

**RESPIRATORY AND OCCUPATIONAL HEALTH PROBLEMS OF SCAVENGERS AND LANDFILL
EMPLOYEES IN A MUNICIPAL LANDFILL SITE IN LOBATSE, BOTSWANA**

Reginald Dennis Gwisai, Olusegun Areola, and Eagilwe Segosebe

Department of Environmental Science, University of Botswana.

ABSTRACT

The objective of this study was to examine the respiratory and common health ailments of scavengers and landfill employees in a Municipal Solid Waste (MSW) disposal site in Lobatse, Botswana. Data were collected through questionnaires, observations at the landfill site, and key informant interviews. The results of the study revealed a high prevalence of respiratory symptoms and a wide range of occupational health problems among landfill employees and scavengers and this could be due to lack of protective clothing. Respondents who have worked at the landfill for at least 1 – 5 years suffered from most ailments. Poor safeguards against diseases, lack of toilet facilities for scavengers, atmospheric dust, offensive odours, and absence of soil cover material contribute to low health conditions. A waste management and disposal system that is environment friendly and conscious of the health and wellness of the urban dwellers is an essential element of sustainable built environments.

Keywords: Respiratory Health, Occupational Impairments, Scavengers, Landfill Employees, Waste Management, Sustainable Development, Lobatse

INTRODUCTION

Solid waste management, an emergent phenomenon in developing nations, has created employment (Abdelatif, 2001; Abd Malek, Hassan and Sapari, 1996; Strange, 2002), and provided the under – privileged opportunities to earn a living from landfill sites (Manyanhaire, Sigauke and Munasirei, 2009; Masocha and Tevera, 2003). Unfortunately, scavengers and landfill employees work with little or no protection against health hazards while scavengers are self – employed and do not have any consideration at all for the health risks involved (Noel, 2010). Researchers have noted that little attention has been given to the human health risks to which scavengers are exposed (Chattopadhyay, Dutta and Ray, 2008; Chofqi *et. al.*, 2004; Mwiganga and Kansime, 2005; Noel, 2010).

Furthermore, although sanitary landfill sites have been observed to constitute a potential hazard to the environment (Christensen and Christensen, 1999; Khan and Agarwal, 2006; Misra and Pandey, 2004; Moyo, Keefe, and Sill, 1993), in many cases some of the effects of the landfills are not so obvious or easily observable. One of such hidden effects is the release of greenhouse gases (GHGs), (Miller, 1996; Odukoya and Abimbola, 2010). Globally annual gas emissions from landfills are estimated at 6 – 20% of the total from anthropogenic sources and have increased tremendously over time (UNEP, 1996). Investigations of the health risks to those employed in the handling, transporting, clean – up or maintenance of substances at landfill sites have been found to be very scarce. Hence, the focus of this study is to examine the environmental health risks to which various people working in landfills are exposed to in a developing country such as Botswana.

The concern for the plight of people working in landfills is partly due to the lower levels of public awareness and respect for public opinion in decision making in developing countries as compared with what obtains in the developed world. Indeed, there are instances where governments and government officials have connived with foreign concerns to secretly dump hazardous wastes at some locations in some countries of the developing world (Patil and Shekdar, 2001; Ray, Roychoudhury, Mukherjee, Roy and Lahiri, 2005). It is against this background that this study investigated and evaluated the environmental health risks to which the people working in sanitary landfill sites are exposed with a view to documenting and highlighting deleterious effects of landfills in a developing country. The study focused on the municipal landfill in Lobatse town in southeast Botswana. The Lobatse landfill site has been criticized for poor operations and laxity in management (The Botswana Gazette, 2010). The Lobatse community had once protested publicly against the substandard operations at the landfill site (BOPA Daily News, 2006). Poor waste management in landfills aggravates health conditions thereby occasioning increased spending on health care and depriving the urban dwellers a better quality of life (World Bank, 2001). The main problem of the landfill site is the health impact that may occur over time to the scavengers and the landfill employees. A population striving for sustainable development needs a sustainable waste management system.

LOBATSE MUNICIPAL LANDFILL

Lobatse town in the South East district of Botswana is located about 70 kilometres (km) south of Gaborone the capital city on Latitude 25° 13' 0'' South, Longitude 25° 40' 0'' East. The town is situated in a depression surrounded by a range of hills (see Figure 1). The average elevation of Lobatse is about 1189 metres above sea level. The Lobatse landfill site lies to

the south – west of the town along the major highway that links Botswana, South Africa and Namibia and about 5 km away from the Lobatse central business district. The landfill currently receives on average 14 500 000 kilograms of waste annually. The waste basically consists of the following waste types in order of descending order of magnitude: domestic, commercial, garden, building, animal, and discarded soil material. Furthermore, a fair amount of clinical waste is disposed after incineration. At the beginning, proper arrangement was made for the segregation and compartmentalization of wastes in the landfill site.

The Lobatse landfill site was commissioned in 1994 before landfill legislation came into being in 1998 (Government of Botswana, 1998). Thus the landfill was not properly engineered according to well-known environmental health standards. Yet, a large number of rag pickers scavenge in the landfill area for salvageable recyclable materials such as cans, plastics, cardboard box and paper. Both the scavengers and the landfill workers employed by the municipal government carry on in spite of the offensive odours and unhygienic conditions without any protective clothing. Hence, this study which was carried out with the aim of assessing the human health risks associated with the landfill site. The selection of the landfill site was based on accessibility rather than on environmental suitability. The sustainability challenges of the Lobatse landfill could be due to lack of application of scientific principles, non-adherence to landfill regulations, and financial problems. This means that in siting landfills planners should look beyond mere waste disposal and consider the overall environmental health and sustainable issues of the area and also factor in remediation measures that may be called for to deal with the negative impacts of the landfill in its neighbourhood.

