

Assessment of Waste Management in the South African Chemical Industry

Sindisiwe Chauke and Charles Mbohwa

Department of Quality and Operations Management
University of Johannesburg
Bunting Road Campus, Johannesburg, South Africa
chaukesindisiwe@yahoo.com, cmbohwa@uj.ac.za

Kehinde Sobiyi

Department of Mechanical Engineering Science
University of Johannesburg
Kingsway Campus, Johannesburg, South Africa
ksobiyi@uj.ac.za

Abstract

The Chemical industry are beneficial in improving human wellbeing by providing employment, better quality health, productive lifestyle and nutrition opportunities. However, the pollution from the industry has been associated with negative impacts on health and safety of humans, threatening the sustainability of the environment. Waste from the Chemical industry poses a significant threat to humans and environment when management is improper. Chemical waste generation and its management have been a serious problem ever since human habitation. Minimizing of waste and reuse are main issues relating to the management of chemical waste. South Africa backs the hierarchy of waste by encouraging production processes that are cleaner, minimizing waste, reusing, recycling and treating waste, making disposal the last option for the management of waste. Stringent hazardous or chemical waste control and management are required to avoid harm or damage to the environment and humans, while reducing liabilities. This paper gives an overview of the waste management of chemical waste in South Africa.

Keywords

Hazardous waste, chemical industry, waste disposal

1. Introduction

South Africa's economy happens to be the most economically developed in Africa mainly because of its well-organized exploitation of the country's rich mineral resources and the much diversified manufacturing sector. Various legislation and by-laws nationally and provincially have been adopted in addressing the waste management in South Africa (Wiebelt, 2001) . However, the disposal of waste in South Africa is mainly landfills and research proves that it is not properly managed according to national requirements (Karani and Jewasikiewitz, 2007) . The waste from the chemical industry is hazardous, which if not properly managed can cause very serious health and environmental impacts. Hazardous waste is described as waste containing organic and inorganic elements with inborn physical, chemical and toxicological characteristics that have dangerous consequences on the health of humans and the environment (Ginindza and Muzenda, 2014). Hazardous waste with low concentrations of toxicity still has detrimental effects on human health and the environment, hence strict management and control is required for the safeguarding of humans and the environment ('Emerging Issues Paper : Hazardous & New waste types', 2008). Hazardous waste in the past was dispose either on the industry' site or private hazardous waste site. Two drivers were initiated in South Africa to change this tendency ('National Waste Management Strategy', 2011):

- Reuse or recycling supporting policy and,
- Growing social resistance to hazardous waste incineration.

Recently, the waste emanating from the chemical industry is becoming a concern in South Africa and urgent attention is required in addressing this problem before it becomes catastrophic to the human and its environment.

2. South African Legislation on Waste Management

Developing countries such as South Africa, are affected by the continuous growth of population and consumption arrangement led humans in urban areas leading to socialto collapse socially and environmentally (Guimar, 2017). Historically, the management of waste was controlled by the

private sector where, glass, paper, plastics, aluminum and tinplate are the materials that is typically recycled (Karani and Jewasikiewitz, 2007). Waste Management is developing as the main sector for environmental infrastructure financing. Finance injection in the waste management decreases negative effects of development impacts (Karani and Jewasikiewitz, 2007) . According to South African National waste strategy, **waste** is any substance that can or cannot *reduced, re-used, recycled and recovered*:

- *That is surplus, unwanted, rejected, discarded, abandoned or disposed of;*
- *which the generator has no further use of for the purposes of production;*
- *that must be treated or disposed of; or*
- *that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector*

South African Waste management is controlled by legislation such as National Environment Management Act, Air Quality Act, Environment Conservation Act, National Water Act, Health Act, Hazardous Substances Act, Nuclear Energy Act and the Occupational Health and Safety Act (Muzenda, 2014). South Africa waste management was firstly regulated officially by the Environmental Conservation Act before the rest of the legislation joined (Muzenda, 2014).

