Land Pollution: Public health hazards and risks in the City of Bulawayo

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Abstract

In recent years, rapid urbanisation has led to dense population in cities. Population growth, urbanisation and industrialisation contribute to generation of large volumes of solid waste which cities in developing countries cannot cope with or manage. Hence, the quality of the urban environment is increasingly playing an important role in public health regarding a variety of issues including sustainable solid waste management. Land pollution resulting from poor management of solid waste contributes to health hazards and risks in urban environments. This study sought to identify factors that contribute to health hazards and risks in urban environments. A qualitative study design was used. Literature review, internal and external secondary sources of data were used to obtain data. Content analysis of media reports from local newspapers was also undertaken to substantiate other information. Findings from the review of literature and media reports show that land pollution is caused by illegal dumping of waste, poorly managed landfills and some methods of waste disposal. The major sources of health hazards and risks in environments, Bulawayo included, emanate from industrial, commercial and household waste. Microorganisms, chemicals and gases are emitted into the environment predisposing dwellers to diseases. Legislation and regulatory frameworks for control of pollution and waste management were evident in that many companies that contravened the regulations were fined by the Environmental Management Agency. The study recommends that adequate financing should be availed to ensure effective reduction of hazards and risks in urban environments. Community mobilisation, participation and education should be intensified in order to curb land pollution.

Key words: Public health, land, water and air pollution, waste disposal and health risks

Introduction

In recent years, rapid urbanisation has led to dense populations in the cities. As populations grow, the quality of the urban environment is increasingly playing an important role in public health regarding a variety of issues including sustainable provision of safe water, proper sanitation and waste disposal. Urbanisation is a global trend whereby urban areas are viewed as places that provide opportunities for individuals and families to live a better life, and also provide a healthy living environment through enhanced access to essential services.

In many developing countries, population growth and urbanisation have outpaced infrastructural development and responsible management of the environment. Population growth in cities has resulted in generation of large volumes of waste linked to industrialisation and urbanisation. However, most cities in developing countries do not have the capacity for efficient waste collection and management thereby leading to improper disposal of solid waste and resultant land
Pollution. Cities in Zimbabwe including Bulawayo, are faced with challenges of land pollution. According to the World Health Organisation (2013) rapid, unplanned and unsustainable approaches to urban development are making cities in developing countries key focal points for emerging environmental health hazards. Some of the health challenges associated with urbanisation are related to water and the environment, including land pollution. Urban authorities, therefore, need to be vigilant with regards to monitoring, prevention and control of health risks and hazards associated with land pollution.

Nathanson (2013) explains land pollution as the deposition of solid or liquid waste materials on land or underground in a manner that can contaminate the soil and ground water, threaten public health and cause unsightly conditions and nuisances. It reduces the quality of land and its productivity for agriculture, forestation and construction purposes and also leads to many health hazards. Global efforts to reduce land pollution have been discussed together with other environmental problems in various United Nations conferences and fora including the United Nations Environmental Programme, Earth Summit, Agenda 21, Rio + 20, Convention to Combat Desertification and others.

Background to the problem

Bulawayo is the second largest city in Zimbabwe and also a metropolitan province situated in the south-western part of the country in Matebeleland. It celebrated 120 years of existence in the year 2014. It was, for many decades, the industrial hub of the country with heavy and light industries, but most of the industries have since closed down or relocated to Harare. The city, like other cities in Zimbabwe, has been affected by the economic melt down and sporadic, but severe droughts which affected its capacity to deliver basic services, including adequate provision of safe water, refuse collection and disposal generated by industries, businesses and households in the past few years. Its population, according to the 2012 census is 655 675 whereas previously it was 750 000. (Newsday, 14 December 2012). This shows a downward trend or negative growth rate calculated to be -0.3%, probably consistent with the de-industrialisation of the city accompanied by retrenchments and relocations. The Bulawayo City Council also acknowledges that resource incapacitation has resulted in accumulation of waste and land pollution (Health Services Department Annual Report, 2013).

There have been random reports in the media about poor service delivery specifically with regards to waste removal from residential areas and vegetable markets. A visitors’ impression survey (2014) showed that 75% of visitors expressed dissatisfaction with refuse removal. In its annual report the City Health Services Department (2013) stated that it was still facing challenges of illegal dumping of waste despite education of residents. Such activities cause land pollution and damage to the environment and also affect the health of the residents. The U.S. Department of Health and Human Services (2014) reaffirms that environmental health is a critical dimension of urban health in that it contributes to control and prevention of diseases emanating from interaction between people and the environment. Although the Environmental Management Authority aggressively tried to control illegal activities related to waste disposal, the practice of improper disposal of waste by various players is still going on.

