Assessment of the Effects of Industrial Chemicals on Environmental and Public Health in Kibaha Municipal Council, Tanzania

Tanzania Education Cooperation (TEC-Org)

REPORT

Assessment of the Effects of Industrial Chemicals on Environmental and Public Health in Kibaha Municipal Council, Tanzania

Prepared by

In Collaboration with

Kibaha Municipal Council

Project Area

Kibaha Municipal Council

Project Duration

Six (6) Months

Date

17 December 2025

Table of Contents

1. Executive Summary
2. Introduction
3. Background and Justification
4. Problem Statement and Study Objectives
5. Methodology
6. Findings and Evidence
7. Environmental and Public Health Risks
8. 7.1 Rapid Industrialization and Emerging Environmental Concerns
9. 7.2 Air Pollution and Respiratory Health Risks
10. 7.3 Water Pollution and Public Health Implications
11. 7.4 Soil Contamination, Agriculture, and Food Safety Risks
12. 7.5 Occupational Exposure and Community Vulnerability
13. Regulatory and Institutional Challenges
14. Stakeholder Analysis
15. Expected Results
16. Sustainability and Way Forward
17. Conclusion
18. References

Executive Summary

This report presents the findings and framework for the assessment of the effects of industrial chemicals on environmental and public health in Kibaha Municipal Council, Tanzania. The assessment was initiated through collaboration between Tanzania Education Cooperation (TEC) / IDEERS4CSD and Kibaha Municipal Council following increasing concerns regarding environmental pollution and public health risks associated with rapid industrial growth within the municipality.

Kibaha Municipality has become one of Tanzania's rapidly expanding industrial zones due to its strategic location along the Dar es Salaam–Morogoro transport corridor and proximity to the Port of Dar es Salaam. Industrial expansion has contributed significantly to economic growth and employment opportunities. However, the increase in industrial activities has also raised concerns regarding chemical pollution, hazardous waste management, air emissions, and contamination of water and soil resources.

The assessment applied a mixed-methods approach involving environmental sampling, document reviews, stakeholder interviews, compliance evaluations, and community consultations. The assessment sought to identify major industrial chemicals and associated emissions, evaluate environmental and public health impacts, and assess compliance with environmental management regulations and standards.

Findings from national studies and previous environmental assessments indicate that industrial emissions, including heavy metals, particulate matter, untreated effluents, and hazardous chemical waste, pose serious environmental and health risks to communities living near industrial facilities. Evidence from Tanzania shows that industrial pollution contributes to respiratory diseases, water contamination, soil degradation, and long-term ecological damage.

The report highlights the need for strengthened chemical management systems, enhanced environmental monitoring, improved regulatory enforcement, and increased community awareness. The findings are expected to support evidence-based environmental planning and sustainable industrial development in Kibaha Municipality while safeguarding public health and environmental integrity.

1. Introduction

Inspired by the environmental stewardship principles of Agenda 21, Tanzania Education Cooperation (TEC) initiatives were established in 1995 and officially registered as a Non-Governmental Organization (NGO) in 2021. Since its establishment, TEC has actively promoted environmental protection, conservation, awareness, research, advocacy, and community engagement initiatives across Tanzania.

The organization has worked closely with governmental institutions, private-sector actors, civil society organizations, and local communities to address emerging environmental challenges and promote sustainable development.

In 2023, TEC initiated formal collaboration with Kibaha Municipal Council following the recognition of Kibaha as a rapidly growing industrial zone serving Dar es Salaam and the Pwani Region. Several TEC members residing within Kibaha industrial areas observed increasing environmental concerns associated with industrial chemical management, including pollution from industrial raw materials, chemical waste, emissions, and industrial by-products.

These concerns prompted informal consultations with stakeholders to explore intervention approaches and understand the scope of the environmental and health challenges facing local communities.

In May 2025, Kibaha Municipal Council formally invited TEC to collaborate in conducting a comprehensive environmental and public health assessment focusing on industrial chemical pollution within the municipality. This collaboration was based on TEC's expertise in environmental sciences, chemical management, stakeholder engagement, and community-based environmental interventions.

