children are particularly vulnerable to some of the toxicants found in, or produced by, e-waste and e-waste recycling activities (WHO,2021) When electronics are improperly disposed and end up in landfills, toxic chemicals are released, impacting the earth's air, soil, water and ultimately, human health (Elytus, 2019).

Novelty Journals

ISSN 2394-9694

International Journal of Novel Research in Humanity and Social Sciences
Vol. 10, Issue 5, pp: (56-62), Month: September - October 2023, Available at: www.noveltyjournals.com

The consequences of improper e-waste disposal in landfills or other non-dumping sites pose serious threats to current public health and can pollute ecosystems for generations to come. Unfortunately, low global recycling rates and other challenges contribute to massive quantities of e-waste accumulating in landfills around the world ((RosinaKhattah,2023). Experts estimate that there will be a total of 347 metric tons of non-recycled e-waste globally by the end of the current year (2023).

E-waste can pose significant health and safety risks. Assessing and controlling risk helps ensure that your storage, transport and/or reprocessing of e-waste prevents harm to human health and the environment(EPA,2021).

In the Ghanaian context, importation of e-waste to Ghana is becoming a huge challenge not only because of its increase in volume but also due to its pollution in the environment with toxic chemicals, management, and disposal (Adeola, 2001; Baker, 2004; Bridgen et al., 2008; Pellow, 2007.)

Estimated total numbers of Collectors, Recyclers &Dependents is between 121,800 to 201,600 which about 1.04% -1.72% of urban population; about 0.50% -0.82% of total of the Ghanaian population (EPA, 2013)

The estimated indirect contribution of informal E-waste Sector to national economy is between US$105 to268million per year. However, informal e-waste workers are very poor. For example, collectors earn US$70-140/month, refurbishersU$190-250 and recyclersUS$175-285/month.

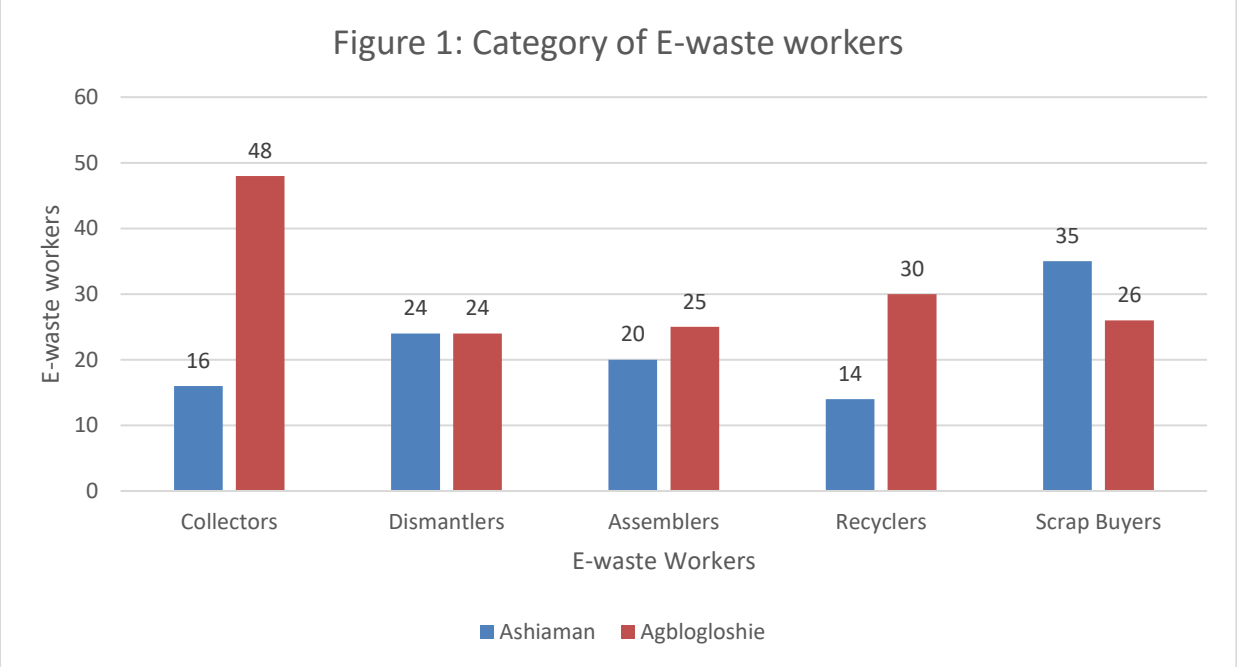
This paper seeks to evaluate and identify the health and safety and environment impacts on the e-waste dealers during recycling, collection, and dismantling of e-waste devices at the Ashiaman and Aglogloshie e-waste management sites in Ghana.

