ISSN: 2976-7687

Journal of Waste Management & Recycling Technology

SCIENTIFIC Research and Community

Research Article

Open Access

Nexus of Air Pollution, Climate Change and Waste: Policy Gaps of Open Waste Burning in Selected Asian Countries

Lakshitha Chathuranga Paranagamage[1*], Miho Hayashi[2], Bimastyaji Surya Ramadan[3], Premakumara Jagath Dickella Gamaralalage[4] and Sadhan Kumar Ghosh[5]

[1]IGES Centre Collaborating with UNEP on Environmental Technologies, Institute for Global Environmental Strategies (IGES), 2108-11 Kamiyamaguchi, Hayama, Kanagawa 240-0115, Japan

[2]IGES Centre Collaborating with UNEP on Environmental Technologies, Institute for Global Environmental Strategies (IGES), 2108-11 Kamiyamaguchi, Hayama, Kanagawa 240-0115, Japan

[3]Department of Environmental Engineering, Faculty of Engineering, Universitas Diponegoro, Semarang, Indonesia

[4]IGES Centre Collaborating with UNEP on Environmental Technologies, Institute for Global Environmental Strategies (IGES), 2108-11 Kamiyamaguchi, Hay ama, Kanagawa 240-0115, Japan

[5]Sustainable Development & Circular Economy Research Centre, Kolkata, India

ABSTRACT

Open waste burning (OWB) is a prevalent waste management practice in many parts of Asia, contributing significantly to air pollution and undermining efforts towards climate mitigation. This paper examines the nexus of waste management, pollution control, and health while providing policy recommendations to address policy gaps and implementation challenges in Asia. This study reviewed OWB policies across 10 selected countries in Asia, examining existing policy frameworks, their effectiveness, and associated challenges. The data has been collected through desk research and interviews with key government officials. Qualitative content analysis was employed to analyze the data collected, complemented by a policy matrix summarizing national approaches to OWB. The study confirms that while many countries indirectly address OWB through air quality and waste management policies, explicit regulations are often lacking, leading to inconsistent enforcement. The study also highlights a critical gap in the waste management infrastructure which leads to OWB practices, and suggests policies that improve public awareness and cross-border collaboration to mitigate the impact of OWB.

***Corresponding author**

Lakshitha Chathuranga Paranagamage, IGES Centre Collaborating with UNEP on Environmental Technologies, Institute for Global Environmental Strategies (IGES), 2108-11 Kamiyamaguchi, Hayama, Kanagawa 240-0115, Tel: +818057141169, Japan.

Received: December 24, 2024; **Accepted:** December 27, 2024; **Published:** January 30, 2025

Keywords: Air Pollution, Black Carbon, Open Waste Burning, Policy Analysis, Waste Management

Introduction

Asia is the largest of the world's continents in terms of population and land area. As such, Asia generates the highest quantity of waste. The most common management strategies used in Asian countries are landfills, open dumps, and open waste burning (OWB). Exceptions to this are developed nations such as Singapore, Japan, and the Republic of Korea. The composition of waste has a major impact on the types of pollutants emitted during OWB. Waste generated in Thailand mainly consists of organic waste with a share of 62.7%, followed by plastic waste (31.68%). This composition indicates that burning plastic along with municipal solid waste generates the emission of hazardous pollutants into the ambient air [1]. OWB is considered incomplete combustion, owing to a lack of both oxygen supply and temperature control. Therefore, the toxicity of the emissions is higher compared to industrial incinerators [2].

Studies show that OWB has become a common practice due to the absence of appropriate dumpsites and waste collection services in poor urban and rural areas. Lower waste collection leads to higher OWB rates in developing countries [1]. In Asia, about 562 million tons of waste is openly burnt annually due to the absence of waste collection coverage [3]. While OWB is an issue in developing countries, controlled burning of waste to recover energy has been introduced in many countries such as Thailand, Malaysia, Japan, and China. OWB is a critical concern for developing countries in Asia wanting to maintain quality living standards in both urban and rural areas. Most developing countries in Asia have yet to achieve total mitigation of the OWB issue [1,3].

OWB emits many short-lived climate pollutants (SLCPs) and other pollutants including polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and polychlorinated biphenyls (PCBs) [1,4,5]. Among all the pollutants emitted during OWB, SLCPs have a short lifetime in the atmosphere. However, they have a greater global warming potential (up to 5,000 times greater) compared to CO2 [6]. SLCPs such as black carbon (BC) and methane (CH4) are emitted from other anthropogenic activities such as motorized road traffic, biomass burning, and incomplete fuel combustion [7].