The assessment seeks to generate scientific evidence and municipality-specific recommendations that will strengthen environmental governance, chemical safety, and sustainable industrial development in Kibaha Municipality.

2. Background and Justification

Kibaha Municipal Council is increasingly becoming a major industrial hub within Tanzania due to its strategic geographical position along the Dar es Salaam–Morogoro highway and the Central Railway corridor. These transport systems serve as critical national logistics routes linking inland regions to the Port of Dar es Salaam.

Over the past two decades, Tanzania has experienced substantial industrial growth, with the manufacturing sector contributing significantly to national economic development. According to the World Bank (2023), the manufacturing sector contribution to Tanzania's Gross Domestic Product (GDP) increased from approximately 6–7% in the early 2000s to about 8.5% by 2022.

The expansion of industrial activities in urban and peri-urban municipalities, including Kibaha Municipality, has resulted in increasing environmental pressures. National environmental reports have identified industries as major contributors to:

- Wastewater discharge
- Hazardous chemical emissions
- Air pollution
- Soil contamination
- Improper disposal of industrial waste

Compliance inspections conducted by the National Environment Management Council (NEMC) indicate that several industries fail to fully comply with national environmental standards related to Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and effluent discharge management.

Scientific studies conducted in industrial regions of Tanzania have revealed elevated concentrations of heavy metals such as lead and chromium in soils and water bodies near industrial zones. Such contamination poses long-term risks to ecosystems, agricultural productivity, food safety, and human health.

Air quality assessments in industrial areas have also shown elevated concentrations of particulate matter (PM10), especially around cement and steel manufacturing industries. According to the

World Health Organization (WHO), ambient air pollution contributes significantly to respiratory illnesses and premature deaths in Tanzania.

Although Tanzania enacted the Environmental Management Act No. 20 of 2004 to regulate environmental pollution and chemical management, municipal-level enforcement continues to face challenges due to:

- Limited technical capacity
- Inadequate environmental monitoring infrastructure
- Resource constraints
- Variable compliance among industries

Given the concentration of industrial facilities within Kibaha Municipality and the documented risks associated with industrial chemical pollution, there is a strong justification for conducting a focused environmental and public health assessment.

3. About the problem to address

Kibaha Municipal Council is experiencing increasing environmental degradation and public health risks associated with intensive industrial activities and inadequate management of industrial chemicals.

Untreated industrial effluents, uncontrolled emissions, and poor handling of hazardous substances are contributing to pollution of water bodies, soil systems, and ambient air quality. Communities residing near industrial areas are increasingly exposed to environmental hazards that may contribute to respiratory illnesses, skin conditions, waterborne diseases, and long-term toxic exposure.

Despite the growing industrial activities within the municipality, there is limited municipality-specific evidence on chemical exposure and environmental health impacts. The absence of consolidated scientific data limits effective environmental planning, regulatory enforcement, risk management, and public awareness initiatives.

The overall objective of this assessment was to evaluate the environmental and public health effects associated with industrial chemicals generated by industries operating within Kibaha Municipal Council and to develop evidence-based recommendations aimed at strengthening sustainable chemical and environmental management practices. Specifically, the assessment

sought to identify and characterize major industrial chemicals and associated emissions released by industries within Kibaha Municipality, assess the extent of chemical contamination in air, water, and soil, and evaluate the related public health risks affecting surrounding communities. In addition, the assessment aimed to evaluate existing chemical management practices and regulatory compliance mechanisms implemented at the municipal level, while also proposing practical and evidence-based interventions to enhance chemical safety, environmental protection, and community awareness regarding industrial pollution and environmental health risks.

The assessment applied a mixed-methods research approach that integrated both quantitative and qualitative techniques in order to generate comprehensive and reliable findings. The methodology included an extensive review of relevant documents such as Environmental Impact Assessment (EIA) reports, National Environment Management Council (NEMC) inspection records, environmental compliance reports, national environmental policies and regulations, and World Health Organization (WHO) environmental health guidelines. In addition, field-based environmental sampling was conducted in selected industrial zones and nearby residential areas to assess water quality, soil contamination, and ambient air quality. Key informant interviews were also carried out with municipal environmental officers, industry representatives, health personnel, community leaders, and environmental experts to gather technical insights and stakeholder perspectives regarding industrial chemical management and environmental health concerns. Furthermore, community consultation sessions were organized to document community perceptions on pollution, reported health concerns, and environmental changes observed over time within affected areas. The assessment also involved compliance evaluations of industrial operations against standards and guidelines issued by the Tanzania Bureau of Standards (TBS), the National Environment Management Council (NEMC), and the World Health Organization (WHO) in order to determine the level of adherence to environmental and public health regulations.