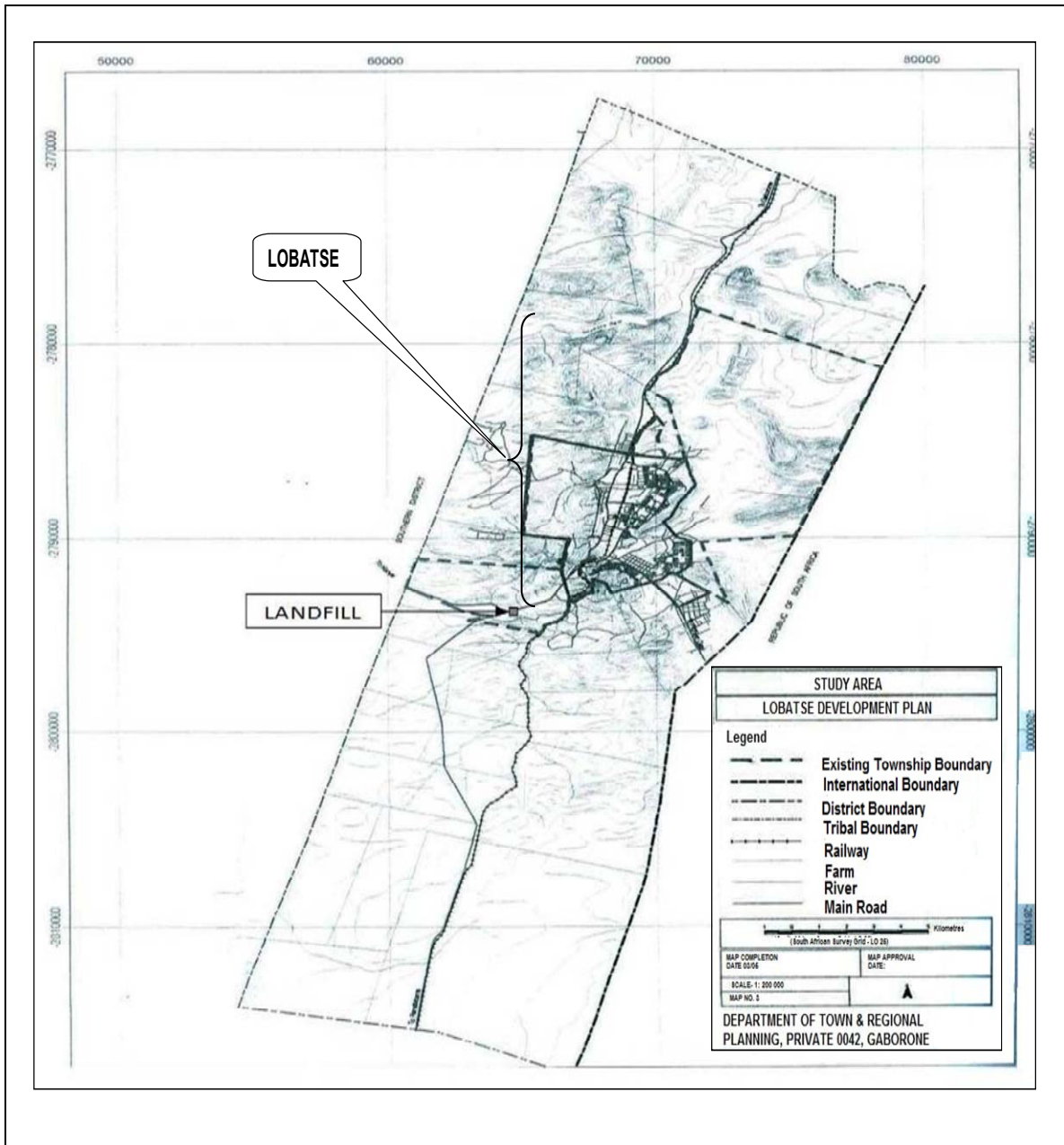


Figure 1: Location of the Lobatse landfill area
 Source: Lobatse Town Council, (2006)

MATERIALS AND METHODS

The study was conducted between June 2011 and May 2013 after obtaining necessary research permits from relevant government departments and the Lobatse Town Council. The landfill site reconnaissance was done to appreciate the general state of affairs of Lobatse landfill before commencing the study. Onsite investigations were conducted at the site, comprising (1) interviews with the scavengers and landfill workers on modes of operation, their perceptions and attitudes towards landfill site activities; (2) analysis of the health risks and routes of exposure to them by the scavengers and landfill employees as they go

about their landfill and scavenging operations; and (3) landfill site observations and interviews with key informants (landfill site managers). The results were statistically analyzed using Pearson's product moment correlation coefficient (r) to test the strength of the relationships under investigation. IBM SPSS Statistics software was used for data analysis. Furthermore content analysis was used for the qualitative data.

RESULTS AND DISCUSSION

Subjects and Working Conditions

All the landfill scavengers and employees were selected for study totaling thirty – two individuals working at the Lobatse landfill site. There were more males (53.1%) than females (46.9%) and the highest proportion of respondents were in the 35 – 39 years age group (34.4%). Half (50%) of the respondents had been working in the landfill for 1 – 5 years (see Table 1). Among them, 40.6% were scavengers; 27.6% were supervisory staff, landfill truck drivers, security staff and operators of such equipment as the Bomag compactor, waste transport trucks, weighbridge, the incinerator, and water browser; and the rest (31.8%) were waste spreaders and separators. Most (94%) respondents worked 6 - 10 hours per day, 7 days a week. The majority (59.4%) did not use mouth and nose protective covering masks and many (40.6%) did not have gloves while working at the landfill, thereby exposing themselves to hazards including possible injury from broken glass, used discarded needles and other sharp or prickly objects, and infection from a wide range of pathogens and helminth eggs (Rankokwane and Gwebu, 2006; Ray *et. al.*, 2005; Sarkar, 2003).

Collection of Respiratory and Occupational Health Data

The subjects were interviewed and requested to fill in a questionnaire giving information about demographic and the socio – economic conditions, working conditions, type and length of work, respiratory health complications, reproductive health problems, general health issues, physical injuries, deformities and other ailments and anomalies and poisoning related cases. As most (75.1%) respondents were poorly educated, research assistants assisted the respondents in recording their responses to the questions in the questionnaire. The questionnaires were analyzed with the help of community health nurses who evaluated the signs and symptoms presented by each respondent. Respiratory, reproductive and other health issues were ascertained from the questionnaire responses.

