

## The environmental health risk effect and the possible renewable energy potential of the solid waste dump site in Riverton City, Kingston, Jamaica

Aruna M. Jarju<sup>1</sup> and Stephanie Cato<sup>2</sup>

<sup>1</sup>King Graduate School - Monroe College, USA

<sup>2</sup>New York City College of Technology - Citytech, USA

Copyright © 2022 ISSR Journals. This is an open access article distributed under the *Creative Commons Attribution License*, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**ABSTRACT:** Air is one of the most indispensable components that are crucial to the sustainability of life. Air pollution threatens the health of humans and other living beings on our planet. Choudhary et al., (2013). Managing air pollution has become a difficult challenge because air pollutants have become a universal concern Adams and Kanaroglou (2016). When high levels of air contaminants such as nitrogen, lead, carbon monoxide, and sulfur oxides are present in an environment, humans' health is compromised. There are numerous countries today that are processing waste from consumers and converting it to renewable energy. The chief executive officer of Harvest Power - Chris Kasper conveyed that "Waste is a problem that can't be ignored". He believes that it is significant to recycle waste and make societies naturally healthy. This study will focus primarily on Riverton City and surrounding areas in Kingston, Jamaica. The primary purpose of this study is to determine the environmental health risk effect and the possible renewable energy potential of the solid waste dump site in Riverton City, Kingston, Jamaica.

**KEYWORDS:** Waste disposal, air pollutants, environmental health risk, and renewable energy.

### INTRODUCTION

Jamaica like many other countries in the Caribbean, mismanagement of waste from households and markets has become the country's main concern. A solid waste (SW) mismanagement is a global issue in terms of environmental contamination, social inclusion, and economic sustainability [3,14], which requires integrated assessments and holistic approaches for its solution [1]. Attention should be paid in developing and transition countries, where the unsustainable management of SW is common [13]. Differences should be highlighted between developing big cities and rural areas, where management issues are different, specifically regarding the amount of waste generated and the SW management (SWM) facilities available [2]. Poverty marks a serious issue and thus, the people living around the site don't seem to worry about implementing measures that will help in the management of the waste dumped at the Riverton dumping site.

At the dumping site in Riverton City, Kingston, heavy material waste, and household waste are the main waste types disposed of and burn as a way of treatment. Uncontrolled disposal generates serious heavy metals pollution occurring in the water, soil, and plants [14], open burning is caused by CO, CO<sub>2</sub>, SO, NO, PM<sub>10</sub>, and other pollutant emissions that affect the atmosphere [9]. Therefore, SW mismanagement is caused by severe and various environmental and social impacts, which do not allow improvements in sustainable development.

Effective solid waste management in Jamaica is a major challenge. There are no strategies of waste disposition noted at the Riverton dumping site and how to improve its sustainability. Another important point that will be focused on in this paper is the public awareness of how dangerous the dumping site is to the people living in the area. At the Riverton Dumping site in Kingston - Jamaica, open burning at the landfill/dumping site is the only way to get rid of the waste. Research has proven that open burning causes a lot of environmental and health problems. The open burning of waste, whether at individual residences, businesses, or dumpsites, is a large source of air pollutants [16]. It is important for the Jamaican authorities to take a step in

improving the technology of waste treatment at the Riverton City Dumping site. This study will help the government with strategies and the technology / s that could be used to improve the treatment of the Riverton City Dumping site.