The South Africa has a National waste management strategy with goals that also should be adhered to by any organization that generates waste:

- *Promoting waste minimization, re-using, recycling and recovery of waste.*
- *Ensuring the effectiveness and efficiency of waste delivery services.*
- *Growing the contribution of the waste sector to the green economy.*
- *Ensuring that people are aware of the impact of waste on their health, well-being and the environment.*
- *Achieving integrated waste management planning*
- *Ensuring sound budget and financial management for waste services.*
- *Providing measures to remediate contaminated land*
- *Establishing effective compliance with and enforcement of the Waste Act*

The country also has the Environmental Management Policy that set a number of objectives for integrated pollution and waste management system. These objectives include:

- Promoting cleaner production and start mechanisms that ensure continuous improvement in all parts of environmental management.
- Preventing and managing pollution of any area of the environment.
- Setting targets to minimize generation of waste and pollution at source while promoting waste hierarchy management practices.
- Regulating and monitoring waste production, enforcing measures for waste control, and coordinating waste management through a single government department
- Setting up information systems on chemical hazards and toxic releases and ensuring the outline of a system to trail the hazardous materials transportation.
- Ensuring the safeguard and active management of human health problems related to the environment in all forms of economic activity.

The South African legislation requires that the private sector; takes accountability for their final product all through the life cycle of the product; establishing cleaner technology practices and minimize generation of waste; forming systems and facilities to recycle waste at the end of their lifecycle of the products; developing waste management technologies that will ensure all waste generation in the country is managed according to the hierarchy of waste management; preparing and implementing industry waste management plans; and complying with license conditions and regulations ('National Waste Management Strategy', 2011).

3. The Chemical industry sector initiatives

In all the industries, the chemical industry happens to be the most regulated, these regulations' emphasis is mainly on the control of air and water emissions and waste disposal (Morrow & Rondinelli, 2002)The Chemical industry has an obligation to track chemical waste from when it was generated right through to final disposal (Scungio, Ascp and Asq, 2013). South African National Waste Management Strategy indicates that one of the requirements for waste management are to identify and quantify the generated core waste and how much impact it has on the quality of water and surrounding environment (Karani and Jewasikiewitz, 2007). García, Pongrácz and Keiski (2004), argues that the chemical industry has an assumption that minimizing waste means reducing the quantity of waste transported to landfill, whereas waste

management is a cradle to grave process. The South African Chemical and Allied industries association decided on the adoption of the ISO 14001 and Responsible Care; both standards ensured that companies environmental objectives are met (Dwarika, 2015). The Responsible Care program accentuates the significance adoption of waste reducing strategies and the necessity of organization's staff and customers training (García, Pongrácz and Keiski, 2004). The ISO 14001 voluntary international standard have been established to incorporate environmental aspects into organization processes and products (Dwarika, 2015). Environmentally unsafe inputs are replaced with more environmentally safe ones by preventing pollution and thus avoid high generation of waste. Some of the chemical companies in South Africa have implemented Green chemistry in their business as an environmental sustainability strategy. Green chemistry supports the use of a principles that have a capability of reducing or eliminating hazardous waste generation during the production and application (García, Pongrácz and Keiski, 2004).

4. Hazardous chemical waste types

The hazardous waste may be in a form of solid, liquid or gaseous and including a range of toxic, ignitable, corrosive substances (Jang and Lakhan, 1989). Hazardous waste is grouped into four hazard ratings in terms of Department of Water Affairs and Forestry in South Africa (Ginindza and Muzenda, 2014):

- **High Hazardous waste**- contains significantly high toxic ingredients and persist in the environment and accumulate in biological tissues, this waste requires stringent control and serious attention.
- **Moderate Hazardous waste**- it possess highly dangerous characteristics , highly explosive, flammable, corrosive and contains significant concentration of high/ moderate toxic constituents.
- **Low Hazardous waste**- it has dangerous characteristics or with significant concentrations of available toxic ingredients.
- **Potential Hazardous waste**- it has characteristic toxicity, which are either in a form that will remain insoluble or are of significant concentrations.