2. MATERIALS AND METHODS

E-waste dealers in Ashaiman and Agblogbloshie sites burn electrical and electronic appliances, exposing people to toxic chemicals and causing environmental pollution. Sampling and sample size estimation were used to select a representative sample of workers to provide data using structured questionnaires, interviews, and focus group discussions for analysis. SPSS 20.0 and Excel 2016 were used to analyze the collected data.

Sample and sampling size assessment

About 153 population of e-waste scrap dealers were selected using Slovin's formula (Slovin,1960) for the two sites shown in Figure 1.



Novelty Journals

ISSN 2394-9694

International Journal of Novel Research in Humanity and Social Sciences
Vol. 10, Issue 5, pp: (56-62), Month: September - October 2023, Available at: www.noveltyjournals.com

Figure 1: Ashiaman Study sites

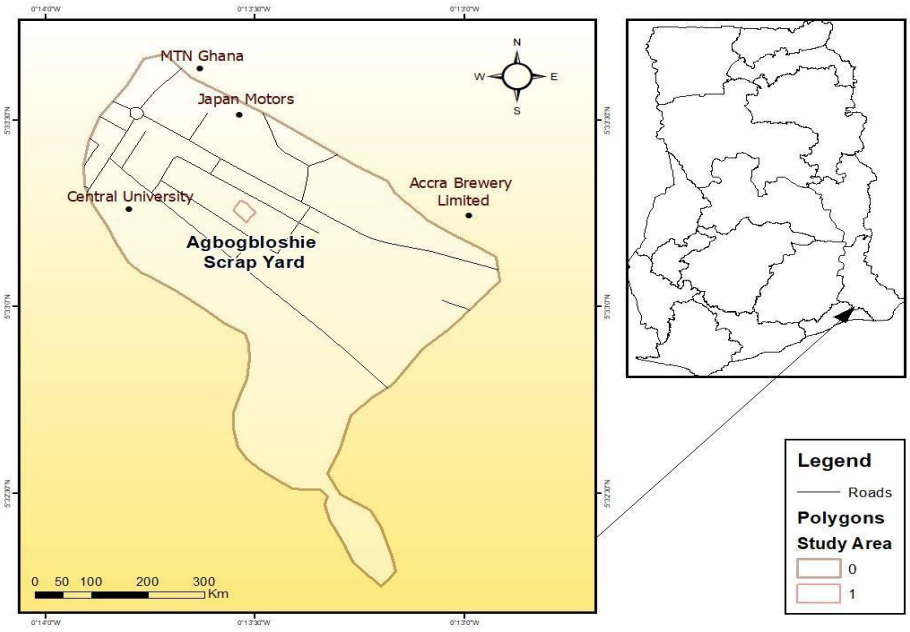


Figure 2: Agblogloshie Study site

Ashiaman Study site

Figure 1 shows Ashiaman study site

Ashaiman's latitude is 5.692858, and the longitude is -0.029869; with the GPS coordinates of 5° 41' 34.2888" N and 0° 1' 47.5284" W. Covering a total area of 45 sq. km; It is bound to the North and East by Kpone-Katamanso District and, on the South and West by the Tema Metropolis with an estimated population of 217,717. The e-waste activities in area involve scrap picking, reuse, recycling and burning.

Agblogbloshie Study site

Figure 2 shows Agblogbloshie Study site

Agbogbloshie, the biggest e-waste recycling site in Ghana has an area of about 313sq.km, and currently less than a kilometer from Central Business District (CBD) of Accra. The GPS coordinates are: Latitude: 5° 33' 3.9276". Longitude: -0° 12' 49.8528". Latitude: N 5° 33.0655'. Longitude: W 0° 12.8309'. Latitude: 5.551091°. Roughly 40,000 Ghanaians inhabit the area, most of whom are migrants from rural areas.

According to Prakash et al and Oteng-Ababio, informal e-waste operations occur in different parts of the country, but the hub of recycling operations in the Greater Accra Region at the scrapyards at Agbogbloshie as well as at Gallaway all in the Greater Accra metropolitan area and Ashiaman, in the Tema Metropolis. In their studies and found that the e-waste economy in this area is highly stratified and made up four main activities which are: collection, recycling, repair and refurbishment, and trading of metals. (Prakash et al., 2010; Oteng-Ababio ,2011)

Studies in 2009 by Amoyaw-Osei et al.,2010 have revealed that almost all of the annual volume of e-waste (171,000 tonnes) handled by recyclers in 2009 came directly from consumers, from consumers via communal collection, from consumers through repairers and directly from waste imports. This workload was handled by the informal recyclers (Amoyaw-Oseiet al.,2010). Between 10,000 and 13,000 metric tons of e-waste are treated annually in Ghana by the informal sector (Prakashet al.,2010).

