WebLog Journal of Environmental Sciences

Review Article
Published: 26 Oct, 2026

Waste Management Crisis in Pakistan with Focus on Balochistan Addressing Environmental Impacts and Advancing Sustainable Development Goals through Policy and Practice



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Abstract

Solid waste management has emerged as one of the most urgent environmental and public health challenges in developing countries, particularly in Pakistan. Rapid urbanization, population growth, and unsustainable consumption patterns have greatly increased waste generation beyond the capacity of municipal systems to manage it effectively. As a result, improper waste disposal has led to environmental degradation, health hazards, and economic losses. Pakistan generates approximately 49-50 million ton of solid waste annually, with an annual growth rate surpassing 2%, yet only 50-60% assembled, and an even smaller fraction is properly treated or disposed of. Inefficient collection systems, open dumping, lack of waste segregation, and limited recycling infrastructure has intensified the crisis, particularly in urban areas. Plastic waste constitutes about 10-15% of municipal waste, further complicating management due to low recycling rate.

Keywords: Solid Waste; Waste Management; Balochistan; Recycling; Sustainability

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Received Date: *10 Oct 2026*
Accepted Date: *24 Oct 2026*
Published Date: *26 Oct 2026*

Citation:
Tabassum Khan N, Tabasum A. Waste Management Crisis in Pakistan with Focus on Balochistan Addressing Environmental Impacts and Advancing Sustainable Development Goals through Policy and Practice. WebLog J Environ Sci. wjets.2026.j2603. https://doi.org/10.5281/zenodo.23883616

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Introduction

A waste management crisis refers, to the failure of systems responsible for the collection, transportation, treatment, recycling, and disposal of solid waste, leading to uncontrolled accumulation, and environmental contamination [1]. It is represented by open dumping, inefficient collection, lack of recycling enforcement. infrastructure, and weak regulatory Waste management is the systematic control of the generation, collection, transportation, treatment, and disposal of waste materials. It covers all types of waste solid, liquid, and gas aiming to minimize environmental, health, and aesthetic impacts while recovering resources. Effective systems adhere to 7R approach (Refuse, Reduce, Reuse, Repair, Repurpose, Recycle, and Recover).

Current Scenario in Pakistan

Pakistan generates approximately, 49.6 million tons of solid waste annually, with an annual growth rate exceeding 2% due to town expansion [2]. However, only 50-60% of waste is collected, and even less are properly disposed of in sanitary landfills [3]. Plastic waste constitutes a significant portion of municipal waste, accounting for approximately 10-15%, with minimal recycling due to lack of segregation at source [4]. Major cities such as Karachi and Lahore experience severe waste accumulation, with landfill sites exceeding capacity and widespread open dumping practices [5].

Current Status in Balochistan

Balochistan faces more severe challenges compared to other provinces due to its colossal geography, limited infrastructure, and weak institutional capacity. Waste management in Balochistan, in Quetta, is currently facing a critical crisis, with over 50% of municipal solid waste remaining owing and dumped in open, uncontrolled areas. While the "Safa Quetta" initiative aims towards improve sanitation, the province lacks comprehensive, modern waste disposal, proper landfilling, and hazardous waste treatment.

• Municipal waste collection system is poorly developed, particularly in Quetta and surrounding districts [6].

• Open dumping and burning remain the chief disposal methods, contributing to air, soil pollution [3].

• There is a lack of engineered landfill and recycling plants, which exacerbates environmental degradation [7].

• Rural communities rely heavily on informal waste disposal practices, including: burning and burial [6].

• These challenges are further intensified by limited funding, lack of technical expertise, and inadequate governance frameworks.

Causes of Waste Management Crisis

1. Natural causes

• Rapid population growth leading to increased waste generation [8].

• Geographical dispersion within Balochistan complicating waste collection logistics [7].

2. Man-Made causes

• Poor urban planning and infrastructure development [2].

• Lack of waste segregation, at source [4].

• Weak policy implementation and enforcement [3].

• Low public awareness, and behavioral issues

• Increased production and consumption of plastics

Environmental Impacts

Improper waste management leads to severe environmental consequences:

• Soil contamination

Leachate from waste dumps introduces toxic substances into soil, reducing fertility and contaminating agricultural land [9].

• Water pollution

Waste dumping contaminates surface and groundwater sources, increasing risks of waterborne diseases [10].

• Air pollution

Open burning releases harmful pollutants, including dioxins and particulate matter, contributing to respiratory diseases [11].

• Marine pollution

Plastic waste enters rivers and oceans, affecting aquatic ecosystems and biodiversity [12] (Figure 1).

Health Impacts

Poor waste management directly affects human health:

• Increased incidence of respiratory diseases, due to air pollution [13].

• Spread of infectious diseases such as cholera and diarrhea [14].

• Exposure to toxic chemicals, and heavy metals

• Growth of disease vectors such as mosquitoes and rodents

Sustainable Development Goals and Waste Management

The challenge of waste management sits at very heart of sustainable development, and its most direct expression is found in Sustainable Development Goals (SDGs) framework established by the United Nations [15].

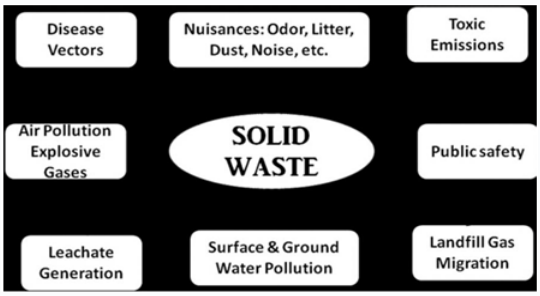


Figure 1: Improper waste management leads to severe environmental consequences.