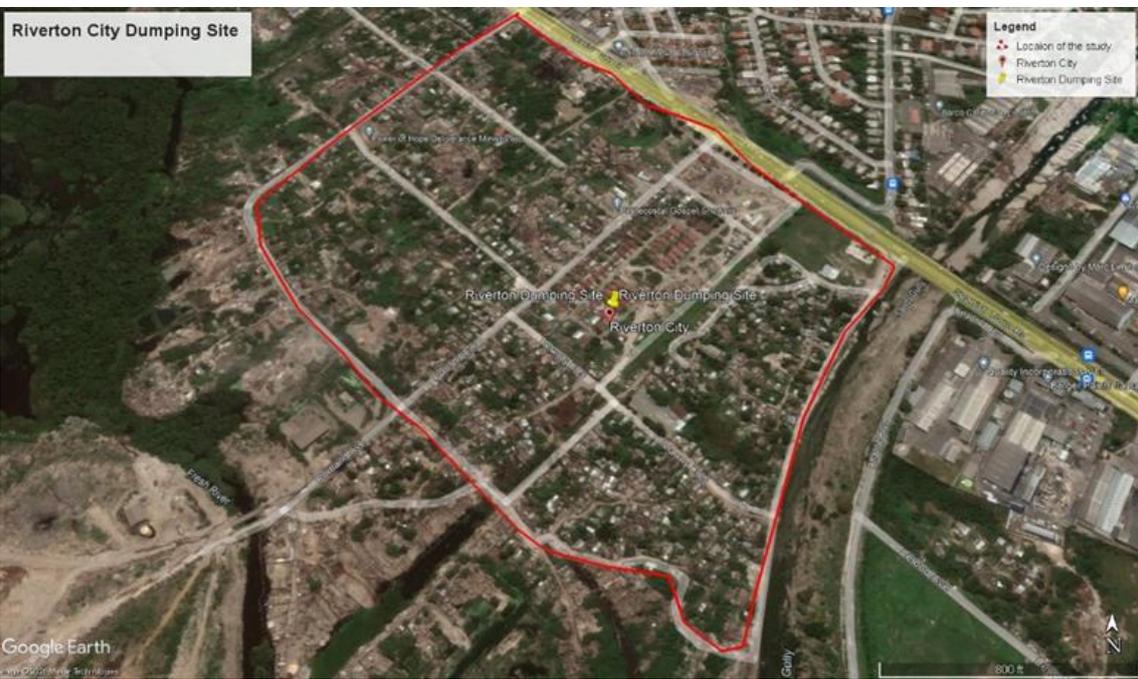
There is a huge concern for any change at the site but a change for good would be great for the population living around the dumping site. There are many attempts to close the dumping site at Riverton city but the people working on the site are concerned about how they will survive since the site is the only source of income for them.

The technology that could be implemented could be the use of steam turbines run through a natural gas from a small-scale biogas plant. The plant will help improve the health condition of the residents living within the peripheral of the Riverton dumping site.

**RIVERTON DUMPING SITE**

The Riverton City dumpsite is one of the most prominent and probably one of the largest sites in Jamaica. It is located in Kingston the densely populated city of Jamaica fig. A. On a daily basis, waste is dumped at the site and smoke is viewed coming from the burning of the solid waste.

