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Dompoase Landfill in the Kumasi Metropolitan Area of Ghana: A 'Blessing' or a 'Curse'?

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ABSTRACT

The challenge of managing solid waste effectively is becoming crucial in the Kumasi Metropolitan Area largely due to rapid urbanization, poor financing capacity of authorities and lack of safe waste disposal sites. More than 90% of solid waste generated was not properly disposed off until 2004 when the Dompoase Landfill was constructed to be the final disposal site for all the wastes produced in the metropolis. The project has been hailed as a 'blessing' from the point of view of costs, location and environmental impacts. Waste in the landfill is also to be used to produce energy and fertilizer through composting. However, the operation of the landfill has come with very daunting challenges as people who reside close to it and the general public has put up fierce resistance in an effort to protect their right to live in a healthy and hazard-free environment. The aim of this paper is to highlight some of the benefits as well as the health and environmental effects of the Dompoase Landfill. Using mainly qualitative techniques, this study shows that the Dompoase Landfill has been a source of livelihood to peri-urban agriculturalists that use the fertile lands on the fringes of the landfill despite the much anticipated negative environmental and health effects. The paper concludes that though the landfill has been a source of 'blessing' to some actors, it can also be a 'curse' due to its health hazards.

Key words: Contamination, landfill, open-dump, peri-urban agriculture, solid waste.

Introduction

The search for proper solid waste management options has engaged the attention of governments of many developing nations, Ghana inclusive. According to Tchobanoglous (1993), solid waste management may be defined as a discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations that are also responsive to public attitudes. Rapid urbanization over the past decades has resulted in high population concentration in major Ghanaian cities, thereby increasing pressure on urban infrastructure and services. Thus, the demand for environmental services such as water and waste disposal has increased tremendously (Songsore et al., 2005). Against this situation, city authorities in the country have not been able to keep pace with the growing waste disposal needs of the areas under their jurisdiction. The lack of waste disposal services has resulted in waste accumulation and unsanitary environmental conditions in many parts of these cities.

Urbanization in the Kumasi Metropolitan Area (KMA) has picked up a considerable momentum - over 2,022,919 million people are estimated to live in the metropolitan area with a growth rate of 5.4 per cent annually (KMA, 2010). This is a mixed blessing for the socio-economic stability of the city. This is because urbanization offers economies of scale and extensive benefits from economies of agglomeration. Despite

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numerous benefits of modernization, the metropolitan area remains largely hostage to poor and dysfunctional infrastructure. One manifestation of the city's poor infrastructure is its inability to manage and organize adequate collection and safe disposal of the solid waste within its jurisdiction, generated from the production and consumption activities. As a result, the KMA is saddled with a worsening waste situation which is proveing to be intractable and threatening public health and the environment. In 1995, the rate of domestic waste generation in Kumasi was estimated at 600 tons per day (Post, 1999). By 2005, 1,000 tons of solid waste was generated each day in the city; three years later, the KMA was collecting 1,200 tons a day, and a 2010 KMA document shows that 1,500 metric tons of waste is now generated in Kumasi each day (KMA, 2010).

There are a number of different options available for the management and treatment of solid waste including waste minimization, recycling, composting, energy recovery, and disposal at landfill or open dumpsite. Open refuse dumps, which are a common practice, are most commonly located at the perimeter of the city in open lots, wetland areas, or next to surface water sources. The open dumps are generally sited based on considerations of access by collection vehicles rather than public health effects. Generally, the widespread prevalence of uncontrolled dumping reflects the weak capacity of metropolitan authorities in dealing with the problem.