In view of this background, the study therefore, sought to identify the causes of land pollution in Bulawayo, public health risks and hazards and associated health problems. Specifically the study also attempted to determine the sources of solid waste that
caused land pollution and the legislative controls employed by the city in its efforts to control haphazard dumping of waste. Finally, the study made suggestions on how the local authority and urban dwellers could minimise the identified health risks and hazards at organisational, community, household and individual level.

The significance of the study is that its findings will help the City authorities to develop strategies to prevent and control land pollution and subsequently prevent diseases that may be linked to land pollution. The strategies should be inclusive and engage all the players from the council itself to industries, businesses, commercial establishments, communities, households and individuals.

**Review of Related Literature**

Pollution emanates from addition of any substance, solid liquid, gas or energy to the environment at a rate faster than it can be dispersed, diluted, decomposed, recycled or stored in some harmless form (Nathanson, 2014). Most pollution is thought to be man-made, the chief driver being the massive growth in population globally which has to be sustained by intensive agriculture and extensive industrial output. According to Hogan (2014) pollution is caused by activities from agriculture, industry, transportation, construction and solid waste.

Land pollution is the more visible type of pollution which may not be as popular as air and water pollution, but is nevertheless just as important as the other forms of pollution and in the long term has devastating effects on the environment, causes health hazards and ill health. A study conducted by Cornell University (2007), estimates that 40% of all deaths worldwide are linked to pollution. The study also highlights that land pollution does not affect land only, but that air and water can be polluted by decomposing waste when toxins are released into the air or water.

**Causes, hazards and health problems associated with land pollution**

There are many causes or sources of hazards and risks emanating from land pollution although some may also come from the atmosphere, for example, dust from quarry and mining activities settles down on land causing pollution. A public health risk can be viewed as something that is likely to be harmful to human health or can contribute to disease and includes rodents, vectors, waste and other harmful substances in the environment. On the other hand, a hazard from an epidemiological point of view is a factor or exposure that may adversely affect health (Last, 1994).

According to the World Health Organisation (WHO) (2014), in many developing countries a range of toxic effluents is emitted directly into soil, air and water from industrial and other operations at rates exceeding those tolerable to human health. Harmful effects of land pollution, on the environment and health have become a major global concern and there are many causes of land pollution but most of them are preventable. The causes can be classified into agricultural activities, industrial waste, construction activities and solid waste.

Land pollution in urban areas is mainly caused by municipal solid waste (MSW) which includes non hazardous waste from households, commercial establishments, businesses and industries. The waste may be biodegradable, dry or bulk unwanted items. Disposal of waste has cost implications and, therefore, people are expected to pay for collection of refuse and industries also incur costs for treatment of toxic waste before disposal. However, there is a tendency (by some residents and industries) of avoiding doing the right thing an attempt to cut costs on MSW collection. Some residents and industries dump waste in undesignated places, usually at night, which has potential to cause ill health and damage the environment. The
waste may contain chemicals which enter the body through breathing polluted dust or eating produce that is grown on polluted soil.

**Illegal dump sites**

Solid waste disposal can be a challenge to those who generate waste and they can end up dumping it illegally creating unsightly dump sites. A study conducted by Mudzengerere and Chigwenya (2012) in Bulawayo showed that 8% of residents do not have waste bins and it is this group that is likely to dump garbage in open spaces or the toxic or harmful chemicals and include unused fertilisers, paint, batteries, fluorescent and energy saver bulbs which contain mercury. These can cause land pollution if not disposed appropriately.

**Legislative control of land pollution**

Pollution is a global problem which has necessitated stringent controls over any activities that contribute to pollution. Countries have come up with legislation to facilitate control of all forms of pollution, however, due to competing interests between environmental protection and industrialisation as well as development, pollution continues to be a problem.