4. Findings and Evidence

The assessment findings revealed significant environmental and public health concerns associated with industrial chemical pollution within Kibaha Municipal Council, reflecting broader national trends observed in rapidly industrializing municipalities across Tanzania. Existing national environmental reports and scientific studies indicate that industrial activities continue to contribute substantially to environmental degradation through air emissions, wastewater discharges, hazardous waste generation, and contamination of natural resources. Research

conducted in industrial regions of Tanzania demonstrated that prolonged exposure to industrial pollutants and heavy metals such as lead and chromium significantly increases the risks of respiratory illnesses, cardiovascular diseases, skin irritation, and other environmentally related health conditions, particularly among communities residing in close proximity to industrial facilities. These findings are consistent with national health sector data showing that acute respiratory infections remain among the leading causes of outpatient attendance in urban and peri-urban settings affected by industrial and transport-related pollution.

The assessment further identified that cement, steel, and manufacturing industries are among the leading contributors to particulate matter emissions in Tanzania, particularly PM_{10} concentrations that frequently exceed national ambient air quality standards. Similar industrial profiles are increasingly emerging within Kibaha Municipality due to ongoing industrial expansion along the Dar es Salaam–Morogoro industrial corridor. Preliminary field consultations and community engagement sessions conducted during the assessment revealed growing concerns among local residents regarding persistent offensive industrial odors, excessive dust emissions, discoloration of water sources, poor industrial waste disposal practices, and increased occurrences of respiratory illnesses, especially among children, elderly populations, and workers residing near industrial areas. Community members also reported eye irritation, persistent coughing, and reduced quality of life associated with continuous exposure to industrial emissions.

Environmental observations conducted during field visits further indicated signs of environmental degradation surrounding industrial zones, including declining vegetation quality, accumulation of solid and chemical wastes, contamination of drainage systems, and deterioration of nearby water channels. In some areas, residents expressed concerns regarding the potential contamination of shallow groundwater sources used for domestic purposes. The assessment also identified challenges related to inadequate enforcement of environmental regulations, limited environmental monitoring infrastructure, and inconsistent compliance with waste management and effluent discharge standards among certain industries operating within the municipality. These findings underscore the urgent need for strengthened environmental governance, enhanced industrial compliance monitoring, improved chemical management systems, and increased community awareness initiatives aimed at reducing environmental pollution and protecting public health within Kibaha Municipal Council.

5. Environmental and Public Health Risks

Rapid Industrialization and Emerging Environmental Concerns

The assessment identified significant environmental and public health risks associated with increasing industrial chemical exposure within Kibaha Municipal Council, reflecting broader national concerns linked to rapid industrialization across Tanzania's eastern development corridor. Kibaha Municipality has emerged as one of the fastest-growing industrial zones in Pwani Region due to its strategic position along the Dar es Salaam–Morogoro highway and the Central Railway network, both of which serve as major national transport and logistics corridors connecting inland regions to the Port of Dar es Salaam. According to the World Bank (2023), Tanzania's manufacturing sector contribution to Gross Domestic Product (GDP) increased from approximately 6–7% in the early 2000s to about 8.5% by 2022, with industrial expansion being concentrated mainly in urban and peri-urban municipalities such as Kibaha. While industrialization has contributed to employment creation, infrastructure development, and economic growth, the rapid increase in industrial activities has also intensified environmental pressures associated with chemical emissions, hazardous waste generation, wastewater discharge, and pollution of air, water, and soil resources. The assessment findings indicate that inadequate management of industrial chemicals and weak environmental control systems are contributing to increasing environmental degradation and heightened public health vulnerabilities among nearby communities.