In 2004, Ghana achieved a major landmark in solid waste management practices when three landfills were constructed at Dompoase in the Kumasi Metropolis, the Tamale Metropolis and, the Sekondi-Takoradi Metropolis respectively. The Accra facility at Kwabenya, which is the fourth, has stalled (Oteng-Ababio, 2011). These projects were mostly sponsored by external donors including the World Bank and the DFID. All the new landfill sites were designed and developed with technical assistance from foreign consultants. Generally the trend has been to develop solid waste disposal sites alongside waste stabilization pond-based treatment systems for liquid wastes. The construction of the Dompoase landfill has been described as a 'blessing' because it is considered the most feasible option from the point of view of costs and level of environmental impacts. The project is seen as a panacea to the waste management problems in the Kumasi Metropolis. Despite the much touted benefits of the Dompoase Landfill by city authorities as the best solution to the waste management problems in the KMA, the project has also received negative publicity due to its health and environmental implications (Cointreau, 2005). The landfill is said to contain toxic groundwater contaminants, including nitrate, ammonia, solvents, PCBs, and heavy metals (Buenrostro et al., 2008). Once these substances reach groundwater, the contamination can be very damaging, particularly if it reaches drinking water wells. The project has thus been described as a 'curse' by the communities surrounding it. The main aim of this investigation is to examine the over emphasized benefits of the landfill as a panacea to solid waste management in the KMA and the neglected negatives. The study also seeks to determine the extent to which the landfill can be a 'blessing' or a 'curse' to its inhabitants, and the balance of effects – negative and positive – of the landfill on the residents.

Research Approach and Methods

Considering the self-evident nature of the situation at the Dompoase Landfill in the Kumasi Metropolis, the study reviewed extensive literature on the Dompoase Project in particular and landfill management in Ghana in general. We first conducted in-depth interviews with officials from the Environmental Protection Agency (EPA), Regional Coordinating Council (RCC), Kumasi Metropolitan Assembly (KMA) and the Community Water and Sanitation Agency (CWSA). The interviews covered themes on their role in waste management as well as their detailed knowledge about the project. Secondly, we interviewed the managers of the Dompoase landfill to understand the operations at the site, the major problems, and the socio-economic benefits to the wider community. Thirdly, we held three focus group discussions with residents in the communities close to the landfill, categorized into landowners, opinion leaders and ordinary residents.

This approach is deemed appropriate when the object of the research is to explore attitudes or reactions of a group or community in response to some commonly experienced aspects of their environment (Tsiboe, 2004). Through such interactive discourses, participants are able to offer insights on the perspective of the community, revealing clues to the social contexts that shape their opinions (Saleh 2002). Each focus group had eight participants composed of men and women. Issues discussed during the FGDs included the question of land ownership, access to water and its quality, their perception about negative and positive impacts of the landfill, identification of beneficiaries and affected persons/sectors of the communities and recommendations for improvements.

All the proceedings, which were mainly in the local language, were recorded and later transcribed, analyzed and organized around the key themes. Finally, we conducted water quality test on the various water sources available to the communities. All tests were conducted at the Ashanti Regional Laboratory of Ghana

Water Company Limited in Kumasi. Water samples were collected from River Oda at Dompoase (3 locations of fetch) and Well water samples from three Wells in the communities from three different locations.

Management of the Dompoase Landfill Site

The general guidelines concerning the construction and management of landfills in Ghana are embodied in the Local Government Act of 1994 (Act 462) and the Environmental Sanitation Policy (ESP) of 1999, revised in 2008. While regulatory authority is vested in the Environmental Protection Agency (EPA), general solid waste management in Ghana is the responsibility of the Ministry of Local Government and Rural Development, which supervises the decentralized Metropolitan, Municipal and District Assemblies (MMDAs). The MMDAs are responsible for the collection and final disposal of solid waste through their Waste Management Departments (WMDs) and their Environmental Health and Sanitation Units. The EPA Act (Act 490) was the enabling legislation and, with regard to waste management, enabled the Minister in charge of the Environment to make regulations concerning the type, quality or conditions or concentration of substances that may be released into the environment; and the collection, storage, recovery, recycling or disposal of substances which may be hazardous to the environment. The Ghana Landfill Guidelines, developed by the EPA (2002), is an attempt to promote and help upgrade landfills by improving site selection, waste compaction and drainage resulting in 'High Density Aerobic Landfills' and culminating in achieving operation of 'Sanitary Landfills' by 2020. The identification and final sitting of a landfill, its technical design, operation and final reclamation is a very complex task and requires qualified and trained personnel including civil and sanitary engineers, geologists, chemists, biologists, economists, lawyers, sociologists, etc. who will have to work in close cooperation to ensure efficient management of the site.