Particulate matter (PM) consists of fine particles dispersed in the air, which is not a gas and is made up of various chemical compounds and particles. Due to the fine size of PM, particles may be transported around the body through the bloodstream, entering vital organs such as the heart, brain, and lungs, causing various health impacts [8]. In addition, BC and PM have severe implications especially for the health of dumpsite workers and surrounding communities [9,10]. BC is a component of PM which consists of ultra- fine particles derived from anthropogenic sources such as transport, OWB, and coal-fire plants that can directly enter the bloodstream and enable the absorption of a wide wavelength range of UV, visual and near-infrared solar radiation [4,11]. BC also can cross blood-brain barriers and cause neurodegenerative diseases. Furthermore, BC contributes to significant global warming predominantly in the short term. The effect of BC on short-term health is more severe than PM2.5 and PM10 [4]. The main sources of BC and PM are non-road transportation, wood combustion, and diesel vehicle combustion [12]. The OWB issue is more serious in Asia than in other regions as there are many air pollution hotspots in this region. For instance, Nepal has been identified as the global hotspot for air pollution due to brick kilns, traffic, and OWB [4].

There are a growing number of studies related to OWB, showing the increasing interest of researchers over the years. However, only a few of these studies set out the results of OWB inventories and practices, showing the impact on a regional or global scale. For instance, gives comprehensive global estimates of OWB practices and their potential impact in terms of the release of anthropogenic emissions [13]. Meanwhile carried out a more rigorous approach to estimate BC emissions from OWB [6]. The results underscored that BC emissions contribute over 2-10% of global CO2eq and are four times greater than the amount of CH4 released during waste decomposition. Furthermore, conducted an estimation of global mortality due to chronic exposure to PM2.5 emitted from OWB [14]. The results showed that the chance of premature death increased by 0.5% due to exposure to OWB. Regional studies on OWB were also done by, showing that OWB contributes to the highest number of regional deaths in North and West Africa [15]. Many researchers have already indicated that OWB practices are an urgent global issue both for health and the environment [16]. Conducted an economic assessment of two case studies in Asian countries [17]. They found that OWB has a greater environmental cost compared to the integration of closed burning such as incineration and composting. Despite the environmental, health, and economic losses caused by OWB, it is still a common practice. Therefore, there is an urgent need for policies and regulatory viewpoints to solve issues related to OWB, by finding the root causes and suggesting actions to deal with the impacts of these practices.

Despite having multiple effects on climate change, air pollution, and human health, OWB has been largely overlooked in Asia's national and sub-national policies and strategies. This paper aims to examine policy gaps in Asia to tackle the OWB issue and its impact on waste related to climate change and air pollution. Furthermore, the paper will discuss and provide recommendations to prevent OWB in Asia. The results of this paper will benefit policymakers and stakeholders in international development to initiate programs to transform open waste-burning-free countries and mitigate the emission of SLCPs in developing countries across Asia. It is crucial to address the root causes of OWB through effective policies, regulatory frameworks, improved waste management systems, and sustainable infrastructure development. The strategies targeting the sources of pollution can help mitigate environmental degradation, safeguard public health, and reduce immediate threats posed by SLCPs.

Materials and Methods

This study puts particular focus on reviewing existing national policies, regulations, ordinances, and rules related to OWB, as well as identifying gaps in policies and implementation. However, in some cases, regional laws and regulations have been taken as examples to elaborate their effectiveness. Furthermore, this paper is limited to the examination of the open burning of municipal solid waste and household waste, and the burning of materials at dumpsites. It does not address the burning of agricultural waste or construction debris.

The study employed a multifaceted research methodology incorporating desk reviews, as well as primary and secondary data collection and analysis, to achieve a comprehensive understanding of policy and implementation gaps. The primary data collection was specifically confined to conducting interviews with government officers from various levels within ministries and local governments of Cambodia, Lao PDR, Thailand, India, Maldives, Nepal, Pakistan, Iraq, Jordan, and China. After collecting various policies related to waste management, air pollution, and climate change, the contents of the documents were screened with the following keywords: open burning, waste burning, particular matter, black carbon, and dumpsite fire. After screening, a policy matrix was developed based on national policies, strategies, laws, and regulations relevant to OWB. In addition to the policy matrix, this paper utilizes data obtained through key informant interviews conducted with the government officers of the above-mentioned countries. Questions were asked regarding the existing policies, policy gaps, and challenges when implementing policies as well as further recommendations related to OWB. The snowball method was used to select key informants in the government sector. All key informants were directly engaged in policy formulation and implementing policies related to waste management, air pollution, and climate change.