Table 1: Demographic and Socio – Economic Characteristics of Scavengers and Landfill Employees

Characteristics	Landfill Employees and Scavengers	
	n	%
Age (Years)		
20 – 29	3	9.3
30 – 39	13	40.6
40 – 49	9	28.1
50 – 59	5	15.6
>60	2	6.2
Gender (Sex)		
Male	17	53.1
Female	15	46.9
Length of time working at the landfill		
> 1 year	8	24.9
1 – 5 years	16	50
6 – 10 years	4	12.5
> 10 years	4	12.5
Marital Status		
Married	24	75
Single	8	25
Educational Level		
Not Educated	6	18.8
Primary School	18	56.3
Junior Secondary School	6	18.8
Senior Secondary School	2	6.3
Working Hours/Day		
6 – 10	30	93.8
>10	2	6.2
Method of Transporting Materials		
Transport to Point of Sale	18	57.1
Wait for Collection	14	42.9
Preferred Companies		
CAC	6	46.2
King Can	1	7.7
PRM	1	7.7
Simple Recycle	3	23.1
Dumatau	2	15.4

Source: Author's Findings (2013)

Incidence and Prevalence of Diseases

Respondents at the Lobatse landfill reported the following disease symptoms, viz: headache, general body weakness, common cold, coughing, spitting, chest pain, shortness of breath and addiction to pain killer tablets (analgesics) consumption (see Figure 2). The major effects of disease symptoms appear to be experienced through the respiratory system and this could be due to the way scavengers work through the waste without mouth and nose coverings. Most of the respondents (68.8%) reported being affected by headaches with males (64%) being more affected than females (36%). A high incidence of headache occurrence could be due to the weather (high temperatures) and strenuous working conditions at the

landfill. The male workers are probably more affected because of complications by such other factors as smoking, alcohol consumption, and insufficient night sleep. The continuous incidence of these ailments could lead to severe diseases that may permanently affect landfill workers, rendering the occupation unsustainable, health wise.

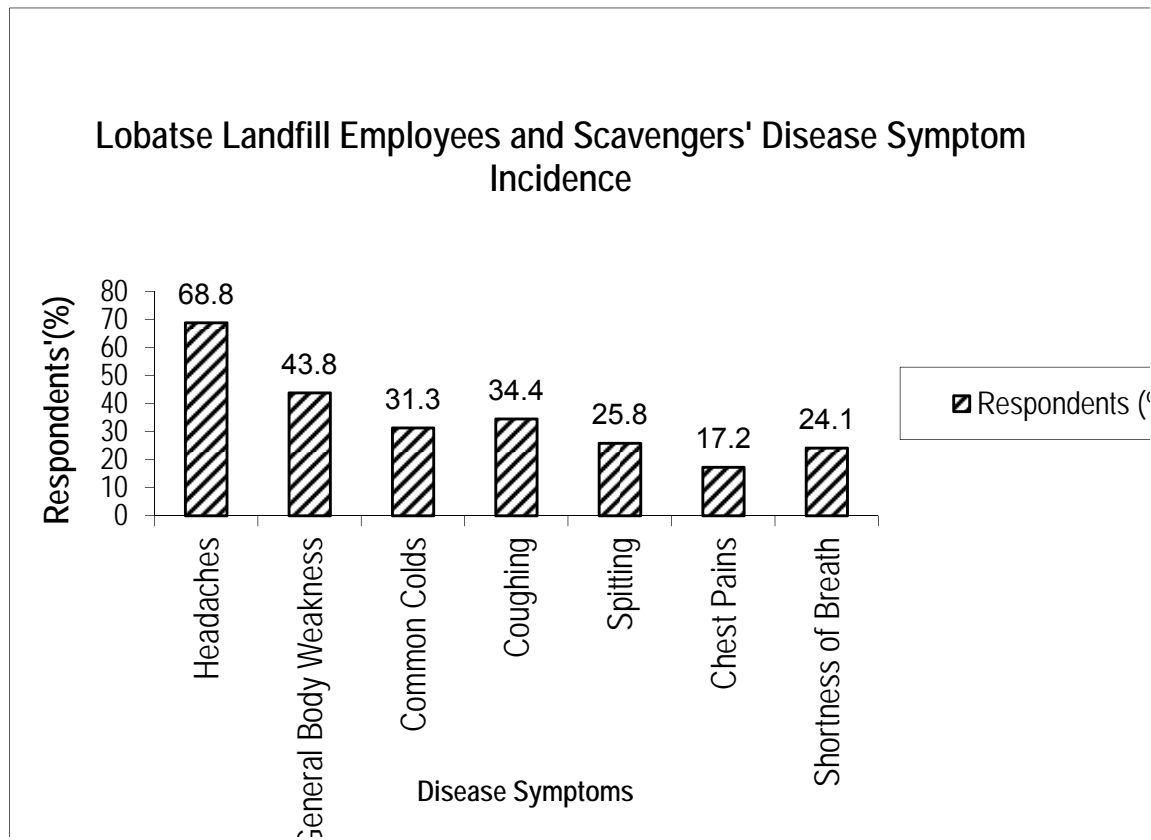


Figure 2: Lobatse Landfill Employees and Scavengers' Disease Symptom Incidence

Source: Author's Findings (2013)

Length of Time Working at the Landfill

Table 2 shows the length of time that scavengers and landfill employees have been working at the Lobatse landfill. As stated earlier, half of the 32 respondents interviewed at the Lobatse landfill have been working at the landfill for 1 – 5 years (see Figure 3); the period is less than that for other developing countries (Medina, 2000). This means the severity of exposure to health hazards could be less than those experienced in other comparable landfills (Nas and Jaffe, 2004). Most of the respondents (59.4%) work in the landfill every day just as observed by Tevera (1994). Among those working every day the majority (93.8%) keep on working even when it is raining just as observed in other studies (Afon, 2012; Medina, 2000; Nguyen, Chalin, Lam and Maclaren, 2003; Oelofse and Strydom, 2010). Therefore, scavengers are at risk of being affected by various occupational dangers and health hazards. Despite working at the landfill on a daily basis, Lobatse scavengers do not reside at the landfill site. Therefore, scavengers are interacting with the

local community on a daily basis which increases the chances of spreading pathogens from the landfills that may spread diseases, through contact with scavengers and salvaged materials. This means that the quality of health among the town dwellers will decline over time as they are impacted by landfill related ailments. Thus, the town is progressively less healthy and liveable to the residents.