Figure 1: A Photo of Dompoase Landfill Site in the KMA

The Dompoase landfill (Fig. 1) is located in the Asokwa sub-metro and covers about 100 acres. The site is expected to be operational till 2018. It receives both solid and liquid waste from the municipality. The landfill conforms to some international specifications as it has a well-lined base and leachate collection and treatment ponds. The first pond serves as a settling pond, the second get the artificial aeration (aeration pond), and the third one serves as a final settling pond with only natural aeration. From the aerated pond, the partly treated leachate flows to the next water body which is river Oda at Digya community.

The EPA provides expert advice on the public health risks of chemicals, radiation and infectious diseases to local governments and a range of other stakeholders including members of the general public. In Ghana, the EPA is the main regulator of emissions from active landfill sites. The use of landfills for waste disposal in Ghana is becoming important due to the absence of recycling, recovery and re-use of waste. However, landfills are not subjected to strict controls which require sites to be designed and operated such that there is no significant impact on the environment or human health. The Ghana Landfills Guidelines (EPA, 2002) are the main piece of regulations relating to the control of emissions from landfills in the country and set some criteria on emissions and the management of a site. There are no strict restrictions on the types of waste that each landfill can accept and the practice of co-disposal of different waste types is permitted. Various materials including all liquid wastes, corrosive, explosive or flammable waste, hospital and clinical infectious waste are allowed to be deposited. Waste going to the landfill are not required to be pre-treated (including sorting) to enable recovery and recycling. In addition, there are no requirements to ensure that waste entering the landfill meets the relevant waste acceptance criteria for the class of landfill. This increases the amount of waste going to

the landfill. Interestingly, emerging issues on sustainable solid waste management have shown that the landfill can be one of the greatest economic assets to the communities where they are located.

Dompoase Landfill as a "Blessing"

An extensive interview with officials of the Waste Management Department of the KMA revealed that the Dompoase landfill is the recommended choice for solid waste disposal for the metropolitan area in the short to medium term because of its cost implications and environmental impacts. The long term intention of the project is to produce an alternative source of energy for the metropolis. According to the director of the Waste Management, the Dompoase project can produce 30 megawatts of energy if properly managed. Methane is generated as soon as solid waste is put in the landfill. Peak production starts about a year after deposit, but gas can be generated for 20 or more years, depending on the l landfill characteristics (Goldstein, 2006). The landfill has gas collection systems. The idea is that the authorities can drill small wells and install compressors and pipes to remove the gas. The gas will be collected in the pipes and then channeled to a central collection point, where it may be treated to remove contaminants and moisture. It then can be transported by pipeline or used on site to generate heat or electricity, or transformed into cleaner gas and sent to a natural gas pipeline. Studies have shown that landfill gas can be burned directly to generate electricity or it can be processed into a higher-energy gas for power generation. It can also be burned as a heat source for various industrial processes (U.S. Environmental Protection Agency, 2008). For example, in Denton (USA), landfill gas is used to produce biodiesel fuel. Gas wells from Denton's landfill supply gas for heating water, as part of a chemical process that converts vegetable oils and animal fats to biodiesel fuel (U.S. Environmental Protection Agency, 2008).

Assesing the benefits of various solid waste management projects has attracted little attention because of the overwhelming negative environmental and health implications of those projects. The agronomic benefit of the Dompoase Landfill was evidenced by the steady increase in the land area under cultivation and total output since the landfill became operational. The fringes of the landfill are flourishing with agricultural activity. There is further evidence that also suggest that agriculture already occupy up to 85 percent of the fringe area of the site, employ over 500 people (mainly farmers, labourers and traders), and has become an important centre for the supply of urban fresh vegetable needs in the Kumasi Metropolis (Ministry of Agriculture, 2010).

The variety of crops grown includes plantain, cassava, yam and vegetables of or all kinds (Fig. 2). One farmer in an interview had this to say:

"Though we sometimes complain about the negative effects, the soil has been helpful to me; I am able to harvest three times in a year". yam and vegetables of or all kinds (Fig. 2). One farmer in an interview had this to say:

Again, another farmer in a focus group discussion disclosed how he was able to pay for the children's school fees with proceeds from his harvest:

"I got almost GHS5,000,00 from the sale of my vegetables last year. I wish you could come and see how retailers come queuing for my lettuce, business was good last year."

The flourishing farming activities are enabled by the physical and chemical properties of the soil offered by the dumped waste. This practice can be a way of reducing urban food insecurity.