**Fig-A**



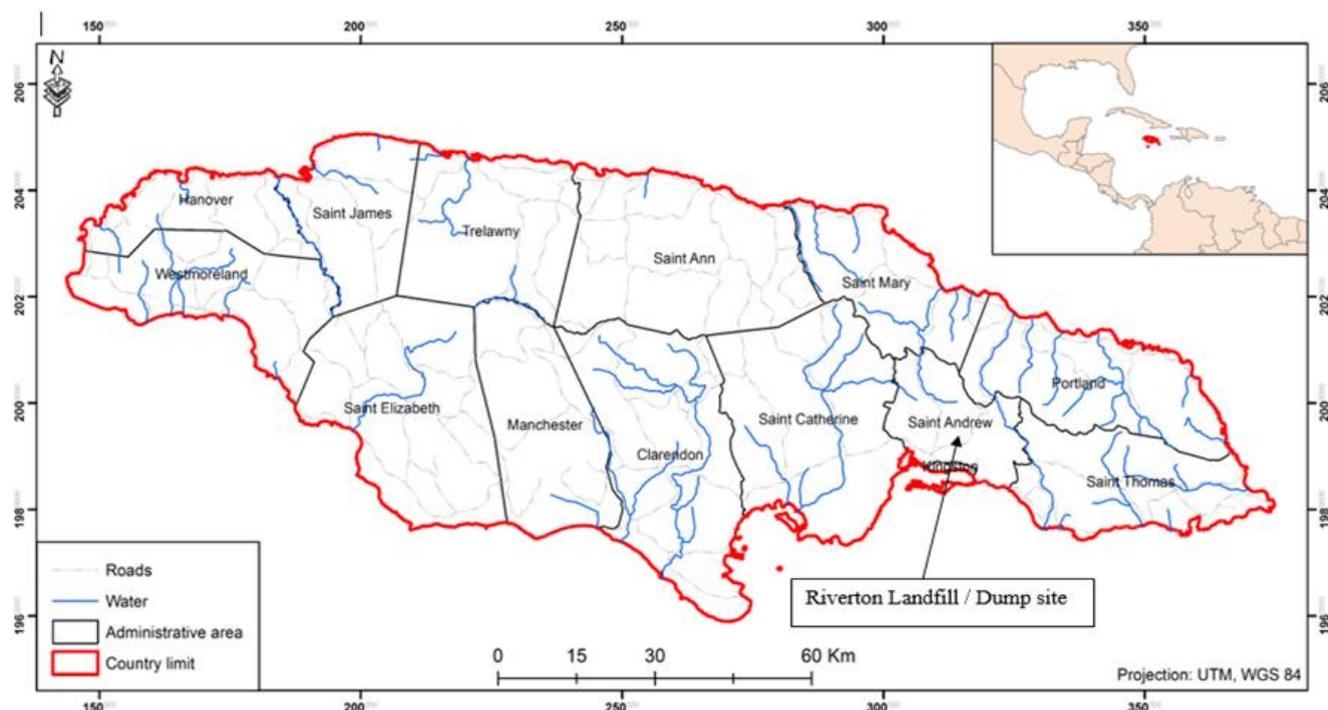
**Fig-B**



**LOCATION OF THE STUDY**

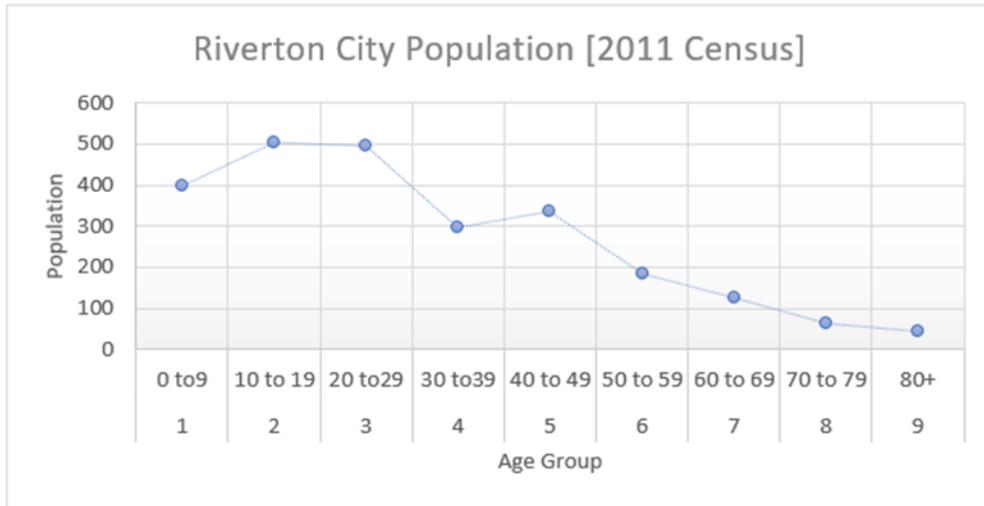
The Riverton City dumping site is located in the city of Riverton -Kingston. Riverton like a few of its Kingston neighbors is an urban community city in Jamaica. It has an area of 1.387 Km<sup>2</sup>, with a population density of 1,764 / Km<sup>2</sup> [2011 population census]. Unlike other dumping sites in the world, Riverton city dumping site is a source of income for the population living around the dumping site. Metal scraps and other unwanted things were dumped at the site and collected by the residents, recycled, and sold to the population of Riverton.

The population of Riverton according to the 2011 census is 2,448 out of which 1,594 are male and 854 are female. The age bracket is shown in table 1 below.



#	Year Bracket / Generation	Population
1	0-9	399
2	10-19	503
3	20-29	495
4	30-39	298
5	40-49	336
6	50-59	185
7	60-69	124
8	70-79	64
9	80+	44

Source: Jamaican Government



Source: Jamaican Gov.