SDG 12: Responsible Consumption and Production calls for a fundamental transformation in how societies produce, use, and dispose of materials, emphasizing sustainable resource efficiency, and waste minimization [15]. In the context of mounting waste generation, and inadequate disposal systems, SDG 12 underscore need to reduce waste at its source, promote recycling and reuse, and ensure sustainable use of natural resources, thereby addressing inefficiencies in production systems and unsustainable consumption patterns [1, 2]. Yet, the implications of waste management extend far beyond a single goal, intricately connecting with multiple dimensions of sustainable development [1].

SDG 11: Sustainable City and Communities highlight the critical role of effective urban waste management systems in creating livable, and resilient cities, particularly as rapid urbanization in developing regions places immense pressure on municipal infrastructure and service delivery [2]. Efficient waste collection, segregation, and disposal are therefore indispensable for reducing environmental degradation and improving urban sustainability [16]. Equally significant is the linkage with SDG 6: Clean Water, and Sanitation; as improper waste disposal frequently leads to contamination of surface, and groundwater resources through landfill leachate, and indiscriminate dumping [11]. Such contamination undermines access to safe drinking water and sanitation services, thereby posing serious public health risks. This directly affects SDG 3: Good Health, and Well-being, as exposure to polluted environments contributes to respiratory illnesses, waterborne diseases, and toxicological hazards associated with hazardous waste and chemical exposure [17].

The environmental consequences of waste mismanagement also intersect with global climate priorities under SDG 13: Climate Action, as open burning of waste and unmanaged landfills are significant source of greenhouse gas emission, particularly methane, potent contributor to climate change [11]. Sustainable waste management practices such as composting, recycling, and waste-to energy technology that can therefore play a vital role in mitigating climate change [15].

Furthermore, the pervasive issue of plastic waste links waste management to SDG 14: Life Below Water, as plastics escaping waste systems enter rivers, and ocean, posing severe threats to marine ecosystems, biodiversity, and food chains [12]. Similarly, SDG 15: Life on Land underscores the impact of land-based pollution, where poorly managed waste contributes to soil degradation, habitat

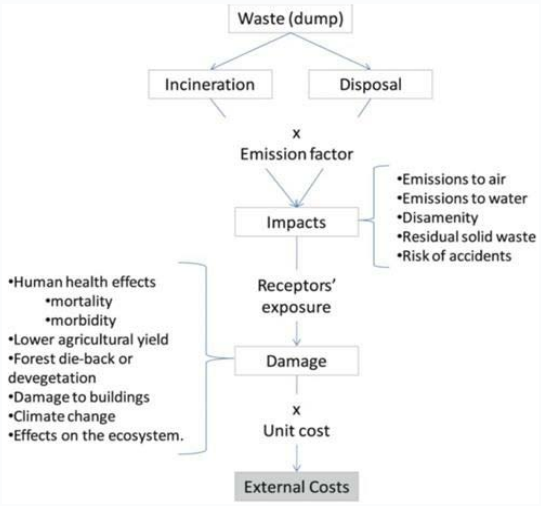


Figure 2: The challenge of waste management.

disruption, and loss of terrestrial biodiversity [9].

In essence, waste management is not an isolated environmental concern but a cross-cutting issue that influence public health, ecosystem integrity, urban sustainability, and climate resilience. Achieving SDG 12 serves as a gateway to progresses across these interconnected goals, reinforcing the idea that sustainable waste management is fundamental to building a healthier, cleaner, and more sustainable future [1, 15] (Figure 2).

Policy Frameworks and Strategic Initiatives in Balochistan

The Government of Balochistan has introduced a series of policy frameworks aimed at strengthening waste management systems and promoting sustainable environmental practices. The Balochistan Comprehensive Development and Growth Strategy (2021-2026) prioritizes institutional capacity building and emphasizes the needs for environmentally sound waste disposal mechanisms [18]. In alignment with this vision, the Balochistan Integrated Waste Management Plan, (BIWMP) proposes development of modern waste management infrastructure, including sanitary landfill, treatment facilities, and recycling systems to replace traditional disposal methods [7].

In the healthcare sector, the Balochistan Hospital Waste Management Rules 2020 establish mandatory guideline for the safe segregation, handling, and disposal of medical waste, thereby reducing risks to public health and the environment [19]. Regulatory, oversights are provided by Balochistan Environmental Protection Agency (BEPA), which enforces environmental standards, and requires Environmental Impact Assessments (EIA) for development projects to mitigate pollution [20].

Alongside these frameworks, practical initiatives are implemented to improve on-ground waste management. The Quetta Safa Initiative, introduced under a micro-franchise model by the Balochistan Public Private Partnership Authority, enhances waste collection efficiency while creating local employment opportunities [21].

Furthermore, efforts to establish modern sanitary landfills in Quetta aim to replace open dumping within environmentally controlled systems that incorporate leachate management [7]. Emerging recycling and composting initiatives are also promoting



Figure 3: Proper waste management.

resource recovery and supporting a transition toward a circular economy by targeting materials such as plastic, paper, and metals [1] (Figure 3).

Conclusion

Thus, the waste management crisis in Balochistan and across Pakistan is a pressing environmental and public health emergency that demands immediate, structured intervention. Resolving this crisis requires shifting away from the current linear "collect-and-dump" model and actively adopting a sustainable circular economy.

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