Figure 2 A Farmer harvesting vegetables on a farm on the fringes of the landfill site

One area where landfills have gained importance in developing countries, over the last two decades, is the support they offer for urban and peri-urban agriculture. The main reason for this is the concern for food security as towns and cities grow rapidly. One explanation for the growth and importance in agriculture in the Dompoase area is that it is a response to government policies of structural adjustment and subsequent retrenchment of labour that resulted in high unemployment and increasing urban poverty. Food produced locally from urban areas have several added benefits, including the provision of employment, reduction in the cost of food brought about by reduced cost of food transportation and diversification in local food sources resulting in

more secured supply (Osumanu, 2009). Beyond these considerations, however, concerns also arise on urban and peri-urban cultivation which include conflict over water supply, health particularly from use of contaminated wastes in cultivation and conflicting land use. Furthermore, this demonstrates the importance of matching waste with livelihood support systems in the wake of increasing urban unemployment in Ghanaian towns and cities and collaborates with Yaro (2008) who argue for economic and environmental sustainability as twin objectives rather than stand alone.

Another unintended benefit brought up by the Dompoase landfill is the construction of a 10 km road linking the Esreso Highway to the landfill site. The construction of this access road has brought much relief to the residents of the three communities located near the site. Hitherto, vehicular movement in these communities was restricted because of the bad nature of the road. Not only has the road been constructed but three bridges have also been constructed on the water bodies to facilitate the free flow of the tributary streams of River Oder. The access roads have opened up the communities and promoted economic activities. Shops and markets have sprung up and this is improving the lives of the communities. One joyous woman had this to say in an interview:

"……ever since they constructed this road, business is okay as many people now come here to buy our items. At first, the bad nature of the road prevented people from coming because they preferred Atonsu to this place".

She did not, however, care about the circumstances under which the road was constructed. In another interview, one resident recounted her happiness with the construction of the road.

"At first, the slightest drizzling will trigger off massive flooding, but ever since this road was constructed, flooding has been a thing of the past. We thank the government for this project".

Scavenging for scrap metals and recyclable plastic products is another blessing brought by the Dompoase Landfill. The landfill has become a source of scavenging and recovery activity that sometimes tend to nullify its negative aspects. Scavenging has been and still is a common activity that takes place in the informal sector in many developing countries. According to Di Gregorio (1994), scavenging, as an occupation, is a labour intensive industry which involves several individuals in the process of waste recovery. Different kinds of scrap metals and recyclable plastic materials are collected from the landfill on daily basis. The plastic materials and scrap metals collected are generally of higher quality compared to those collected from other points because of the non-separation of waste materials at source. Scavenging for plastic wastes and scrap metals have become a lucrative business for many residents at Dompoase and the surrounding communities as a result of the monetary incentives that come along with it (Owusu-Sekyere et al.,2013). The survey showed that scavengers are paid GHS8,000.00 for 10 tons of scrap metals and 25Gp for 1kg of plastic waste collected. Eighty percent (80%) of the scavengers at the landfill said it takes them between 2 to 3 weeks to do such a collection. In a focus group discussion, it came out that the pickers prefer the scrap metals because of the high demand and economic value. A 46 year old scrap dealer had this to say in a focus group discussion:

"……..as for the scrap metals, immediately you call the Tema Steel Company Officials, they come and weigh them and give you your money but with the plastic you may have to wait for a while and gather more before they will come and buy them, but how do you keep such bulky and filthy items".

This view was corroborated by other members in the group. Similarly, a 34 year old man explained how the market has been good for him with the empty plastic bottles:

"The plastic containers are patronized by the indigenous medicine practitioners who prepare traditional herbs. As we sit here, I have been contracted by Yareyeya Herbal Company to provide as many plastic containers as possible. This is real business for me".

Several companies have been established in Kumasi, Accra and Tema to recycle plastic wastes and scrap metals. One of such companies is Clamonia Limited located at Amanfrom, a suburb of the KMA. The company, which employs over 80 workers, buys the plastic waste materials from various locations. According the company's manager, their plant can recycle 18,000 tons of plastic waste a day and therefore looked beyond the metropolis for supplies:

"…….we go even beyond Sunyani and Techiman in the Brong Ahafo Region to get the products because the Ashanti Region alone is unable to supply our demand".