Health and Safety Impact Assessment areas

The assessment areas included:

- Exposure to harmful substances
- Exposure during recovery of valuable materials
- Exposure of Children to e-waste
- Availability of Health and safety surveillance

3. RESULTS AND DISCUSSIONS

Age Profile of respondents

The demographic profiles of the e-waste dealers indicate that most of these e-waste dealers are under 18 years old and some are above 18 and 20 years of age. Most of the respondents agree that e-waste activities are beneficial due to income generation for their livelihood.

Thirty –three point 4 percent (33.4%) of the respondents were within the age bracket of 23 to 30 while 46.6%, were within 18 to 20 years.

Exposure to harmful substances

The health and safety impact is due to exposure to over 1,000 harmful substances such as lead, mercury, nickel, brominated flame retardants and polycyclic aromatic hydrocarbons (PAHs) which can cause negative birth outcomes like premature birth, changes in lung functions, respiratory issues, DNA damage, impaired thyroid function and increased risk of some chronic diseases later in life. The respondents at the two site had poor undersatanding and knowelde of the presences of these harmful substances . The full complents of PPEs were not avaible to used to manage this risks

Recovery of valuable materials

The health and safety impact is due to workers who aim to recover valuable materials such as copper and gold are at risk of exposure to these harmful substances. Where wet chemical leaching is done to extract precious metals such as gold or silver immediately with wet chemical processes exposes worker's hazardous substances such as dioxins and gaseous lead. If this processes are not performed under controlled conditions (heat regulation), very hazardous substances are released which can be lethal the workers. Currently these processes are not being done under controlled workplace condition

Exposure of Children to e-waste

E-waste is made up of different hazardous substances such as heavy metals and persistent organic pollutants with the capacity to contaminate the environment if processed or recycled inappropriately. Humans and animals become exposed to e-waste constituents via ingestion, inhalation, and dermal contact. Several health effects have been linked to e-wastes. The most susceptible are children, pregnant women, and workers in primitive recycling sites.

Exposure to lead from e-waste recycling activities has been associated with significantly reduced neonatal behavioural neurological assessment scores, increased rates of attention deficit/hyperactivity disorder (ADHD), behavioural problems, changes in child temperament, sensory integration difficulties and reduced cognitive and language scores (WHO ,2021)

Currently there are no mechanisms to monitor the health and safety impact on children at the two e-waste management sites.

Availability of Health and safety surveillance programme

E-waste workers are exposed to a variety of chemicals including metals, particulates, persistent organic compounds, and flame retardants. Exposure varies according to job task with higher exposures observed for dismantling and burning e-waste. Exposure to job stress and physical hazards (e.g., noise) also occurs.

Many studies have measured workers' exposure in the e-waste recycling industry; fewer have investigated health effects. Biological measures were reported more often than external exposure measures. In order to protect workers, efforts are required to better understand exposures and their health effects. Removing hazardous materials from electronic equipment and reducing e-waste production would benefit workers, communities, and the environment. (Julander et al,2012; Kiddee et al, 2018; Song Q et al,2015; Adesokan ,20160; Zeng X et al,2017)

The few researches done in Ghana can form the basis for the establishment of a health surveillance programme in Ghana. (Srigboh,2016; Amankwaa et al,2017; Obiri S et al,2016)

Recycling and Final Disposal Facilities in Ghana

There are several e-waste recycling facilities in Ghana to ensure a sound Environmentally Friendly E-waste management practices. Some of the notable facilities include:

- **Electro Recycling Ghana Limited**: This is a certified waste disposal company and operator of an approved primary treatment facility. As the leading and only e-Waste company located in Ghana, it is their mission to promote sustainability, a clean recycling process and a fair workspace with high quality standards ERG Limited Electrorecycling in Ghana (electro-recycling.com)

- **Neweco E-waste Recycling Ghana**: Neweco is an e-waste company recycling electronic waste (e-waste) in Ghana Their mission is keeping the environment of Ghana, Africa green and healthy by recycling electronic waste instead of the e-waste going to landfills. Neweco E-waste Recycling Ghana (ghana-ewaste.com)