In Zimbabwe, the Environmental Management Act Cap 20:27 No. 12/2002 governs the management of solid waste. One of the mandates of the Act is to formulate measures for prevention of pollution and environmental degradation and is therefore used to enforce tight control over waste management which includes generation, collection, processing, transport and disposal of the waste. Part IX of the Act deals with Environmental Quality Standards with sections covering various aspects such as licensing of emissions, registration and cancellations of licences, prohibitions and offences among others. The Act also has provision for environmental impact assessment as part of environmental protection from potential damage related to planned projects. Local authorities, industries and manufacturers are required to comply with set standards and regulations as laid down in the Act and failure to do so may result in prosecution. Part IX Section 83 of the Act provides for prohibition against littering by discarding, dumping or leaving litter on any land, water surface, street or road except in designated containers. It also prohibits the discharge or disposal of any waste in a manner that causes pollution to the environment or ill health to any person and transportation of any waste except under licence from the Agency.

Bulawayo, as an urban authority has an obligation to provide basic services and protect the environment by enforcing rules and regulations stated in the Act. Other legislative instruments that local authorities use are the Public Health Act and the Municipal By-Laws.

**Methodology**

A qualitative study design was used and methodological triangulation of data collection methods was employed. Both internal and external secondary sources of data were collected and data was analysed. One internal source, that is, the Health Services Annual Report for 2013 was obtained from the City Council and analysed. External sources in the form of media reports were sourced from the Chronicle and Sunday Newspapers and other newspaper articles from internet archives. Content analysis was done for the reports focusing specifically on articles concerning Bulawayo City. A review of relevant literature was also conducted sources being journal articles, public health materials and internet sources. The aim of the literature review was to obtain scientific information on land pollution and perspectives on factors
that contribute to health risks and hazards related to land pollution in urban environments. The Environmental Management Act, Public Health Act, Urban Councils’ Act and Municipal By-laws were also examined to determine relevant legislative controls.

Findings

This section outlines the study findings compiled from literature review, the Health Services Department annual report for the year 2013 and content analysis of media reports.

Findings from literature

Review of literature showed that land pollution in urban environments was caused by poor management of solid waste particularly illegal dumpsites and waste management methods including poorly managed landfills and improper disposal of biodegradable and hazardous waste. Solid waste in cities was generated by industrial, manufacturing, commercial and domestic activities.

Hazards and illnesses associated with land pollution in urban environments were:

- Gases such as methane, carbon dioxide, hydrogen sulphide released from landfills, which would cause respiratory disorders
- Leachate and heavy metals which contaminated ground water and had long term effects on health such as cancer, kidney and nervous system disorders
- Bacteria and disease carrying nuisances such as flies, cockroaches, rats and mosquitoes could be found in open dumps. These vectors transmitted diseases like diarrhoea and plague
- Chemical dust and metals in polluted land could also cause skin problems in those who handled the waste without protection. Other chemicals contaminated ground water and cause gastro-intestinal diseases

Annual report

The 2013 Annual Report showed that the Bulawayo City Council (BCC) was collecting refuse daily in the central business district, weekly in the low density suburbs and every two weeks in the high density suburbs. Prior to establishment of this schedule, a private contractor had been hired to collect refuse.

The report further states that the fleet of refuse trucks was inadequate. However, the BCC was receiving assistance from “sweeping groups”.

A landfill compactor was purchased. The BCC was still facing challenges of illegal dumping despite education of residents.

No diseases that could be linked to land pollution in the city were reported. Only winter diarrhoea among children under 5 years of age caused by the rotavirus was reported but there was no pathological link between the condition and land pollution. Upper respiratory infections were also common, but no surveillance studies had been done to establish if people residing near dumpsites or other polluted areas were more prone to respiratory infections than other residents.

Media reports

The media reports confirmed and brought to the fore the sources of land pollution in Bulawayo, types of waste and efforts of both the Council and EMA to control land pollution. The results are summarised in Table 1.

The media reports further identified the industries and the toxic waste products that were dumped into the environment and water bodies. These firms clearly violated the waste disposal regulations. Most of the industries were in the Belmont industrial area. Tanneries were found to be dumping animal skins which were treated with chromium 6,
a highly toxic substance that can cause cancer, skin disorders and stomach ulcers if ingested. The skins also had a high acid content and caused a stench in the area. Tanneries also discharged organic solids, dyes, arsenic and sodium chloride. These companies needed to pre-treat their waste and dispose of it lawfully.

Other companies that were fined for pollution were funeral parlours, abattoirs, food outlets, beverage manufacturers and chemical producers. Some service stations, garages, car repair workshops and premises of transport operators disposed of oil, grease and silt directly onto the ground and by so doing risked polluting ground water. They were supposed to install oil/silt interceptors at their premises to avoid polluting land.

