

CASE STUDY 1: HAZARDOUS WASTE MANAGEMENT IN TANZANIA - RETROSPECTION AND FUTURE OUTLOOK

M. E. Kaseva and S. E. Mbuligwe

Department of Environmental Engineering, University College of Lands and Architectural Studies (UCLAS), Dar es Salaam, Tanzania.

Keywords : Waste, hazardous waste management, Tanzania

Contents

1. Introduction
 2. Hazardous Waste Management General Concepts and Principles
 - 2.1 Significance of Hazardous Waste Management
 - 2.2 Hazardous Waste Problems
 3. Technical Issues, Facts and Figures on Hazardous Waste Management in Tanzania
 - 3.1 Identification and Characterization of Sources of Hazardous Wastes
 - 3.2 Composition and Characteristics of Hazardous Wastes
 - 3.3 Quantification of Hazardous Waste
 4. Current Hazardous Waste Management Practices in Tanzania
 - 4.1 Management Practices
 - 4.2 Industrial Hazardous Waste Management Practices
 - 4.3 Existing Medical Waste Management in Tanzania
 - 4.4 Policy and Legislation Issues
 5. Future Outlook on Hazardous Waste Management in Tanzania
 - 5.1 Needs for Proper Hazardous Waste Management
 - 5.2 Opportunities for Improvement of Hazardous Waste Management
- Glossary
Bibliography
Biographical Sketches

Summary

Gradually hazardous waste management is becoming an issue of concern in Tanzania. In the past, hazardous waste management has not been accorded its due importance and recognition essentially because of a low-level of awareness and financial and technical constraints. The population explosion and economic development accompanied by massive production of solid waste, including hazardous wastes, has triggered discussions that are aimed at targeting the lessons from developed countries that can help avert public health and environmental catastrophes in developing countries. This article gives an overview on hazardous waste management and practices in Tanzania. The discussion is centered on the major sources of hazardous solid wastes, namely: industrial activities, agricultural and agro industry, medical facilities, commercial centers, households and the informal sector which is currently recognized to be unique and a major source of hazardous solid waste in many developing countries. Concerning the technological aspects, waste management technologies, waste composition and waste characteristics, some facts and figures on hazardous waste management in Tanzania are reported.

1. Introduction

Hazardous waste management is a relatively recent phenomenon in developing countries. Tanzania, which has little advanced technology and is financially constrained, suffers severe consequences from hazardous waste mismanagement. Furthermore, the problems are exacerbated by little public awareness about where wastes are generated, or about their nature and effects. This minimal awareness prevails even among well-educated people. Beginning in 1996, there have been reports that agricultural hazardous wastes have been mismanaged, but these do not portray the full gravity of the problems because poor records are kept and there are deficiencies in relevant studies. Although a number of reports on the state of hazardous wastes in Tanzania do exist, they mainly focus on isolated cases. Agrochemical hazardous waste mismanagement in Tanzania can be traced partly to politically motivated development efforts. For example, the main strategy used to achieve self-sufficiency in agricultural production was intensive agrochemicals use. Although the strategy paid off in the short-term by averting famine and reducing external food dependence, it has also polluted soils and water bodies. It is noteworthy that there are a number of clandestine “import routes,” known as “rat routes,” which serve as entry points for externally generated hazardous wastes and goods that are banned in their countries of origin. There have also been reported cases of imports containing hazardous goods or expired goods that were repackaged and resold to unsuspecting buyers in Tanzania.

Currently, Tanzania has more than 183 hospitals, 291 health centers and 3286 dispensaries. Almost 58% of the hospitals, 6.2% of the health centers and 30% of the dispensaries are not government-owned and managed, and as such they are accorded almost no monitoring by government authorities. As a result, many health facilities generate hazardous and infectious wastes that are not dealt with properly. Hazardous substances can contaminate containers that are resold by scavengers as recyclables to unsuspecting customers, and other items contaminated with infectious or toxic constituents can find their way into the environment and cause harm. Filling stations for petrol, diesel and kerosene have mushroomed in every corner of Tanzania, especially in Dar es Salaam after the liberalization of the petroleum industry. Apart from potential fire hazards, cases of hydrocarbon water pollution have been reported, especially in groundwater, which is an important source of water for many city dwellers.

2. Hazardous Waste Management General Concepts and Principles

2.1 Significance of Hazardous Waste Management

Hazardous wastes are often by-products of development and part of the quest for prosperity. For a developing country like Tanzania, the rate of waste production, the types and sources of waste, and the potential risks from hazardous waste increase with economic development. Efforts to pursue economic growth are often not accompanied by the capacity to handle side effects that ensue from these efforts. So, as Tanzania struggles to catch up with developed countries, it exposes itself to unforeseen dangers from hazardous wastes.