Air Pollution and Respiratory Health Risks

Air pollution emerged as one of the most serious environmental and public health concerns identified during the assessment. Industrial activities within Kibaha Municipality, including cement production, steel processing, fuel combustion, transportation operations, chemical handling, and manufacturing activities, were found to contribute substantially to emissions of particulate matter, dust, smoke, and toxic gases into the atmosphere. National Environment Management Council (NEMC) reports indicate that particulate matter (PM_{10}) concentrations in industrial areas of Tanzania frequently exceed the national ambient air quality standard of 100 µg/m³, particularly in

municipalities hosting cement and steel industries similar to those increasingly operating within Kibaha. According to the World Health Organization (WHO), ambient air pollution contributes to approximately 46,000 premature deaths annually in Tanzania, with urban and peri-urban populations facing the highest levels of exposure due to combined industrial and transport emissions.

Community consultations conducted during the assessment revealed widespread concerns regarding persistent dust emissions, offensive industrial odors, smoke accumulation, and declining air quality in residential areas located near industrial facilities. Residents reported increased incidences of coughing, breathing difficulties, chest discomfort, eye irritation, skin irritation, and recurrent respiratory infections. Health sector data from the Ministry of Health further indicate that acute respiratory infections consistently rank among the leading causes of outpatient attendance in Tanzania, especially within densely populated and industrialized areas. Prolonged exposure to airborne industrial pollutants has been associated with increased risks of asthma, chronic obstructive pulmonary diseases, cardiovascular diseases, hypertension, lung irritation, and reduced lung function. Vulnerable groups including children, elderly individuals, pregnant women, and industrial workers were identified as being particularly susceptible to the adverse health effects associated with poor air quality and continuous exposure to toxic industrial emissions.

Water Pollution and Public Health Implications

The assessment also identified water pollution as a major environmental and public health challenge within Kibaha Municipality. Findings indicate that insufficient treatment of industrial effluents, poor wastewater management systems, and improper disposal of liquid chemical waste are contributing to contamination of both surface water bodies and shallow groundwater sources used by surrounding communities for domestic purposes. National compliance inspections conducted by NEMC have shown that a substantial proportion of industries in Tanzania fail to consistently comply with national effluent discharge standards, particularly regarding Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) levels. Excessive discharge of untreated or partially treated industrial wastewater increases the risk of introducing toxic chemicals, heavy metals, oils, and other hazardous substances into nearby rivers, drainage systems, and groundwater reserves.

Community members consulted during the assessment expressed concerns regarding water discoloration, unpleasant odors from drainage systems, oily residues in stagnant water, and

suspected contamination of wells and shallow water sources. Residents reported fears regarding the safety of water used for drinking, cooking, bathing, and other domestic purposes. Exposure to contaminated water may contribute to increased risks of waterborne diseases, gastrointestinal infections, skin disorders, chemical toxicity, and long-term chronic health complications resulting from continuous exposure to hazardous substances. Reduced water quality further threatens household sanitation, food preparation safety, and access to clean and safe drinking water, particularly among low-income communities residing close to industrial areas where alternative water sources may be limited.

Soil Contamination, Agriculture, and Food Safety Risks

The assessment further highlighted significant environmental risks associated with soil contamination resulting from industrial chemical deposition, hazardous waste accumulation, and improper waste disposal practices. Although Kibaha Municipality-specific peer-reviewed soil contamination datasets remain limited, evidence from adjacent and comparable industrial settings within the Dar es Salaam–Pwani industrial corridor provides strong indication of similar risk patterns.

A study by Mwegoha and Kihampa (2010) examining industrial and agricultural zones in Dar es Salaam and parts of the wider coastal region (including Pwani influence zones) reported elevated concentrations of heavy metals such as lead (Pb), cadmium (Cd), chromium (Cr), and mercury (Hg) in soils located near industrial and traffic-intensive areas. In several sampled locations, lead concentrations exceeded 100 mg/kg, while cadmium levels were reported above 2 mg/kg, both of which are considered above typical international soil safety thresholds for agricultural soils (WHO/FAO guideline ranges generally indicate concern at Pb >50–100 mg/kg and Cd >1–3 mg/kg depending on land use context). These findings suggest a clear risk of toxic accumulation in regions experiencing similar industrial expansion patterns to Kibaha.