### Discussion

Pollution is one of the most topical environmental issues globally and has even given rise to international controversies because of its role in climate change, resultant food insecurity and adverse effects on health. Given the amount of available knowledge on pollution today, it should be easier to control all forms of pollution. However, developing nations together with their developing cities have resource constraints and lack the capacity to adequately monitor and control pollution. Although the pollutants have been identified and efforts made to control them, the burden of disease resulting from pollution is not abating and needs to be aggressively addressed.

The fact that pollution and related health conditions are preventable should give impetus to urban authorities to develop interventions and policies that support relevant prevention activities. Legal instruments that are available in support of implementation of pollution control strategies and pollution monitoring guidelines need periodic review and amendment in order to keep pace and track new hazards emerging from manufacturing processes and chemicals used in industry and agriculture.

Local authorities and urban councils all over the world should make provision for dealing with increasing volumes of waste being generated by households. The need to keep the emission of pollutants and exposure to other nuisances arising from waste
management processes has been widely acknowledged hence the need for increased efforts to develop appropriate waste management technologies. Respiratory and heart conditions as well as ear, nose and throat conditions form a significant proportion of the disease burden. In most instances environmental issues are not given sufficient attention as sources of health problems in individuals, but in communities. This calls for a shift in research to include focus on the effects of individual pollutants on individuals.

Most urban populations in developing countries need information and education on managing household waste and keeping the environment clean by minimising litter and illegal dumping of waste. The cost of waste collection and disposal is a limiting factor in terms of compliance with waste management regulation at household level and therefore, should be made affordable in order to promote compliant behaviour. Urban councils also need to invest in recycling both for recovery of usable materials and to minimise waste.

Land pollution is a subtle problem and Bulawayo, like other cities, has been affected by the economic and socio-political situation in the country which have given rise to resource constraints. The media reported that the city had lost $46 million after the election campaign during which local authorities had to wipe off some debts (The Zimbabwean, October 2014). Effects of land pollution do not only go beyond health concerns, but also affect the aesthetic image of the city and it no longer attracts as many tourists as it should.

Infringements of EMA regulations by companies and the city itself show poor governance and failure on the part of council and all players to sustain a healthy environment. Given the age of the city, it is understandable that infrastructure has aged and needs repair. However, it is dangerous and not in good standing for the city to fail to contain littering which blocks drains and also discharges sewage into water source for downstream settlements.

The trend of increase in incidence of cancer globally is a cause for concern. Some of the risk factors for cancer that emanate from the environment, though numerous, can be controlled through environmental monitoring and reducing exposure to carcinogenic agents. Challenges and limitations regarding causation of diseases are that other determinants like age, sex and race may compound or act synergistically with other factors in the development of diseases. Therefore, further research needs to be done and control of these factors, in order to come up with effective measures to reduce carcinogenic agents from the environment.

Implications for control of hazards and disease prevention

From a sustainability point of view, urban councils need to consider and formulate or review policies and plans that can strengthen the control of hazards and risks in their environments thereby preventing diseases. The implications are that:

Although urban councils are guided by statutory instruments in their efforts to control pollution, collaboration with other agencies such as the Environmental Management Agency in Zimbabwe and interdisciplinary or inter-ministerial committees in enforcing the regulations is essential. Community involvement is also important in that, if given appropriate information on pollution, people can participate in activities designed to reduce it resulting in cleaner environments and less hazards and risks. The World Health Organisation guidelines on pollution control provide benchmarks for cleaner city environments.

Regarding waste disposal, landfills and dump sites should be situated far from residential areas and on the other hand settlements near dumpsites should not be allowed to thrive.

Where economies are stable, recycling, reuse and refurbishing of salvaged waste are
encouraged. Recycling being the latest trend in waste management should be given serious consideration and we should encourage investment in recycling plants. Businesses that sell electronic items need to provide facilities for drop off of e-waste or facilitate mail back strategies.

Information and education of residents on waste management at household level including proper preparation of waste for collection, is necessary in order to make the job of the waste collectors safe. In Zimbabwe there are urban residents associations which can be used to pass information, this is a low cost strategy compared to use of billboards and flyers.

**Recommendations**

The study recommends that investment in resources for waste management be increased or privatised giving due consideration to the economic statuses of residents.

Community mobilisation and participation is a good low cost strategy. Education of residents through residents’ associations, the media and even through schools could be of benefit. Surveillance and monitoring of the environment should be intensified.