Although hazardous waste problems lay in health- and safety-related considerations, additional factors enter the equation in Tanzania. These factors include the low public awareness, the technological and economic backwardness, the lack of legislative provisions for hazardous waste management, and the widespread hazardous waste dumping due to deficient control mechanisms and unscrupulous workers at national entry points. Also, liberalization of the economy has increased the types, the quantity and the spatial coverage of actual and potential sources of hazardous wastes and it has led to the sprouting of industries and other economic establishments that produce hazardous wastes in areas that were previously reserved for other uses like residential areas and sites near water sources.

It is also notable that many hazardous substances, mainly chemicals that are used in Tanzania, are imported, and more often than not there is neither strict control of their importation nor follow up procedures to track their use and disposal. This is added to the fact that there is often no validation of the general quality and suitability of hazardous chemicals for use prior to importation.

2.2 Hazardous Waste Problems

In Tanzania, safety and health issues are complicated by ignorance, legislative deficiencies, enforcement laxity, technological deficiencies and poverty. Industrial management laxity, which arises from the general quest for economic and social development and the low level of economic and social advancement, also complicates Tanzania's hazardous waste problems. Many people also do not receive regular medical care, which makes it more difficult to detect hazardous waste management problems and to provide adequate healthcare to victims of the management deficiencies. In addition to general environmental and human health harm from industrial waste mismanagement, a number of less obvious hazardous waste threats also exist in Tanzania. Accidental harm may occur when people do not read the labels of hazardous materials containers due to general illiteracy or not knowing the foreign languages in which most instructions are written. Household hazardous wastes are often not stored or used properly, and most people, the educated and illiterate alike, are not fully aware of the potential hazards from household materials and goods. Household sprays and insect repellents are an example of household substances whose dangers are not known to many people.

There have also been cases in which people ate seeds coated with toxic pesticides to stave off hunger, and scavengers often rummage through hospital or industrial wastes oblivious of the hazards they are exposed to or simply lacking alternative options for earning a living. Scavengers also magnify the inherent risks of wastes when they return hazardous waste to the main waste stream or divert it to other routes. Domestic pesticides have also been used in criminal undertakings, and in some cases thieves have fed meat doped with a potent pesticide to guard dogs in order to commit theft. Also, many cases of suicide and homicide involving the use of pesticides have been reported. Between 1975 and 1985, for example about 1320 people died from pesticide poisoning in Tanzania.

Major types of hazardous wastes in Tanzania currently include agro-chemical, household, mining and mineral processing, health care facility, industrial, construction and garage and workshop wastes. With respect to agro-chemical wastes, pesticides, including obsolete ones, cause problems in their handling, transportation, storage, application, and disposal. With respect to health facilities, there are more than 3760 health care facilities in the country that produce hazardous waste which presents a serious problem because the facilities are not properly equipped for managing their waste. In the mineral sector, new investments, mainly in gold mining, result in hazardous waste production from both the mining and the mineral processing stages. Gold mining experienced a surge in the late 1990s and early 2000s, and is a potential source of concern. Mines and mineral processing sites for coal, diamond and other minor minerals are less dangerous than gold mining, but tailings can still contaminate water sources and present dangers. In construction, materials that contain asbestos have been manufactured until recently, and asbestos is still used as a roofing material even where rainwater harvesting for household water use is practised, which presents an obvious public health risk. Garages and workshops, which are scattered in residential areas, discharge the remains of hazardous sprays, greases, petrol and heavy metals from spillages and workshop activities. Crude waste disposal sites also present a secondary source of hazardous waste risks because they receive ordinary solid waste and hazardous waste from almost all sources mentioned earlier. Additionally, auto repair workshops and related small-scale facilities have mushroomed amidst residential areas since economic liberalization, and their wastes present hazards due to a lack of pertinent controls and, where controls exist, relaxed enforcement of regulations. Many of these establishments qualify as small quantity generators (SQGs) of hazardous wastes, and the location of these facilities within human settlements magnifies the hazards.

Most institutional sources in Tanzania belong to the government, and laboratories are sources of mostly chemical hazardous wastes, including heavy metals. Some military installations are used for the manufacture and storage of ammunition and they are also used as testing grounds for military hardware.