Tema Steel Company, the largest producers of iron rods and fabricated metals in Ghana, employs thousands of Ghanaian workers. The main source of its raw material is scrap metals obtained from scavengers. Blowplast Limited, another company that recycles plastic waste, has an organized network of about 100

people engaged in collecting plastic sachet wastes. They supply the company's 14 trucks that regularly pick up the waste from various areas. The plastic wastes are transported to Tema, where they are stored in a depot or warehouse that belongs to the company. The company collects between 7-8 tons of waste plastic sachets per day, but the capacity of the recycling plant is 24 tons. The company pays 20Gp per a kilogram of plastic waste. One kilogram contains about 200 plastic sachet wastes. Some individual collectors are able to collect up to 200 kg per day. This means that, on the average, some individual collectors are able to make over GHS40.00 a day which is higher than the nominal minimum daily wage of GHS4.48 in Ghana. Hence, the plastic waste is seen as a real "gold". Waste scavenging has become a means of livelihood, especially among the less privileged who have adopted multiple and diverse means of seeking a livelihood. In spite of the fact that scavengers understand the social and health implications of the trade, several individuals are in the trade without considering these implications of the profession. Several others are also not capable of changing their situations. This calls for an ideal combination of social and health education to create the platform for efficient exploitation of the economic value of waste and ensure sustainable livelihoods. The mounting waste consisting of all kinds of materials can therefore have potential socio-economic benefits not just for the very poor in society but the nation as a whole.

Dompoase Landfill as a "Curse"

Notwithstanding the enormous socio-economic potentials the Dompoase landfill offers to the communities in particular and the nation as a whole, the project has been described as a 'Curse' by the communities due to its impact on health and the environment. This description has largely been the case because of poor maintenance of the site by city authorities. This study investigated a wide range of health problems including water contamination, respiratory symptoms, irritations of the skin, nose, and eyes, gastrointestinal problems, fatigue, headaches, psychological disorders, and allergies. The paper relied on the results of the water quality test and residents reporting symptoms of diseases through interviews. The responses to questions of environment and health concerns of the landfill reflect the beliefs and perceptions of the community members regarding their overall health and quality of life.

The aim of the water quality analysis was to collect baseline water quality data on the various sources of household water supply in order to ascertain the underlying factors responsible for water contamination problems and evaluate their health risks to the population. The scope of work that was covered included the determination of microbiological properties different water sources. The Microbiological properties – faecal coliforms and E. coli contamination was the priority because of the link to infectious diarrhoeal diseases. Faecal coliform and Escherichia coliform (E. coli) contaminations were wide spread (Table 1). The available water sources showed E. coli and faecal coliform levels that were higher than the WHO recommended limits of zero (0). For water to be considered as no risk to human health, the fecal coliform and E. coliform counts/100ml should be zero (WHO 2004). The three different locations of the River Oda which serves as an alternative source of water for the communities showed high fecal coliform levels of 9.3, 13.7 and 10.1 respectively.

Table 1: Results of Water Quality Tests.

Source	Faecal Coliforms (cfu/100ml)	E. coli 100mg/l
1. R Oda		
i. location 1	9.3	5.3
ii. location 2	13.7	7.2
iii.location 3	10.1	6.1
2. Wells		
i, Well 1	5	2.1
ii, Well 2	4	1.4
iii Well 3	5	2.2
WHO Guidelines Value	0/100 ml (0-3/100 ml during epidemics).	0

Source: Tests Conducted at GWCL Regional Laboratory, September 2012.

Again, the same locations showed E.coli levels of 5.3, 7.2 and 6.1 respectively. The high level of fecal coliforms and E. coliform are signs of biological contamination and does not make the water suitable for domestic use without treatment (Toranzos and McFeters, 1997). It also indicates significant health risk to humans and other aquatic animals. For agriculture purposes, vegetables watered with these water sources may also be contaminated. But the poor microbial quality of water might also be due to contamination caused by human activities.

Although this study did not consider direct exposure measurement, increased prevalence of self-reported health symptoms such as fatigue, sleepiness, and headaches among residents near the landfill site were consistently reported. Similarly, residents complained that the regular unpleasant odours from the landfill

posed health problems by causing eye irritation or respiratory ailments. In a focus group discussion, one resident living proximal to the dumpsite had this to say:

"Whenever it rains, running water from the dumpsite runs through many of our homes depositing a lot of garbage in the process and the stench that accompanies it cannot be described, even our livestock and pets die when they drink from the gutters that have been contaminated by the dark-coloured water draining from the site".