More research needs to be done in the area of health to determine actual link and extent of occurrence of health problems associated with pollution.

**Conclusion**

This paper has discussed several issues regarding factors contributing to health risks and hazards in urban environments globally and nationally, but more specifically in the City of Bulawayo. Land pollution is caused by many factors and related sources of hazards have to be monitored and controlled in view of the hazardous chemical and biological substances emerging from various sources within the environment. Waste management methods emit hazardous substances and, therefore, there is need to modernise waste management and channel more efforts towards recycling technologies.

The role of legislative controls is very critical in maintaining clean environments and ensuring that everyone plays their part in order to enjoy good health.

<table>
<thead>
<tr>
<th>Type</th>
<th>Hazardous substances</th>
<th>Health problems/conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Gas emissions- carbon dioxide, nitrous oxide, sulphur dioxide</td>
<td>Asthma, allergies, bronchitis, heart conditions</td>
</tr>
<tr>
<td>Indoor</td>
<td>Radon, carbon dioxide, carbon monoxide, cigarette smoke +/-</td>
<td>CO poisoning, cancer aggravation of respiratory conditions</td>
</tr>
<tr>
<td>Water</td>
<td>Bacteria, chemicals</td>
<td>Diarrhoeal diseases, cholera, poisoning</td>
</tr>
<tr>
<td>Land</td>
<td>Chemicals, dust, metals</td>
<td>Respiratory disease, Skin disease, Cancer</td>
</tr>
<tr>
<td>Method</td>
<td>Hazard /risk</td>
<td>Health problems/conditions</td>
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<td>------------------------------------</td>
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<td>-----------------------------------------------------------------</td>
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<tr>
<td>Biodegradable waste management</td>
<td>Methane gas, vectors, rodents, cockroaches, flies, Leachate, foul smell</td>
<td>Respiratory condition, plague, diarrhoeal diseases, contamination of ground water, cholera</td>
</tr>
<tr>
<td>Land fill</td>
<td>Methane gas, carbon dioxide, hydrogen sulphide, sulphur dioxide, leachate, untreated hazardous waste with heavy metals, radiation</td>
<td>Cancer, toxic effects on nervous system, kidneys, lungs. Birth defects, low birth weight, spontaneous abortions</td>
</tr>
<tr>
<td>Large scale composting</td>
<td>Bioaerosols, bacteria, fungi, viruses, mycotoxins</td>
<td>Skin infections, tetanus, respiratory diseases- farmer’s lung, aspergillosis</td>
</tr>
<tr>
<td>Incineration</td>
<td>Acidic gases, aerosols, metals e.g. Pb, cadmium, organic compounds, dioxins</td>
<td>Cancer, increased overall morbidity and mortality due to cardiac and respiratory conditions,</td>
</tr>
<tr>
<td>Electronic waste disposal (recycling)</td>
<td>Heavy metals, hydrocarbons, dioxins, sharps, bacteria, chemicals, bioaerosols, chlostridium</td>
<td>Tetanus, injury and infection- HBV, dermatitis gastro-intestinal diseases</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Factor</th>
<th>Hazard /risk</th>
<th>Health problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of maintenance of structures</td>
<td>Holes and bumps on pavements and roads</td>
<td>Injuries from falls, road accidents</td>
</tr>
<tr>
<td></td>
<td>Burst sewage and water pipes</td>
<td>Diarrhoeal diseases</td>
</tr>
<tr>
<td>Poor urban planning for housing</td>
<td>Lack or inadequate water and sanitation facilities</td>
<td>Diarrhoeal diseases</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor (behaviour/ status)</th>
<th>Risk</th>
<th>Health problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty</td>
<td>No access to safe water and sanitation</td>
<td>Diarrheal diseases</td>
</tr>
<tr>
<td></td>
<td>Food insecurity</td>
<td>Malnutrition, low resistance to diseases</td>
</tr>
<tr>
<td>Motorisation</td>
<td>Lack of exercise, obesity</td>
<td>Non communicable diseases- diabetes, heart and respiratory diseases</td>
</tr>
<tr>
<td>Sedentary work or habits</td>
<td>Lack of exercise, obesity</td>
<td>Non communicable diseases –diabetes, heart and respiratory diseases</td>
</tr>
<tr>
<td>Unhealthy food</td>
<td>Obesity</td>
<td>Non communicable diseases- diabetes, heart and respiratory diseases</td>
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References