Despite having an underdeveloped industrial base, Tanzania has many industries, and a good proportion of these produce hazardous wastes. Over 80% of all industries in Tanzania are in urban areas and 50% of these are found in major urban areas like Dar es Salaam city and a few other towns. Notably, almost 42% of all industries are concentrated in Dar es Salaam. Large sources of hazardous industrial wastes are the petroleum industry, producers of vegetable oil and fats, cigarettes and tobacco, pyrethrum products, insecticides and pesticides, paints, drugs, laundry and toilet detergents, auto tyres, dry cells and auto batteries, rolled steel, and glassware. Some industries also release toxic, corrosive, flammable and reactive wastes at different degrees of intensity and varying flow rates. Most industries are not well equipped to handle their effluent, and a recent study on industrial effluent revealed that a soap factory was discharging untreated effluent with a pH value of more than 11 and a COD concentration of more than 1700 mg/l. Studies carried out downstream of a major solid waste disposal site for Dar es Salaam city indicated that there were very high flows of heavily polluted leachate running to the Msimbazi River, which traverses the city, and the leachate was causing pollution that harms aquatic life.

There are also a number of contaminated sites, and a good example is an abandoned fertiliser plant site. Not only is the site of the plant contaminated, but it has also become a source of air, water and soil pollution in Tanga, a coastal town in northern Tanzania. There are also abandoned solid waste disposal sites that contain hazardous wastes and some sites are contaminated from accidental oil, petrol, kerosene, and other hazardous substance spills that occurred during transportation. Sites that were once used to store obsolete pesticides in many parts of Tanzania are typical contaminated sites, and many contaminated sites are not cleaned up because the large financial resources necessary are not available. According to a 1998 study by the National Environment Management Council (NEMC), there are more than 300 contaminated sites in Tanzania. The informal sector, which presents many waste hazards, employs a large part of the country's workforce, especially in Dar es Salaam.

Reported health and environmental effects from hazardous wastes in Tanzania are scanty because there is generally no monitoring. However, cases of water pollution as well as soil and food contamination have been documented, and some health effects have been correlated with pollution. For example an increase in cancer and susceptibility to uncommon diseases have been linked to agrochemical pollution. Pesticide pollution has been revealed by the presence of a number of pesticide components in soil and water, and improper storage of pesticides has been reported to result in DDT pollution in some parts of the Coast Region. Fish caught in Lake Tanganyika, which is the second deepest lake in the world, have been found to contain measurable quantities of DDT and its metabolites, and legumes and cereals collected from Arusha were found to contain BHC, DDT, dieldrin, fenithrothion and malathion. Furthermore, samples of maize, wheat and beans from local markets in Tanzania were found to contain DDT, dieldrin, lindane and endosulfan in high concentrations. Despite such growing evidence, data that provide a direct correlation between hazardous wastes and their health effects are hard to come by in Tanzania.

No specific study on effects of hazardous waste on the tourism industry, which is an important foreign exchange earner in Tanzania, has been reported. However, circumstantial evidence and other indications suggest that such effects are highly likely. For example, since many small rivers and streams in national parks have no bridges, vehicles carrying both tourists and national park workers have to cross them by wading through the water. This enables hazardous pollutants such as oils, greases, fuels (petrol and diesel), and heavy metals found on vehicle body and parts to easily get access to water, hence pollution of the water. Motorboats used to transport tourists around lakes and across rivers in national parks have effects similar to those of vehicles. Additionally, several cases of animals dying after ingesting plastic bags left in national parks by visitors have been reported. It can further be imagined that hazardous constituents of wastes that are not properly managed in national parks can leach or be flushed to surface and ground water during rains. There is ample evidence of marine pollution by hazardous wastes, which can be attributed to marine vessels such as ship and boats. Rivers that receive untreated industrial effluents and in turn discharge into the Indian Ocean are confirmed sources of marine-hazardous waste pollution. One of the most heavily polluted rivers with respect to hazardous constituents is Msimbazi River in Dar es Salaam City. Sources of hazardous waste pollution to this river are industries, a poorly managed municipal waste disposal site, storm water outfalls, and

farms under urban agriculture. A recent marine pollution study carried out at Kivukoni Front, Dar es Salaam indicates that both seawater and fish contain hazardous pollutants, lead and amines. Samples of fish were found to contain between 0.13 and 0.36 mg/kg of lead. Seawater samples were found to have an average lead content of 0.2 mg/L, which is way above the Tanzania Standard of 0.1 mg/L. This pollution was attributed to marine vessels such as boats used by fishermen and ships that visit Dar es Salaam port.