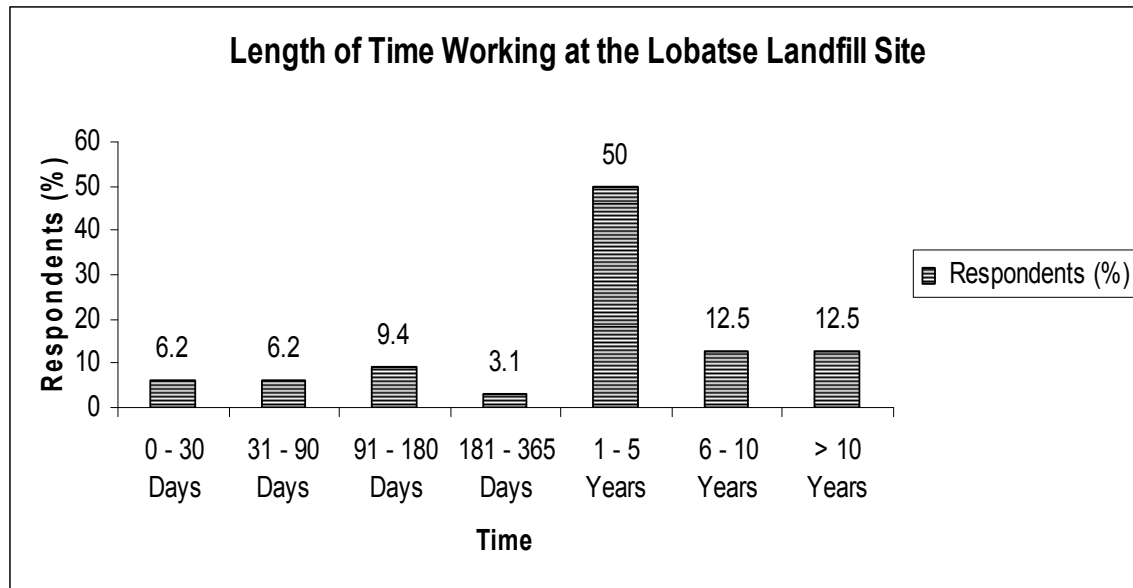


Figure 3: Length of Time Working at the Lobatse Landfill Site

Source: Author's Findings (2013)

Lobatse Landfill Respondents Age Distribution

The highest proportion (34.4%) of the respondents is in the 35 – 39 age – group, followed by the 40 – 44 age – group (15.6%), (see Table 2). Both leading age – groups are part of the working class age, therefore taking up work at the landfill proves to be a viable occupational option with benefits (Medina, 2000). The findings of the study are similar to those observed by previous studies (Tevera, 1994) where the same age groups (≥ 30 years) constituted the largest proportion of scavengers. The noticeable presence of the elderly (≥ 50 years) among the scavengers perhaps is a pointer to the level of poverty in the society; the aged scavenge when there is no other means of support.

Table 2: Lobatse Landfill Respondents Age Distribution

Category	Lobatse Landfill Respondents Age Distribution										Respondents (n)
	20-24 Yrs.	25-29 Yrs.	30-34 Yrs.	35-39 Yrs.	40-44 Yrs.	45-49 Yrs.	50-54 Yrs.	55-59 Yrs.	60-64 Yrs.	> 65 Yrs.	
Respondents Age (%)	3.1	6.2	6.2	34.4	15.6	12.5	6.2	9.4	3.1	3.1	32

Source: Author's Findings (2013)

Headaches and General Body Weakness

Most of the respondents are affected by headaches (68.8%) and general body weakness (43.8%). Moreover most males (64%) are more affected than females (36%) for both ailments. Headache occurrence appears to be a prevalent condition among scavengers and has been observed to be a leading disease symptom in other studies (Nguyen *et. al.*, 2003). Among those who have worked only 1 – 5 years at the landfills, 50% have been affected by headaches and 42.8% by general body weakness. In the same category, most respondents in the age groups ≥ 35 years are affected by headaches, while only 28% are affected by general body weakness. This shows that those ≥ 35 years experienced relatively high incidence and prevalence of headaches as compared to those < 35 years. This probably shows that the elderly are more adversely affected by the landfill health effects as compared with the younger age groups. Furthermore as the years have gone by most scavengers have been spending more time at the landfill site reclaiming discarded materials from gargantuan mounds of waste.

Factors associated with Headaches and Body Weakness Incidence

The leading types of headaches affecting the respondents include frontal attack (27.3%); overall head attack (27.3%), and centre attack (18.2%). Frontal and overall attacks occurred mostly while bending down in the process of waste salvaging. This confirms the risk caused by engaging in strenuous physical activity in hot weather conditions amidst colossal mountains of waste (Afon, 2012; Nguyen *et. al.*, 2003). The level of severity of the headache attacks is judged to be moderate by 45.5% of respondents and acute by 36.4%. Gutberlet and Baeder (2008), and Pandey (2004) observed that extreme weather conditions could play a leading role in intensifying and prolonging disease occurrence.

Among those who suffer from general body weakness the highest proportion of respondents felt weak in the afternoon (28.8%) and all day long (28.8%). Therefore, a strong relationship exists between body weakness and factors such as length of hours working in the landfill, weather conditions (high temperatures), and ambient environmental conditions (dust and waste). This is because most of these employees felt weak in the afternoon or after they have been at the landfill all day long (Gutberlet and Baeder, 2008; Oyelola, Babatunde, Abiodun and Popoola, 2011; Tevera, 1994). In addition to high temperatures the cause of the weakness also could be due to the inhalation of toxic chemicals and odours released by the waste materials at the landfill (Gutberlet and Baeder, 2008).

Respiratory Ailments and Diarrhoea

The 35 – 39 years age group is the cohort most affected by diarrhoea, and respiratory symptoms. The diarrhoea cases could be due to unsafe handling and direct contact with waste and other disease vectors that the scavengers come in contact with (Adewole, 2009; Nguyen *et. al.*, 2003; Wilson, Velis and Cheeseman, 2006). It is also sad that quite a number of the scavengers and employees eat in the open at the landfill site with the high risk of contamination from dust and pathogens in the air. Respiratory symptoms are normally

due to long dry periods of landfill surfaces that produce dust from the waste (e.g. with inhalable toxic chemicals) and the landfill surroundings. The main driver in exacerbating breathing problems is lack of protective clothing such as mouth and nose coverings (Adewole, 2009; Afon, 2012; Gutberlet and Baeder, 2008; Sarkar, 2003). Air borne dust at the Lobatse landfill has made the working environment to be unsuitable as there is no water to spray on landfill surfaces at intervals so as to reduce dust (Lobatse Town Council, 2012; Sarkar, 2003).

Common Colds and Coughing

A rather low percentage of respondents suffered from common colds (31.3%) and coughing (34.4%). These ailments appear to be peculiar to respondents working at landfills and dumpsites as observed by other researchers (Oyelola *et al.*, 2011). However, the percentage affected by coughing is less than in prior studies which had the majority of scavengers coughing (Nguyen *et al.*, 2003; Oyelola *et al.*, 2011). The Lobatse landfill environment (landfill surroundings, nature and composition of waste) is probably better managed than the open dumpsites in other countries, hence the lower percentage of coughing (Hunt, 1996; Nguyen *et al.*, 2003). The highest proportions of respondents affected by common colds have worked at the landfill ≤ 5 years (40%) and 6 – 15 years (30%) respectively. This agrees with the findings of previous studies which have observed that the length of time spent at the landfill increases disease susceptibility (Afon, 2012; Athanasiou, Makrynos and Dounias, 2010; Nguyen *et al.*, 2003; Tevera, 1994).