- **E-MAGIN Ghana**: E-MAGIN Ghana is an initiative aimed at promoting sustainable e-waste management practices in Ghana. The project seeks to establish a sustainable e-waste management system that will ensure that e-waste is managed in an environmentally sound manner. (E-waste management in Ghana (E-MAGIN Ghana): From cradle to grave (unep.org)

The Technical Guidelines on Environmentally Sound E-Waste Management for Collectors

(Tier 1), Collection Centers (Tier 2), Transporters (Tier 3), Treatment Facilities (Tier 4) and Final Disposal (Tier 5) in Ghana have been developed by the Environmental Protection Agency (EPA) with the support of the project "Sustainable Recycling Industries" (SRI) funded by the Swiss State Secretariat for Economic Affairs (SECO) between 2015-2018. (EPA,2018)

The guidelines are mandatory in compliance with Act 917, Act 328 and LI 2250 with respect to every undertaking operating in the field of collection, storage, transport, treatment and final disposal of e-waste in Ghana. These guidelines have provided the means to enforce the legal provisions of Environmental Protection Agency.

4. CONCLUSIONS

There is significant progress in the Health and Safety assessment and risk mitigation infrastructure in Ghana but more effort is needed from the Ghanaian regulatory authorities and relevant stakeholders both local and international partners to ensure e-waste workers and the environment are adequately protected from the risks associated e-waste waste management practices in Ghana.

ACKNOWLEDGEMENT

Funding for this project was provided by Andrew Mellon Establishment scholarship plot, University of Ghana Legon (Grant /Project no G-31700720.

REFERENCES

[1] Agyei-Mensah, S., & Oteng-Ababio, M. (2012). Perceptions of health and environmental impacts of e-waste management in Ghana. *International Journal of Environmental Health Research*, *22*(6), 500–517. https://doi.org/10.1080/09603123.2012.667795

[2] Akortia, E., Olukunle, O. I., Daso, A. P., & Okonkwo, J. O. (2017). Soil concentrations of polybrominated diphenyl ethers and trace metals from an electronic waste dump site in the Greater Accra Region, Ghana: Implications for human exposure. *Ecotoxicology and Environmental Safety*, *137*, 247–255. https://doi.org/10.1016/j.ecoenv.2016.12.008

[3] Akram, R., Natasha, Fahad, S., Hashmi, M. Z., Wahid, A., Adnan, M., Mubeen, M., Khan, N., Rehmani, M. I. A., Awais, M., Abbas, M., Shahzad, K., Ahmad, S., Hammad, H. M., & Nasim, W. (2019). Trends of electronic waste pollution and its impact on the global environment and ecosystem. *Environmental Science and Pollution Research*, *26*(17), 16923–16938. https://doi.org/10.1007/s11356-019-04998-2

[4] Alabi, A. O., & Bakare, A. A. (2017). Genetic damage induced by electronic waste leachates and contaminated underground water in two prokaryotic systems. *Toxicology Mechanisms and Methods*, *27*(9), 657–665. https://doi.org/10.1080/15376516.2017.1349228

[5] Alabi, O. A., Bakare, A. A., Xu, X., Li, B., Zhang, Y., & Huo, X. (2012). Comparative evaluation of environmental contamination and DNA damage induced by electronic-waste in Nigeria and China. *Science of the Total Environment*, *423*, 62–72. https://doi.org/10.1016/j.scitotenv.2012.01.056

[6] Alam, O., Wang, S., & Lu, W. T. (2018). Heavy metals dispersion during thermal treatment of plastic bags and its recovery. *Journal of Environmental Management*, *212*, 367–374. https://doi.org/10.1016/j.jenvman.2018.02.034

[7] Ali, I. H., Siddeeg, S. M., Idris, A. M., Brima, E. I., Ibrahim, K. E., Ebraheem, S., & Arshad, M. (2019). Contamination and human health risk assessment of heavy metals in soil of a municipal solid waste dumpsite in Khamees-Mushait, Saudi Arabia. *Toxin Reviews*, *40*(1), 102–115. https://doi.org/10.1080/15569543.2018.1564144

[8] Awasthi, A. K., Zeng, X., & Li, J. (2016). Relationship between e-waste recycling and human health risk in India: a critical review. *Environmental Science and Pollution Research*, *23*(12), 11509–11532. https://doi.org/10.1007/s11356-016-6085-7