Within Kibaha Municipality, these risks are increasingly plausible due to the rapid growth of industrial activities along the Dar es Salaam–Morogoro corridor, including manufacturing, cement-related operations, metal works, and transport-linked industrial services. Field observations conducted during the assessment indicate weaknesses in industrial waste handling systems, including inadequate segregation of hazardous waste, open dumping in non-designated areas, and insufficient effluent treatment before discharge into surrounding environments.

Soil contamination in such contexts poses serious implications for agricultural productivity and food safety, particularly in peri-urban Kibaha where smallholder farming coexists with expanding industrial zones. The accumulation of toxic metals in soils can lead to reduced soil fertility, disruption of microbial activity, and impaired plant growth, ultimately lowering agricultural yields. More critically, heavy metals such as lead and cadmium can be absorbed by edible crops (e.g., leafy vegetables and grains), increasing the likelihood of bioaccumulation in the human food chain.

Environmental observations further revealed localized land degradation, declining vegetation vigor, discoloration of soils, and contamination of nearby drainage channels in proximity to industrial clusters. Such patterns are consistent with findings from Tanzania's urban-industrial regions where uncontrolled discharge of industrial residues has been linked to progressive ecosystem stress. Studies by the National Environment Management Council (NEMC) have similarly emphasized that poor hazardous waste management in rapidly industrializing districts contributes to long-term soil quality decline, loss of biodiversity, and increased exposure risks for surrounding communities.

Occupational Exposure and Community Vulnerability

Occupational and community exposure to hazardous chemicals remains another major concern identified during the assessment. Workers in industrial settings face exposure through inhalation, dermal contact, spills, and unsafe handling under conditions where protective systems are limited, with global estimates indicating 2.78 million work-related deaths annually and approximately 374 million non-fatal occupational injuries each year. Risk factors observed in similar industrial contexts include inadequate PPE use rates in informal and semi-formal industrial workplaces often exceeding 40–60% non-compliance, weak chemical storage practices, and insufficient ventilation systems.

Communities living near industrial facilities are exposed indirectly through contaminated air, water, and soil pathways. Globally, exposure to ambient and household air pollution contributes to approximately 7 million premature deaths per year, reflecting the scale of environmental health risks associated with industrial emissions and combustion-related pollutants. Children in such environments are particularly vulnerable, with respiratory infection rates in polluted industrial-adjacent zones often reported at 20–30% higher than in low-exposure areas in comparable developing urban settings, while elderly populations and individuals with pre-existing conditions face significantly increased risk of chronic respiratory and cardiovascular illnesses.

Preliminary field consultations in the Kibaha industrial corridor revealed observable concerns including increased frequency of respiratory symptoms, skin irritations, and general illness patterns reported by residents in proximity to industrial clusters, alongside visible environmental degradation indicators such as air quality deterioration, waste accumulation, and limited risk communication between industries and surrounding communities.

6. Regulatory and Institutional Challenges

The assessment further identified several institutional and regulatory challenges that continue to constrain effective environmental protection and chemical management within Kibaha Municipality. Although Tanzania enacted the Environmental Management Act No. 20 of 2004 to regulate pollution control and chemical management, implementation at municipal level remains challenged by limited technical capacity, inadequate environmental monitoring infrastructure, resource constraints, and inconsistent compliance among regulated industries. National environmental oversight systems indicate that environmental enforcement capacity is constrained by limited laboratory coverage (fewer than 10 accredited environmental testing laboratories serving the entire country), insufficient environmental inspectors relative to the over 100+ districts nationwide, and inadequate field monitoring equipment in many local authorities, affecting compliance surveillance effectiveness.

The rapid pace of industrial expansion within Kibaha Municipality has also increased pressure on municipal authorities responsible for environmental management and public health oversight. Weak enforcement capacity and irregular environmental monitoring increase the likelihood of continued industrial non-compliance, illegal waste disposal, and uncontrolled emissions. National compliance trends show that a significant proportion of small and medium-scale industries operate with partial or no full environmental compliance certification (often reported in national inspections as more than 30–40% non-compliance in inspection cycles in rapidly industrializing zones), increasing pressure on enforcement systems.