-
-
-

TO ACCESS ALL THE 15 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

Kaseva, M. and Mbuligwe, S. E. (1999). Ramification of Solid Waste Disposal Site Relocation in Urban Areas of Developing Countries: a Case Study in Tanzania. *Resources, Conservation and Recycling* Vol. 25 (2000), pp. 147 – 161. [This paper examines the solid waste recycling impacts associated with the relocation of a waste disposal site in Dar es Salaam]

Kawamala, E. V. (2000). Human Health Risk Assessment in Relation to Carcinogenic Substances. Unpublished Report, Department of Environmental Engineering, UCLAS. [This is a dissertation that focuses on human carcinogenic health risks from marine pollution at Kivukoni Port Front, Dar es Salaam City]

Marwa, C. (2000). Management of Solid Waste from the Dry Cell Factory - Case Study Matsushita Electric Company (EA) Ltd. Unpublished report, Department of Environmental Engineering, UCLAS. [This is a report on solid waste management in Matsushita Electric Company in Dar es Salaam, which manufactures dry cells]

Mato, R. A. M. and Kaseva, M. E. (1999). A Critical Review of Industrial and Medical Waste Practices in Dar es Salaam City. *Resources, Conservation and Recycling*. Vol. 25(1999), pp. 271 – 287. [This is a paper which reviews industrial and medical waste management in Dar es Salaam]

Mato, R. A. M. (2002). Groundwater Pollution in Urban Dar es Salaam, Tanzania. Eindhoven University of Technology. [This is a PhD thesis that focuses on assessment and development of an information system for guiding groundwater pollution protection in Dar es Salaam City]

Mbuligwe, S. E. (1999). Public Health and Environmental Hazards Imminent from Hospital Sanitation Services in Tanzania. *The Tanzania Engineer*; Vol. 6, pp. 24 -29. [This paper discusses potential impacts from health care facilities]

Mbuligwe, S. E. (2003). The Health and Environmental Trail of Agrochemicals Use in Tanzania – Root Causes, Impacts and Mitigation Prospects. In Press: *The Journal of Building and Land Development*. [This is a paper that discusses causes and effects of agrochemical waste pollution in Tanzania]

MOH (1995). Health Statistics Abstract 1995. Health Information System (HIS) Unit, Ministry of Health (MOH). The United Republic of Tanzania. Issue No. 3, June 1995. [This is a report on health care situation in Tanzania]

Mtalo, J. O. and Swai, CL (1996). Investigation of Health Care Solid Waste Management in City Health Facilities. Urban Health Project (Unpublished Report). [This is a report that presents an inventory on health care waste management in Dar es Salaam City, Tanzania]

NEMC (1994). Report on Management of Solid Waste in Referral Hospitals in Tanzania – Muhimbili Medical Centre, Kilimanjaro Christian Medical Centre, Bugando Referral Hospital and Mbeya Referral Hospital. National Environmental Management Council (NEMC) Unpublished report. [This is a report that presents an inventory on health care waste management in Tanzania]

NEMC (1994). Proposals for the Environmental Protection Bill. National Environment Protection Council (NEMC), Dar es Salaam, Tanzania [This is a comprehensive proposal on environmental legislation in Tanzania]

NEMC (1998). Obsolete Pesticides and Veterinary Wastes in Tanzania. National Environment Management Council (NEMC). Unpublished Report). [This is an inventory report on obsolete pesticides and veterinary wastes in Tanzania]

VPO (1997). National Environmental Policy. Vice-President’s Office (VPO), Dar es Salaam, Tanzania. [This is a policy document on environmental management in Tanzania]

Biographical Sketches

M. E. Kaseva PhD is currently a senior lecturer at the University College of Lands and Architectural Studies (UCLAS), Dar es Salaam, Tanzania, in the Department of Environmental Engineering where he has been employed since 1988. He is a LEAD International (Leadership for Environment and Development) Fellow. He is also a registered engineer (T), a member of the Institution of Engineers Tanzania (IET), and the International Water Association (IWA). He has previously worked with the Ministry of local government as an assistant executive engineer. M. E. Kaseva has carried out various research works related to water and waste management in Tanzania, out of which a number of publications have been made. Currently he is engaged in research work on the use of constructed wetlands for polishing on-site anaerobically pre-treated domestic wastewater.

Stephen E. Mbuligwe lectures in the Department of Environmental Engineering at the University College of Lands and Architectural Studies (UCLAS), Dar es Salaam, Tanzania. He is also a practitioner in Public Health and Environmental Engineering. He has been involved in teaching, research, and consultancy in the field of Environmental Engineering since 1992. He holds an Advanced Diploma in PHE, a postgraduate Diploma in Environmental Management and an MSC in Environmental Engineering. He is member of a number of Professional Associations including the International water association (IWA) and the Association of Public Health and Environmental Engineering of Tanzania (APHEET). He is also a registered professional public health and environmental engineer in Tanzania. His current research focuses on treatment of VOCs in upflow engineered wetland systems. He has published a number of technical papers in his field.