[9] Basu, N., Ayelo, P., Djogbenou, L., Kêdoté, M., Lawin, H., Tohon, H., Oloruntoba, E. O., Adebisi, N. A., Cazabon, D., Fobil, J. N., Robins, T. G., & Fayomi, B. (2016). Occupational and Environmental Health Risks Associated with Informal Sector Activities—Selected Case Studies from West Africa. *New Solutions: A Journal of Environmental and Occupational Health Policy*, *26*(2), 253–270. https://doi.org/10.1177/1048291116651726

[10] Black, M. M., Karki, J., Lee, A. T., Makai, P., Baral, Y., Kritsotakis, E. I., Bernier, A., & Heckmann, A. F. (2019). The health risks of informal waste workers in the Kathmandu Valley: a cross-sectional survey. *Public Health*, *166*, 10–18. https://doi.org/10.1016/j.puhe.2018.09.026

[11] Boudier, F., & Bensebaa, F. (2011). Hazardous Waste Management and Corporate Social Responsibility: Illegal Trade of Electrical and Electronic Waste. *Business and Society Review*, *116*(1), 29–53. https://doi.org/10.1111/j.1467-8594.2011.00376.x

[12] Cazabon, D., Fobil, J. N., Essegbey, G. O., & Basu, N. (2017). Structured identification of response options to address environmental health risks at the Agbogbloshie electronic waste site. *Integrated Environmental Assessment and Management*, *13*(6), 980–991. https://doi.org/10.1002/ieam.1964

[13] Grant, R. W., & Oteng-Ababio, M. (2012). Mapping the Invisible and Real "African" Economy: Urban E-Waste Circuitry. *Urban Geography*, *33*(1), 1–21. https://doi.org/10.2747/0272-3638.33.1.1

[14] Ha, N. N., Agusa, T., Ramu, K., Tu, N. T., Murata, S., Bulbule, K., Parthasaraty, P., Takahashi, S., Subramanian, A., & Tanabe, S. (2009). Contamination by trace elements at e-waste recycling sites in Bangalore, India. *Chemosphere*, *76*(1), 9–15. https://doi.org/10.1016/j.chemosphere.2009.02.056

[15] EPA (2021). Controlling e-waste hazards and risks | Environment Protection Authority Victoria (epa.vic.gov.au)

[16] WHI,2021. Soaring e-waste affects the health of millions of children, WHO warns.

[17] Srigboh RK, Basu N, Stephens J, Asampong E, Perkins M, Neitzel RL, et al. Multiple elemental exposures amongst workers at the Agbogbloshie electronic waste (e-waste) site in Ghana. Chemosphere. 2016; 164:68–74.

[18] Amankwaa EF, Adovor Tsikudo KA, Bowman J. 'Away' is a place: the impact of electronic waste recycling on blood lead levels in Ghana. Sci Total Environ. 2017;601–602:1566–74.

[19] Julander A, Lundgren L, Skare L, Grandér M, Palm B, Vahter M, et al. Formal recycling of e-waste leads to increased exposure to toxic metals: an occupational exposure study from Sweden. Environ Int. 2014; 73:243–51.

[20] Obiri S, Ansa-As are OD, Mohammed S, Dark HF, Darted AG. Exposure to toxicants in soil and bottom ash deposits in Agbogbloshie, Ghana: human health risk assessment. Environ Monit Assess. 2016;188(10):583.

[21] Kiddee P, Decharat S. Risk assessment of lead and cadmium exposure from electronic waste recycling facilities in Southern Thailand. Environ Earth Sci. 2018;77(12):1–7.

[22] Song Q, Zeng X, Li J, Duan H, Yuan W. Environmental risk assessment of CRT and PCB workshops in a mobile e-waste recycling plant. Environ Sci Pollut Res. 2015;22(16):12366–73.

[23] Adesokan MD, Adie GU, Osibanjo O. Soil pollution by toxic metals near e-waste recycling operations in Ibadan, Nigeria. J Health Pollut. 2016;6(11):26–33.

[24] Zeng X, Yang C, Chiang JF, Li J. Innovating e-waste management: from macroscopic to microscopic scales. Sci Total Environ. 2017; 575:1–5.

[25] EPA,2018 . Technical Guidelines on Environmentally Sound E-Waste Management for Collectors, Collection Centers, Transporters, Treatment Facilities and Final Disposal in Ghana

[26] ERG Limited - Electrorecycling in Ghana (electro-recycling.com) accessed 29th August 2023

[27] Neweco E-waste Recycling Ghana (ghana-ewaste.com) accessed 29th August 2023

[28] E-waste management in Ghana (E-MAGIN Ghana): From cradle to grave (unep.org) accessed 29th August 2023