Consequently, the assessment emphasizes the urgent need for strengthened environmental governance systems, enhanced industrial compliance inspections, improved pollution monitoring infrastructure, stronger occupational health and safety measures, and expanded environmental education and community awareness initiatives. Addressing these challenges will be critical in reducing environmental degradation, protecting public health, and supporting sustainable industrial development within Kibaha Municipal Council.

7. Stakeholder Analysis

The assessment identified key stakeholders involved in environmental management and chemical safety within Kibaha Municipality.

Key Stakeholders

The assessment identified key stakeholders involved in environmental management and chemical safety within Kibaha Municipality, including Kibaha Municipal Council, the National Environment Management Council (NEMC), industrial operators, health facilities, educational institutions, community organizations, civil society organizations, and Tanzania Education Cooperation (TEC) / IDEERS4CSD. These stakeholders play interconnected roles in regulation, service delivery, awareness creation, compliance enforcement, and community engagement, and their coordinated collaboration is essential for strengthening environmental governance and promoting sustainable industrial development within the municipality.

8. Expected Results

The assessment is expected to generate municipality-specific evidence on industrial chemical pollution, identify pollution hotspots and vulnerable populations, strengthen environmental planning and decision-making processes, improve industrial compliance with environmental regulations, enhance public awareness regarding chemical safety and environmental protection, and support sustainable industrial and municipal development initiatives. These outcomes are intended to provide a stronger evidence base for targeted interventions and policy action within Kibaha's rapidly industrializing context.

9. Sustainability and Way Forward

The sustainability of this initiative depends on strengthening institutional capacity, improving environmental monitoring systems, and promoting long-term stakeholder collaboration. Key recommendations include strengthening municipal environmental monitoring systems, enhancing industrial compliance inspections, establishing routine environmental surveillance programs, promoting environmental education and public awareness campaigns, supporting community participation in environmental management, and strengthening partnerships between government institutions, industries, and civil society organizations. The findings from this assessment are intended to guide future environmental planning, regulatory enforcement, and policy

implementation within Kibaha Municipality to ensure long-term environmental protection and sustainable development.

11. Conclusion

Rapid industrial development within Kibaha Municipal Council presents both economic opportunities and environmental challenges. While industrialization contributes to employment creation and economic growth, inadequate management of industrial chemicals poses serious threats to environmental sustainability and public health.

This assessment highlights the urgent need for strengthened chemical management systems, improved environmental monitoring, enhanced regulatory enforcement, and increased public awareness regarding industrial pollution risks.

The collaboration between TEC / IDEERS4CSD and Kibaha Municipal Council represents an important step toward evidence-based environmental governance and sustainable industrial development. The findings and recommendations generated through this assessment are expected to support long-term environmental protection and improved public health outcomes within Kibaha Municipality.

12. References

- Mwegoha, W. J. S., & Kihampa, C. (2010). *Heavy metal contamination in agricultural soils and water in Dar es Salaam and Pwani regions, Tanzania*. African Journal of Environmental Science and Technology, 4(11), 763–769.
- National Environment Management Council (NEMC). (2020). *Industrial Pollution and Chemical Management in Urban Municipalities: State of the Environment Report – Tanzania.*
- National Environment Management Council (NEMC). (2020). *State of the Environment Report – Tanzania.*
- United Nations. (1992). *Agenda 21: Programme of Action for Sustainable Development*. United Nations Conference on Environment and Development (Earth Summit), Rio de Janeiro, Brazil.
- United Nations Environment Programme (UNEP). (2023). *Global Framework on Chemicals: For a Planet Free of Harm from Chemicals and Waste.*
- United Republic of Tanzania (URT). (2004). *Environmental Management Act No. 20 of 2004.*
- United Republic of Tanzania – Ministry of Health. (2020). *Health Sector Strategic Plan and Routine Health Data.*
- World Bank. (2023). *Tanzania Economic Update: Industrialization and Growth.*
- World Health Organization (WHO). (2021). *WHO Global Air Quality Guidelines.*
- Preliminary interviews with key stakeholders on environmental and chemical management issues in Kibaha Municipality.