Ailments associated with Incidence of Common Colds

The largest proportion of those affected by common colds had accompanying symptoms such as (a) sore throat, blocked nostrils and body pains (40%); (b) runny nose, body pains, sore throat and blocked nostrils (30%); (c) runny nose only (20%); and (d) body pains only (10%). As observed by earlier research findings elevated respiratory health problems could have risen from exposure to dust, micro – organisms and microbial toxins at the landfill site (Gutberlet and Baeder, 2008; Poulsen *et al.*, 1995; Rogers, Englehardt, An and Fleming, 2003). Complementary studies have also revealed that moulds and fungal spores normally found on food packaging materials are biological sources of mucous membrane irritations (endotoxins), allergies and respiratory ailments (Athanasiou *et al.*, 2010; Poulsen *et al.*, 1995). In some recycling plants organic dust toxic syndrome has been observed to be a frequent complaint as most of the bio – aerosol particulate matter is suspended in the air (Gutberlet and Baeder, 2008; Lavoie and Guertin, 2001; Oyelola *et al.*, 2011). Similarly An, Englehardt, Fleming and Bean, (1999) noted that gram negative bacterial and fungal spores are lethal to the respiratory and gastro duodenal systems, and also that the concentration of micro – organisms increases in periods of high temperatures and humidity (Poulsen *et al.*, 1995).

Spitting, Chest Pain and Shortness of Breath

A quarter of the respondents (25.8%) produce sputum frequently, with half (50%) of them producing milky sputum, while the rest produce clear sputum (37.5%) and greenish sputum (12.5%). Half of the respondents

(50%) spit all day long and 25% in the morning periods. Only a small percentage of the respondents (18.2%) reported that spitting is affecting their lifestyles with the majority (63%) being males. Moreover half (50%) of those spitting regularly everyday are males who have worked at the landfill for 1 – 5 years. Production of milky sputum is a primary symptom of bronchial and upper respiratory tract infections among solid waste employees, which may later become worse (e.g. greenish sputum) if respiratory infections develop (Athanasίου *et. al.*, 2010). Most of the respondents (65%) affected by spitting are in the 35 – 39 years category half of whom have worked only 1 – 5 years at the landfill. The highest proportion (39%) spit all day. In the same age group less than half (39%) of the respondents produce clear sputum.

A small percentage of respondents suffer from chest pains (17.2%) and shortness of breath (24.1%). The frequency of chest pain occurrence is as follows: daily (60%) and weekly (40%), while the severity effects of shortness of breath are as follows: moderate (42.9%), acute (28.6%), and at times dull (28.6%). The majority (80%) suffer from moderate chest pains, and less than half (40%) of the respondents are affected all day long. Furthermore the majority of males (60%) are affected by chest pains daily and most (60%) experience moderate chest pains, with the highest proportion (40%) being affected all day long. Previous studies elsewhere show that chest pain occurrence increases with an increasing length of time of working at the landfill (Gutberlet and Baeder, 2008).

The majority (80%) of respondents reported that chest pains are affecting their lifestyle and most (60%) of them are males working 6 – 10 hours. It is clear from the findings that males are more affected by chest pains probably due to various conditions such as, the extreme weather, dusty and toxic environment, more working hours hence longer contact with waste materials at the landfill site (Hunt, 1996; Pandey, 2004). The concentration of Total Suspended Particles (TSP) and Particulate Air Matter of 10 micrometres (PM10) have been observed to be the leading rudiments to the majority of respiratory tract diseases (Pandey, 2004). However, some habits common among men, such as, smoking and heavy drinking could also be partly responsible for the higher incidence of chest pains, coughing and spitting and other respiratory tract problems.

Most respondents (60%) reported that shortness of breath affected their lifestyles, with more males (71%) are affected as compared to females (29%). The age groups which experienced the highest percentages (28.6%) of shortness of breath are ≥ 35 years. The older population (≥ 35 years), reported that shortness of breath is affecting their lifestyles (33%), while the severity is moderate (33.3%). This study confirms findings from other studies that the length of time working at the landfill, number of hours per day spent working at the landfill and continuous exposure to waste increase susceptibility to shortness of breath among scavengers and landfill employees (Medina, 2000; Nas and Jaffe, 2004; Nguyen *et. al.*, 2003; Pandey, 2004). The economically active group appears to be affected more; therefore their increased ill health will reduce their capabilities to provide for their families.

Challenges of Working at Lobatse Landfill

The numerous challenges at the landfill include the incinerator which produces smoke that affects people working in the landfill; the emission from the incinerator also produces a pungent foul smell, while the dust output leads to health disorders such as coughing, eye and nose irritation. Previous case studies conducted elsewhere corroborate the same observations (Afon, 2012; Regassa, Sundaraa and Seboka, 2011). As observed by Mangizvo (2010) soil at landfill sites is contaminated by being in contact with solid waste and leachate hence degrading the environment.

The environment around the Lobatse landfill is an eyesore as previously reported in the media (BOPA Daily News, 2006). Most of the landfill employees have not gone for medical examination and private companies are not compliant with scavengers' medical examination requirements. This appears to be a common challenge in most developing countries as scavengers' medical examination is not regularly conducted (Nguyen *et. al.*, 2003). In addition most landfill employees do not have proper protective clothing and work for long hours at the landfill site (6 – 10 hours) which appears to be common to scavengers in previous studies (Tevera, 1994; Wilson *et. al.*, 2006). As observed in prior research, for example in (Amman) Jordan, scavengers could not afford to equip themselves for the dirty and dangerous occupation (Royer, 2011). Moreover some studies have also observed that scavengers operating on landfill sites, without proper facilities and equipment are typically exposed to a range of public health and environmental hazards associated with open dump sites (Pearce and Turner, 1994). This is an unsustainable practice that should not continue unabated as wellness of employees is of paramount importance to attain set workplace targets.