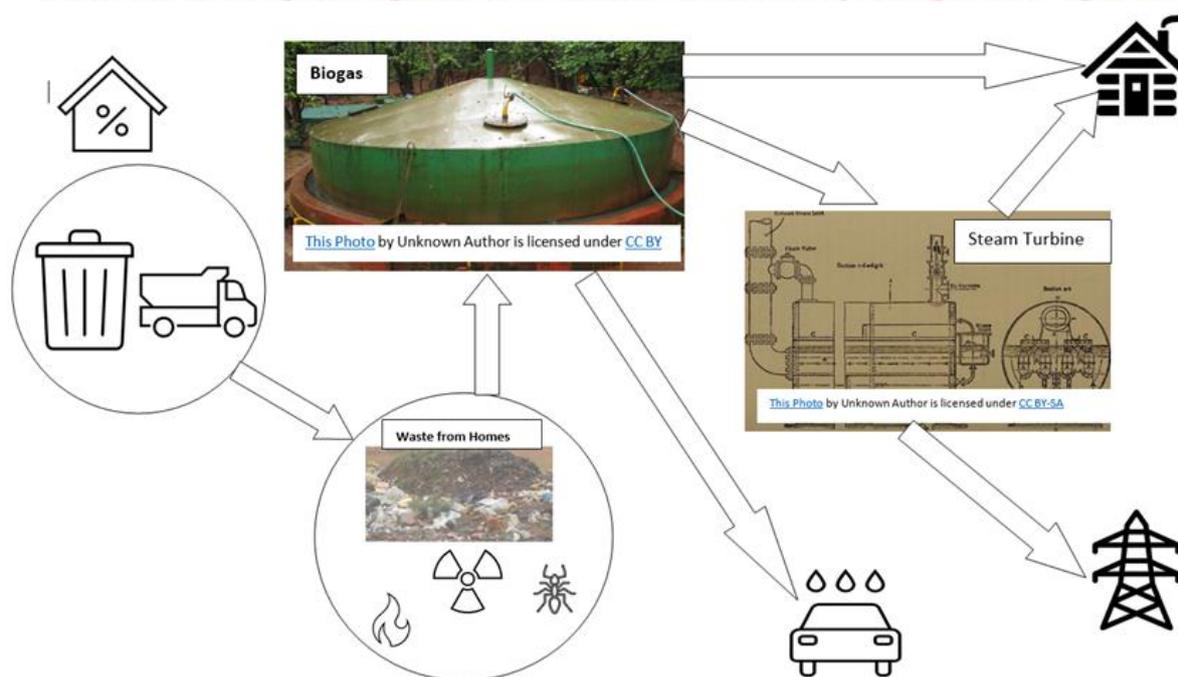
This graph clearly identifies that the highest population of the people living in Riverton city falls under the age of 10 to 29. These group pages are also predicted by this research that they are the ones who are vulnerable to the exposure of the smoke from the dumping site because they are likely to be the ones to work at the site to earn a living.

**METHOD**

**TURNING THE SITE INTO AN ENVIRONMENTALLY FRIENDLY DUMPING SITE**

It is important to note that the residents need the dumping site for economic reasons, thus the Jamaican Government should work with the municipality of Kingston to identify a better way of generating income for the residents around the Riverton Dumping site. This study recommends the use of a biogas plant to generate energy to run steam turbine engines that will supply energy to the residents of Kingston and the surrounding area. The waste collected from the Kingston Municipality and the surrounding can be separated. The metal and other heavy materials can be recycled in other ways, while the soft waste can be used in an anaerobic biogas plant [Fig 1] that can be used to run a wind turbine generator that could be used to supply power to the people living in Kinston and the surrounding.

## RIVERTON CITY LANDFILL / DUMP SITE



### RESULTS AND DISCUSSION

The major concern was how the site could be managed in a better way and help safeguard the health condition of the population living around the dumping site. The solution to the problem at this point is to create a source of income-generating mechanism that will encourage the people to frequent the site to avoid exposure to the smoke at the Riverton dumping site.

Smoke coming from Landfill fires is generally dangerous to our health. They are also hazardous to our environment. smoke from the combustion of the wide range of materials contained within the landfill. The smoke contains many different gases e.g., carbon monoxide, hydrogen sulfide, methane, and other volatile organics which could be of huge concern to the population of Riverton - Kingston.