5. Chemical waste disposal, treatments and managements

Minimization of hazardous waste is crucial environmentally, and mandated by laws (Scungio, Ascp and Asq, 2013). The South African law requires the disposal of chemical or hazardous waste be on a permitted site and chemical waste from these companies is contracted by waste transporters, of which charges are per quantity collected (Davies, 1996). Special handling, treatment and disposal is required of hazardous waste, hence disposal of waste in South Africa is done by accredited service providers (Davies, 1996). Disposal of hazardous waste occurs via incineration, fuel blending and burial on the ground. There are other various methods used for reducing hazardous waste before disposal (Scungio, Ascp and Asq, 2013). One of those methods is neutralization, where a neutralizing agent is used to treat waste to a pH value that is neutral so it can dispose of down the normal drain as permitted by water authorities (Scungio, Ascp and Asq, 2013). Waste facilities management also prove to be an important way of combating illegal dumping for environmental protection and sustainability (Liu, Kong and Santibanez, 2017). Prevention of waste together with recycling is the most effective strategy to improve waste management in the chemical sector

6. Barriers of effective waste management

Organisations that are not using cleaner production technologies, suffers from less competitive economy and are prone to accidental and operational pollution, this increases the treatment and disposal costs that are not productive (Karani and Jewasikewitz, 2007). The chemical industry suffers the challenge of preventing waste during their production and the costs associated with it. Wiebelt (2001), argues that reduction in waste, appropriate treatment and disposal are not affordable within the current economic circumstances of the South African country. Wiebelt (2001), further mentions that higher waste costs of treatment and disposal would decline the international competitiveness of South Africa in crucial export markets. Another challenge faced by the country is illegal dumping, where hazardous waste disposal on sites with no license instead of using an authorized hazardous dump area. The underlying soil quality and watercourse are under high risk of being damaged if solid wastes are dumped inappropriately (Liu, Kong and Santibanez, 2017). Illegal waste dumping has been widely regarded as one of the biggest source

of environmental damage and hence becoming the biggest challenge in South African waste management.

7. Conclusion

The chemical industry is one of the important industry in the South African industrial base, continuously being pressured to operate in an environmental friendly manner. The raw materials and feedstocks processing of chemicals emits hazardous toxins to the environment and produce hazardous waste that can have negatives impact on human beings as well. The chemical waste management is an international environmental issue that requires a waste management plan that will minimize the generation of waste, recycle and have disposal as the final of option.

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Biography

Sindisiwe Chauke is a masters' student at the Department of Quality and Operations Management at University of Johannesburg. She is currently a Quality Internal Auditor and a Senior Quality Control Technician at Henkel South Africa. She holds a National Diploma in Analytical Chemistry and B-tech Degree in Quality.

Charles Mbohwa is a Professor, and Vice-dean at the Faculty of Engineering and Built Environment, University of Johannesburg, South Africa. He earned his PhD from the Tokyo Metropolitan Institute of Technology in Japan. Prof. Mbohwa teaches Production and Operations Management and Food Production. His research activities are in logistics, supply-chain management, quality, operations management, life-cycle assessment, and bio-energy/fuel feasibility. He has general research interests in renewable energies and sustainability issues. Prof Mbohwa's current research in sustainability engineering includes:

Social and climate change comparison of bio-diesel life cycle impacts in Brazil and South Africa; Life Cycle Assessment and Comparisons of Rail and Road Freight Transportation in China and South Africa; The Potential, Energy and Environmental Impacts of Bio-energy in the Sugar Industry in South Africa; and the Economic, Energy and Environmental Evaluations of Biomass-based Fuel Ethanol based on Life Cycle Assessment.

Kehinde Sobiyi is currently a Postdoctoral research fellow at the Department of Mechanical Engineering Science, University of Johannesburg, South Africa. Dr. Sobiyi holds a PhD degree in Metallurgical and Materials Engineering from University of the Witwatersrand.