The landfill employees are concerned that working at the landfill has a high health risk but Lobatse Town Council has not provided a health risk allowance for them. This apprehension is as a result of limited access to medical attention for most landfill employees, which is an unsustainable practice. This appears to be the case in developing countries as scavengers are not considered for any medical examination as the trade is deemed illegal (Royer, 2011). In addition there are no toilet facilities provided for scavengers. The lack of proper sanitary facilities leads to scavengers using the open spaces around the landfill, which attracts vermin and disease pathogens that spread diseases such as diarrhoea, cholera and dysentery (Oyelola *et. al.*, 2011). This means that the millennium development goals of curbing the above stated ailments may be unachievable.

The Lobatse landfill has not used soil cover for almost two years making the surroundings an eyesore. Suitable soil is scarce at the landfill. Hence, this has left the waste to be exposed and blown about by the wind (Lobatse Town Council, 2012; Royer, 2011). The lack of soil cover at the landfill also has led to deleterious consequences for the environment because the absence of soil cover enables rainwater to infiltrate refuse and produce leachate that contaminates ground water reserves and adjacent water sources

(Mangizvo, 2010). The poor aesthetic quality of the landfill has implications for the tourism sector as it is found on a major highway which tourists use from South Africa.

The basic tools used by scavengers in Lobatse are a sack and scythe (in the form of sticks and simpler hooks), as observed by Afon (2012). Usage of such tools appears handy and manageable as most of the materials used as tools are salvaged from the waste disposed of at the Lobatse landfill site (Sarkar, 2003; Hunt, 1996). Furthermore, scavengers feel the landfill compactor disrupts their occupation before they recover all the materials they desire. This signals a conflict between landfill employees and scavengers (Nguyen *et. al.*, 2003).

Among those that reported respiratory infections the blame is put on the dust and odour from the landfill just as observed by previous studies in Asia (Nzeadibe, 2009; Regassa *et. al.*, 2011; Wilson *et. al.*, 2006). This contrasts with other studies where scavengers are not aware of the dangers they face but are economically tied to their occupation for survival (Cointreau, 2006; Nguyen *et. al.*, 2003). Some of the respondents reported that they are asthmatic, smokers, excessive alcohol partakers, and Tuberculosis (TB) patients. Scavengers in other countries have been observed to have similar conditions (Nguyen *et. al.*, 2003) suffering from diseases such as TB, scabies, multi – system disorders, asthma, respiratory infections, ophthalmic diseases, ulcers and stomach problems among other disease infections (Afon, 2012; Oyelola *et. al.*, 2011; Pearce and Turner, 1994; Sarkar, 2003). Therefore, the challenge for the future is to provide safer, healthier working conditions for scavengers especially in uncontrolled landfills, thus attaining sustainable development (Bogner *et. al.*, 2007). Moreover, there is no excuse for municipal authorities not to provide medical care for their employees at the landfill sites: as things stand they do not appear to be faring better than the scavengers in terms of exposure to health hazards.

Hospital Visitation

The highest proportion (28.1%) of respondents claims to visit the hospital only once a month (Table 3). The impact of landfill related ailments could be attributed to these infrequent monthly hospital visits. Most (64.5%) of the respondents use public transport to get to the hospital, while others (29%) walk, 3.2% use a private car and other means (3.2%). On average respondents spend about P35.00 (US\$4.55) to visit the hospital for both consultation fees and transport fare. Just as observed by prior research findings, most of the scavengers either walk or use public transport to get to the hospital (Hunt, 1996). The amount paid to access health is unsustainable and this could mean that when respondents do not have enough money, they may not visit a hospital.

Table 3: Frequency of Hospital Visitations

Category	Frequency of Hospital Visitation								Respondents (n)
	Once a Week	Once a Month	Twice a Month	Once in 3 Months	Once in 6 Months	Once a Year	Never	When Ill	
Hospital Visits (%)	3.1	28.1	6.2	12.5	15.6	21.9	3.1	9.4	32

Source: Author's Findings (2013)

Consumption of Pain Killer Tablets

The majority of the respondents (64.5%) consume painkiller tablets, and most (60%) consume them at home, while 35% consume them both at home and at the landfill. Only 5% claim to consume the tablets only at the landfill. Consumption increases with increasing length of time of working at the landfill but the correlation is statistically insignificant ($r(31) = 0.347$, $p = 0.056$). The high incidence of painkiller consumption could be due to pain from various strenuous ergonomic activities in the landfill such as salvaging through vast mounds of waste, continuous bending (causes back pain), lifting and carrying heavy loads, long working hours, extremely high temperatures during sunny days and headaches (Gutberlet and Baeder, 2008; Oyelola *et al.*, 2011; Pandey, 2004; Tevera, 1994). The indiscriminate consumption of painkillers could lead to drug tolerance and this may affect the health of the respondents as they may consume an overdose to relieve pain.

Disease Occurrence with Age of Respondent

Most disease symptoms declined but insignificantly with increasing age of respondents, for example, general body weakness ($r(32) = -0.014$, $p = 0.941$), common colds ($r(32) = -0.176$, $p = 0.336$), headaches ($r(31) = -0.014$, $p = 0.939$), coughing ($r(32) = -0.043$, $p = 0.814$), spitting ($r(31) = -0.223$, $p = 0.228$), chest pains ($r(29) = -0.110$, $p = 0.569$). The exceptions are shortness of breath ($r(29) = 0.067$, $p = 0.731$) and pain killer tablets consumption ($r(31) = 0.089$, $p = 0.636$).

Disease Occurrence Relationship with Length of Time Working at the Landfill

The following diseases increased insignificantly with increasing length of time working at the landfill; headache ($r(32) = 0.354$, $p = 0.51$), general body weakness ($r(32) = 0.174$, $p = 0.341$), common colds ($r(32) = 0.017$, $p = 0.927$), coughing ($r(32) = 0.067$, $p = 0.715$), spitting ($r(32) = 0.046$, $p = 0.805$), shortness of breath ($r(29) = 0.035$, $p = 0.857$) and hospital visitations ($r(32) = 0.253$, $p = 0.163$). However only chest pains ($r(29) = -0.324$, $p = 0.086$) declined but insignificantly with increasing length of time working at the landfill.

CONCLUSION

Safeguards against disease infection and physical injury are totally lacking even for workers employed by the Lobatse Town Council not to talk of scavengers. Scavenging is an informal sector activity and has not attracted much official attention. This neglect by government is most unwise because the scavengers and landfill workers have the potential to cause epidemic diseases in the cities. As indicated above, the scavengers and landfill workers live 'at home' and commute daily to the landfill site to work. They carry with them all kinds of pollutants from the landfill include dangerous disease pathogens. There is clearly a need to address the medical health needs of the people. It is important also to inculcate the ideals of personal hygiene and environmental sanitation in the scavengers and landfill workers. As indicated in the discussion above, scavengers have been caught collecting food stuffs for consumption which appears to be a common phenomenon. This however has serious public health concerns as they may suffer from food poisoning. To make matters worse there are not toilets for scavengers.