Another important factor that is discussed in this paper, is the presence of leachate at the dumping site, especially during the rainy season. Leachate is a dangerous chemical that could cause cancer, it contains harmful chemicals that could cause serious human health issues. The Riverton City dump is Jamaica's largest solid waste disposal site, but it lacks engineered protection for leachate containment and treatment [17]. A follow-up of this study would look at the exposure of the water sources: wells and rivers surrounding the dumping site.

### CONCLUSION

This study has the objective of identifying the problems and informing the government about the technologies that could be used for waste management at the Riverton Dumping Site - Kingston. Unlike other dumping sites around the globe, the Riverton Dumping site is an income-generating dumping site for its population. Things that are thrown at the site are collected reused or sold to the people again. To better manage the dumpsite, you must first create a source of income for the people. Building a biogas plant will be a source of income and a lifesaving mechanism for the people living within the peripheral of the dumping site. The biogas plant will generate natural gas to the household for cooking, electricity to the households, and biomethane that could be used for small generators and vehicles.

## RECOMMENDATIONS

We recommend the Jamaican government take any action to avoid the hazardous actions of recycling taking place at the Riverton dumping site. The population living in the city has no other sources of income but at the dumping site. People get sick and probably die in some cases, thus it is very important to put forward a mechanism that will help prevent people from air pollution and other environmentally related exposure to ailments. Building a biogas plant at the site will not only prevent exposures to chemicals but create jobs for the youth.

## ACKNOWLEDGMENT

We acknowledge the assistance of a King Graduate School student- Titus Kirwa, who gathered all the literature that is used to conduct this research.

## REFERENCES

- [1] Bing X., Bloemhof J.M., Ramos T.R.P., Barbosa-Povoa A.P., Wong C.Y., van der Vorst J.G.A.J. Research challenges in municipal solid waste logistics management. *Waste Manag.* 2016; 48: 584-592. DOI: 10.1016/j.wasman.2015.11.025. Research challenges in municipal solid waste logistics management - ScienceDirect.
- [2] Ferronato N., Rada E.C., Gorritty Portillo M.A., Cioca L.I., Ragazzi M., Torretta V. Introduction of the circular economy within developing regions: A comparative analysis of advantages and opportunities for waste valorization. *J. Environ. Manag.* 2019; 230: 366-378. DOI: 10.1016/j.jenvman.2018.09.095. [PubMed], [CrossRef], [Google Scholar].
- [3] Ghisolfi V., Chaves G.D.L.D., Siman R.R., Xavier L.H. System dynamics applied to closed-loop supply chains of desktops and laptops in Brazil: A perspective for social inclusion of waste pickers. *Waste Manag.* 2017; 60: 14-31. DOI: 10.1016/j.wasman.2016.12.018. [PubMed], [CrossRef], [Google Scholar].
- [4] Gupta N., Yadav K.K., Kumar V. A review on the current status of municipal solid waste management in India. *J. Environ. Sci. (China)* 2015; 37: 206-217. DOI: 10.1016/j.jes.2015.01.034. [PubMed], [CrossRef], [Google Scholar].
- [5] Hettiarachchi H., Meegoda J.N., Ryu S. Organic Waste Buyback as a Viable Method to Enhance Sustainable Municipal Solid Waste Management in Developing Countries. *Int. J. Environ. Res. Public Health.* 2018; 15: 2483. doi: 10.3390/ijerph15112483. [PMC free article], [PubMed], [CrossRef], [Google Scholar].
- [6] Lahore Electric Supply Company Schedule of Electricity Tariff W.E.F 2019. Available online: <https://lescobillonline.net/lescotariff/> (accessed on 1 February 2021).
- [7] Matter A., Ahsan M., Marbach M., Zurbrügg C. Impacts of policy and market incentives for solid waste recycling in Dhaka, Bangladesh. *Waste Manag.* 2015; 39: 321-328. doi: 10.1016/j.wasman.2015.01.032. [PubMed], [CrossRef], [Google Scholar].
- [8] Mwesigye A, Kucel SB, Sebbit A. Opportunities for generating electricity from municipal solid waste: the case of Kampala City council landfill. In: *Proceedings of the second international conference on advances in engineering and technology, Nagapattinam, India; 2012.*
- [9] Ouda O.K.M., Raza S.A., Nizami A.S., Rehan M., Al-Waked R., Korres N.E. Waste to energy potential: A case study of Saudi Arabia. *Renew. Sustain. Energy Rev.* 2016; 61: 328-340. DOI: 10.1016/j.rser.2016.04.005. [CrossRef], [Google Scholar].
- [10] Sadeq Y., Nizami A.S., Batool S.A., Chaudary M.N., Ouda O.K.M., Asam Z.Z., Habib K., Rehan M., Demirbas A. Waste-to-energy and recycling value for developing integrated solid waste management plan in Lahore. *Energy Sources Part B Econ. Plan. Policy.* 2016; 11: 569-579. DOI: 10.1080/15567249.2015.1052595. [CrossRef], [Google Scholar].
- [11] S Kaza, LC Yao, P Bhada-Tata, F Van Woerden What A Waste 2.0 A Global. Snapshot of Solid Waste Management to 2050. Vol Urban Deve International Bank for Reconstruction and Development / The World Bank, Washington, DC (2018), 10.1596/978-1-4648-1329-0 Google Scholar.
- [12] Sawadogo M., Tacchini Tanoh S., Sidibé S., Kai N., Tankoano I. Cleaner production in Burkina Faso: Case study of fuel briquettes made from cashew industry waste. *J. Clean. Prod.* 2018; 195: 1047-1056. DOI: 10.1016/j.jclepro.2018.05.261. [CrossRef], [Google Scholar].
- [13] S Srigirisetty, T Jayasri, C Netaji Open Dumping of municipal solid waste - impact on groundwater and soil Tech. Res. Organ. India, 4 (6) (2017), pp. 26-3 <http://troindia.in/journal/ijcesr/vol4iss6/26-33.pdf>View Record in Scopus Google Scholar.
- [14] The World Bank. *What a Waste: A Global Review of Solid Waste Management.* The World Bank; Washington, DC, USA: 2012. [Google Scholar].
- [15] Vitorino de Souza Melaré A., Montenegro González S., Faceli K., Casadei V. Technologies and decision support systems to aid solid-waste management: A systematic review. *Waste Manag.* 2017; 59: 567-584.