An aggrieved resident in the community also complained that he thinks the site has exceeded its capacity but it is still being used, hence the compounded nature of the problems posed by the site. When reached for his comments on the landfill situation in the KMA, the head of WMD confirmed that Phase I of the disposal site had virtually reached their maximum limits and urgently requires closure:

"…….as a matter of urgency, we must move to Phase II in the months ahead because Phase I of the site has exceeded its capacity". Similar concerns were raised about the presence of odour in communities near the landfill site: "…..it is so bad that you can't even breath well, especially whenever it rains".

Odours are often key issues for landfill sites, especially those receiving biodegradable waste. Odourous emissions are usually accompanied by reports of ill-health from communities. Individuals reported a wide range of non-specific health symptoms, attributing these to odour exposure, including nausea, headaches, drowsiness, fatique and respiratory problems. Individual responses to odours are highly variable and are influenced by many factors including sensitivity, age and prior exposure to the odour (Macklin et al.,2011).
The presence of insects in the community was a source of worry as they were perceived to be the carriers of the disease causing organisms. In a focus group discussion, a 38 year old mother of three had this to say:

"…….when we first came to stay here about 10 years ago, you could sleep without covering yourself with cloth but since they started dumping refuse here about two years ago, my brother, you cannot walk about without covering the entire body. Look at my body, ……..swollen from mosquito bites. The situation is even worse in the night".

This situation was corroborated by a 47 year old man who said:

"…..as for me, I have sent my wife and kids to my brother's house at Achiase to stay there for a while because the situation is just unbearable".

Observations made around and within the living environments revealed the huge presence of flies in the kitchen and toilet areas. This presented a risk of exposure to food and drinking water. A 54 year old man could not hide his frustration and anger when he recounted how his entire house had been invaded by flies:

"…….the situation is worse when fresh deposits are made and at the same time the winds begin to blow. You may think the flies in the whole metropolis have been sent here, and the same can be said of mosquitoes especially at night".

Expressing similar sentiments, a 'Wakye' seller recounted how she has lost majority of her customers because of flies' invasion:

"…..now nobody wants to buy food from here because they say as you eat, you must drive away the flies with you left hand which creates a lot of inconvenience. In addition, the flies may enter your food and could make you sick".

It is widely known that cockroaches play a role in the transmission of diarrhoeal diseases. In addition, cockroaches are generally considered a nuisance, and can produce an unpleasant odour. The presence of cockroaches in the homes was associated with the same environmental conditions as flies.

Conclusion

The study has shown that the Dompoase Landfill has profound health and environmental consequences due to its improper management. At the same time, the landfill has played multiple and significant roles in the regional economy and impacted positively livelihoods. However, the continuous pursuance of technocratic and public health orientations in the landfill management has obscured the potential win-win attributes of the landfill. Findings from this study indicate that in spite of the numerous health challenges that landfills present, they are of enormous benefit to residents of their locations. Beside their agronomic significance, they offer opportunities for scavenging and income generation and further potential for energy production.
The evidence-base on the potential exposure of emission from the Dompoase Landfill is generally limited due to the inherent variability in the composition of waste and constraints in the waste management sector including budget and legislations. It is also difficult to conclude whether the symptoms reported in this study are an effect of direct toxicological action of chemical substances present in the waste site, an effect of stress and fears related to the waste site, or an effect of

reporting bias by residents. Risks to health from landfill sites are hard to quantify. There is insufficient exposure information and effects of low-level environmental exposure in the general population.

The paper recommends the need for a more interdisciplinary research to improve the levels of knowledge on risks to human health of waste landfill sites. Research needs to include epidemiologic and toxicological studies on individual risk perception and sociologic determinants of ill health. Improvements in landfill design and management, restrictions in the types of waste that can be handled and environmental legislation designed to minimize pollution should ensure that there is no significant risk to the health of the local population. The promotion of peri-urban cultivation and waste separation should be considered as part of a broader comprehensive strategy to improve livelihoods taking into consideration their environmental, social and economic consequences.

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