It is also quite clear that there is a great deal of self medication going on among the scavengers and landfill workers. Indiscriminate consumption of painkillers is not good for the long-term health of the people. The employees of the municipal government at least should be given access to government health facilities and be encouraged to go for medical examinations more frequently. Therefore the lack of access to medical examination could lead to poor health among landfill employees and continual spread of diseases in the city.

There is obvious need for marked improvements in the management and operations of the Lobatse landfill. In Lobatse the smoke, dust and odours from the incinerator and the poor aesthetic quality of landfill environment (eyesore) are the major challenges. The landfill has not used soil cover for over two years and waste is scattered and spread far and wide by wind. This and other health and environmental issues are management problems as is all too often the case in most developing countries. The consequences may affect the sustainability of the tourism sector, millennium health development goals and poverty alleviation measures.

ACKNOWLEDGEMENTS

The authors are thankful to the Department of Environmental Science at the University of Botswana for the support to carry out the study and the Lobatse Town Council, Department of Environmental Health and the Lobatse landfill employees and scavengers. Professor Darkoh from the Department of Environmental Science for his invaluable support.

REFERENCES

- Abdelatif, M.A. (2001). Assessing of Sri Petaling Landfill Towards Pollution in an Unconfined Aquifer, PhD Thesis, University of Putra, Malaysia.
- Abd Malek, Z.D., Hassan M.N., and Sapari, N. (1996). Technological and Economic Evaluation of Solid Waste Scavenging and Recycling Practices. *Pertanika Journal of Science and Technology* 4 (1), 115 – 130.
- Adewole, A. T. (2009). Waste Management towards Sustainable Development in Nigeria: A case study of Lagos state. *International NGO Journal* 4 (4), 173 – 179.
- Afon, A.O. (2012). A Survey of Operational Characteristics, Socio-economic and Health Effects of Scavenging Activity in Lagos, Nigeria. *Waste Management and Research* 0(0), 1 – 8.
- An, H., Englehardt, J., Fleming, L., and Bean, J. (1999). Occupational Health and Safety amongst Municipal Solid Waste Workers in Florida. *Waste Management Research* 17(5), 369 – 373.
- Athanasίου, M., Makrynos, G., and Dounias, G. (2010). Respiratory Health of Municipal Solid Waste Workers. *Journal of Occupational Medicine* 60(8), 618 – 623.
- Bogner, J., Abdelrafie Ahmed, M., Diaz, C., Faaij, A., Gao, Q., Hashimoto, S., K. Mareckova, K., Pipatti, R., Zhang, T. (2007). Waste Management, In Climate Change 2007: Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Mertz, B., Davidson, O.R., Bosch, P.R., Dave, R., Meyer, L.A., (Eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- BOPA Daily News (2006, December 13). Lobatse Landfill in Deplorable Condition. Botswana Press Agency.<http://www.olddailynews.gov.bw/cgi-bin/news.cgi?d=20061213> (Accessed 04/05/2010).
- Chattopadhyay, S., Dutta, A., Ray, S. (2008). Municipal Solid Waste Management in Kolkata, India:-A Review. *Waste Management* 29(4), 1449 – 1458.
- Chofqi, A., Younsi, A., Lhadi, E. K., Mania, J., Mudry, J., and Veron, A. (2004). Environmental Impact of an Urban Landfill on a Coastal Aquifer (El Jadida, Morocco). Laboratory of Environmental Techniques and Geosciences, Faculty of Science, El Jadida, Morocco. *Journal of African Earth Sciences*, 39(3 – 5), 509 – 516.
- Christensen, J. B., and Christensen, T. H. (1999). Complexation of Cd, Ni and Zn by DOC in Polluted Groundwater: A Comparison of Approaches Using Resin Exchange, Aquifer Material Sorption, and Computer Speciation Models (WHAM and MINTEQA2). *Journal of Environmental Science and Technology*, 33, 3857 – 3863.
- Cointreau, S. (2006). Occupational and Environmental Health Issues of Solid Waste Management: Special Emphasis on Middle and Lower – Income Countries. Washington, D.C: World Bank.
- Government of Botswana (1998). Botswana Waste Management Act. Chapter 65:06 (<http://faolex.fao.org/docs/pdf/bot91838.pdf>. Accessed 26/01/14).
- Gutberlet, J., and Baeder, M. (2008). Informal Recycling and Occupational Health in Santo Andre, Brazil. *International Journal of Environmental Health Research*, 18(1), 1 – 15.
- Hunt, C. (1996). Child Waste Pickers in India: The Occupation and its Health Risks. *Environment and Urbanization* 8(2), 111 – 118.
- Khan, M.Z.A. and Agarwal, S.K. (2006). Environmental Management. APH, New Delhi.