doi: 10.1016/j.wasman.2016.10.045. [PubMed], [CrossRef], [Google Scholar].

- [16] Vongdala N., Tran H.D., Xuan T.D., Teschke R., Khanh T.D. Heavy metal accumulation in water, soil, and plants of a municipal solid waste landfill in Vientiane, Laos. *Int. J. Environ. Res. Public Health*. 2019; 16: 22. doi: 10.3390/ijerph16010022. [PMC free article], [PubMed], [CrossRef], [Google Scholar].
- [17] Wiedinmyer C., Yokelson R.J., Gullett B.K. Global emissions of trace gases, particulate matter, and hazardous air pollutants from open burning of domestic waste. *Environ. Sci. Technol.* 2014; 48: 9523-9530. DOI: 10.1021/es502250z. [PubMed], [CrossRef], [Google Scholar].
- [18] Aneisha M. Collins-Fairclough, a Rebecca Co, b Melessa C. Ellis, a Laura A. Hugb, Widespread Antibiotic, Biocide, and Metal Resistance in Microbial Communities Inhabiting a Municipal Waste Environment and Anthropogenically Impacted River, September/October 2018 Volume 3 Issue 5 e00346-18, [https://www.researchgate.net/publication/327892767\\_Widespread\\_Antibiotic\\_Biocide\\_and\\_Metal\\_Resistance\\_in\\_Microbial\\_Communities\\_Inhabiting\\_a\\_Municipal\\_Waste\\_Environment\\_and\\_Anthropogenically\\_Impacted\\_River](https://www.researchgate.net/publication/327892767_Widespread_Antibiotic_Biocide_and_Metal_Resistance_in_Microbial_Communities_Inhabiting_a_Municipal_Waste_Environment_and_Anthropogenically_Impacted_River).