- Lavoie, J., and Guertin, S. (2001). Evaluation of Health and Safety Risks in Municipal Solid Waste Recycling Plants. *Journal of Air Waste Management Association*, 51, 352 – 360.
- Lobatse Town Council (2012). Interviews with the Department of Environmental Health. Lobatse Town Council, Lobatse, Botswana.
- Lobatse Town Council (2006). Lobatse Development Plan 2 (2003-2009). Ministry of Local Government, Lobatse Town Council Urban Development Committee, Annual Report.
- Mangizvo, V. R. (2010). An Overview of the Management Practices at Solid Waste Disposal Sites in African Cities and Towns. *Journal of Sustainable Development in Africa*, 12(7), 233 – 239.
- Manyanhaire, I. O., Sigauke, E., and Munasirei, D. (2009). Analysis of Domestic Solid Waste Management System: A Case of Sakubva High Density Suburb in the City of Mutare, Manicaland Province, Zimbabwe. *Journal of Sustainable Development in Africa*, 11(2), 127 – 140.
- Masocha, M., and Tevera, D. (2003). Open Waste Dumps in Victoria Falls Town: Spatial Patterns, Environmental Threats and Public Health. *Geographical Journal of Zimbabwe*, 33(34), 9 – 19.
- Medina, M. (2000). Scavenger Cooperatives in Asia and Latin America. *Resources, Conservation and Recycling*, 31(1), 51 – 69.
- Miller, T. G. (1996). *Living in the Environment: Principles, Connections and Solutions*. Wadsworth Publishing Company, New York.
- Misra V., and Pandey, S.D. (2004). Hazardous Waste, Impact on Health and Environment for Development of Better Waste Management Strategies in Future in India. *Environment International*, 31(3), 417 – 431.
- Moyo, G., Keefe, D., and Sill, P. (1993). Zimbabwe's Environmental Dilemma, Yap (Eds), *Cleaner Production and Consumption in Eastern and Southern Africa: Challenges and Opportunities*. Weaver Press, Harare.
- Mwiganga, M., and Kansiime, F. (2005). The Impact of Mpererwe Landfill in Kampala-Uganda on the Surrounding Environment. Institute of Environment and Natural Resources, Makerere University, Kampala Uganda. *Physics and Chemistry of the Earth*, 30(11 – 16), 744 – 750.
- Nas, P.J.M., and Jaffe, R. (2004). Informal Waste Management: Shifting the Focus from Problem to Potential. *Environment, Development and Sustainability* 6, 337 – 353.
- Nguyen, H.T.L., Chalin, C.G., Lam, T.M., Maclaren, V.W. (2003). Health and Social Needs of Waste Pickers in Vietnam. (<http://www.docstoc.com/docs/50754786/Health-Social-Needs-of-Waste-Pickers-in-Vietnam> 06/08/2012).
- Noel, C. (2010). Solid Waste Workers and Livelihood Strategies in Greater Port-au-Prince, Haiti. University of the West Indies, Institute for Sustainable Development, Environmental Management Unit, 13 Gibraltar Camp Way, Mona Campus, Kingston, Jamaica.
- Nzeadibe, T.C. (2009). Solid Waste Reforms and Informal Recycling in Enugu Urban Area, Nigeria. *Habitat International*, 33(1), 93 – 99.
- Odukoya A, M., and Abimbola, A, F. (2010). Contamination Assessment of Surface and Groundwater within and around Two Dumpsites. *International Journal of Science and Technology*, 7(2), 367 – 376.
- Oelofse, S.H.H., and Strydom, W.F. (2010). Picking at Waste Facilities – Scavenging or Entrepreneurship. The 20th Waste Conference and Exhibition, Gauteng, South Africa.

Oyelola, O.T., Babatunde, A.I., Abiodun, A.A., and Popoola, E.O. (2011). Occupational Health Hazard Associated with Dumpsite Scavengers and Highway Workers in Lagos Metropolis. *Journal of Environmental Issues*, 1(1), 13 – 21.

Pandey, R. (2004). Solid Waste Management Practice and Health Implication: A Case of Kathmandu Metropolitan City, Nepal. *The Himalayan Review*, 35 – 36, 33 – 47.

Patil, A.D., and Shekdar, A.V. (2001). Health – care waste management in India. *Journal of Environmental Management*. 63, 211 – 220.

Pearce, D., and Turner, R.K. (1994). Economics and Solid Waste Management in the Developing World. *CSERGE Working Paper WM 94 – 05*.

Poulsen, O.M., Breum, N.O., Ebbehoj, N., Hansen, A.M., Ivens, U.I., Van Lelieveld, D., Malmros, P., Matthiasen, L., Nielsen, B.H., Nielsen, E.M. (1995). Collection of Domestic Waste: Review of Occupational Health Problems and their Possible Causes. *Science Total Environment*, 170 (1 – 2) , 1 – 19. DOI:10.1016/0048-9697(95)04524-5

Rankokwane, B., and Gwebu, T.D. (2006). Characteristics, Threats and Opportunities of Landfill Scavenging: The Case Of Gaborone – Botswana. *Geographical Journal* 65, 151 – 163.

Ray, M.R., Roychoudhury, S., Mukherjee, G., Roy, S., Lahiri, T. (2005). Respiratory and General Health Impairments of Workers Employed in a Municipal Solid Waste Disposal at an Open Landfill Site in Delhi. *International Journal of Hygiene and Environmental Health*. 208, 255 – 262.

Regassa, N., Sundaraa, R.D., Seboka, B.B. (2011). Challenges and Opportunities in Municipal Solid Waste Management: The Case of Addis Ababa City, Central Ethiopia. *Journal of Human Ecology*, 33(3), 179 – 190.

Rogers, J., Englehardt, J., An, H., and Fleming, L. (2003). Solid Waste Collection Health and Safety Risks Survey of Municipal Solid Waste Collectors. *Journal of Solid Waste Technology Management*, 28(3), 154 – 160.

Royer, A. (2011). Reduce, Reuse, Recycle: Informal Sector Recycling in Amman, Jordan. Proceedings of the National Conference on Undergraduate Research (NCUR).

Sarkar, P. (2003). Solid Waste Management in Delhi – A Social Vulnerability Study. In Martin, J., Bunch V., Madha Suresh and Vasantha Kumaran, T., eds., Proceeding of the Third International Conference on Environment and Health, Chennai, India.

Strange, K. (2002) Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes. Department for Environment Food and Rural Affairs. United Kingdom.

Tevera, D. S. (1994). Dump Scavenging in Gaborone, Botswana: Anachronism or Refuge Occupation of the Poor? *Geografiska Annaler* 76B (1), 21 – 32.

The Botswana Gazette (2010). Gaborone Solid Waste Management in a Mess. Wednesday, 19 May 2010, Gaborone, Botswana. info@gazettebw.com.

UNEP (1996). International Source Book on Environmentally Sound Technologies for Municipal Solid Waste Management. Technical Publication Series VI.

Wilson, D.C., Velis, C., and Cheeseman, C. (2006). Role of Informal Sector Recycling in Waste Management in Developing Countries. *Habitat International*, 30(4), 797 – 808.

World Bank (2001). Urban Environmental Priorities. Draft for Discussion, C.R. Bartone, Urban Development Division, Infrastructure Group, Washington, D.C., January.

ABOUT THE AUTHORS:

Reginald Dennis Gwisai is a PhD Candidate in the Department of Environmental Science, Faculty of Science, University of Botswana. Private Bag UB 00704, Gaborone, Botswana.

Olusegun Areola is Professor in the Department of Environmental Science, Faculty of Science, University of Botswana. Private Bag UB 00704, Gaborone, Botswana.

Eagilwe Segosebe is Senior Lecturer in the Department of Environmental Science, Faculty of Science, University of Botswana. Private Bag UB 00704, Gaborone, Botswana.