Results and Discussion on Policies Related to OWB

Availability of Policies on Air Pollution, Waste Management, and Climate Change

National policies provide the overarching principles and guidelines that support decision-making, as well as giving the direction for and acting as a framework for all national and local strategies, action plans, and regulations. Therefore, establishing a national policy on a particular subject is crucial to ensure consistency across all related documents. The findings of this study highlight national strategies across Asia and the Middle East that address air pollution, waste management, and climate change, with a particular focus on managing OWB (See Table 1). Each country has established various policies to combat air pollution, often including measures that relate to controlling emissions from waste burning and other industrial sources. In Cambodia, Lao PDR, and Thailand, for instance, policies specifically aim to reduce OWB as a significant source of air pollution, while India's National Clean Air Programme seeks to lower particulate matter levels and addresses OWB indirectly by promoting better waste management practices. Waste management policies across these countries largely focus on promoting the "3R" approach—Reduce, Reuse, Recycle—while improving waste collection, recycling, and disposal infrastructure. Policies in countries like Lao PDR and Thailand seek to reduce open burning by providing better waste disposal alternatives, which is evident in Lao PDR's Solid Waste Management Strategy and Thailand's National Solid Waste Management Master Plan. Many of these policies also seek to minimize waste generation and strengthen infrastructure to handle waste sustainably, thereby reducing the need for open burning.

Climate change strategies across these countries are typically designed to reduce greenhouse gas (GHG) emissions and encourage sustainable practices, though they rarely address OWB directly. Instead, climate policies, such as the NDCs in Lao PDR, Iraq, and Jordan, focus on broader goals of emission reduction that indirectly address OWB by promoting efficient waste management and limiting emissions overall. While some climate change frameworks, like Jordan's and Thailand's Climate Change Master Plans, incorporate sustainable waste practices that reduce the likelihood of OWB, the connection to OWB often remains indirect. General air quality acts, climate change policies, and waste management reforms aim to reduce pollution sources or improve waste disposal methods without explicitly targeting open burning. For instance, Jordan's Action Plan on Solid Waste Management directly seeks to improve recycling rates and reduce the OWB. However, this direct approach is less common, with many policies instead addressing OWB indirectly as part of broader environmental and health goals.

Despite some alignment between policies on air pollution, waste management, and climate change, gaps remain, particularly in how explicitly OWB is addressed. While many countries promote sustainable practices that incidentally curb OWB, actionable measures specifically targeting open waste burning are not always clearly defined, leaving room for improvement. Nevertheless, some nations like China have set specific air quality targets, such as reducing PM2.5 concentrations, and have implemented policies to ban particular types of burning, such as straw burning, thereby contributing to efforts on improving air quality.

Table 1: Availability of National Policy

	Air Pollution	Waste Management	Climate Change
Cambodia	o	x	o
Lao PDR	o	x	o
Thailand	o	o	o
India	o	o	o
Maldives	o	o	x
Pakistan	o	o	o
Nepal	x	o	o
Iraq	o	o	o
Jordan	o	o	x
China	o	x	o

Availability of Other National Strategic Documents

Many national or local level strategies, action plans, regulations, and acts are developed, using a national policy as the framework. Strategies are formulated based on the policies, outlining comprehensive plans and approaches to achieve the goals and objectives defined by the policies. Strategies involve analyzing the environment, setting priorities, and determining the best course of action. Action plans are comprehensive outlines of specific steps and actions needed to implement the strategies and achieve the policy goals and objectives set in a policy. An action plan may include timelines, division of responsibilities, and resources required. Table 2 provides a comprehensive summary of the available strategic plans and action plans related to air pollution, waste management, and climate change. In compiling this summary, only documents that directly address these subjects were considered. It is important to note that Nationally Determined Contributions (NDCs) were excluded from this summary.

Table 2: Availability of Other National Strategic Documents

	Air Pollution	Waste Management	Climate Change
Cambodia	Clean Air Plan -2021	National Circular Economy Policy and Action Plan 2021-2035 National Sustainable Consumption and Production Roadmap - 2022	Cambodia Climate Change Strategic Plan 2014-2023.
Lao PDR	National Pollution Control Strategy and Action Plan (2018-2025)	National Action Plan on Plastic Management in Lao PDR	Green Growth Strategy to 2030
Thailand	No strategic plan or action plan	National Solid Waste Management Master Plan (2016-2021)	Thailand Climate Change Master Plan (2015-2050)
India	National Clean Air Programme 2019	National Urban Sanitation Policy (NUSP), 2008:	National Action Plan on Climate Change
Maldives	National Action Plan on Air Pollutants (2019)	Strategic Action Plan 2019-2023	Not available
Pakistan	Pakistan Clean Air Program	Draft Guidelines for Environmentally Sound Waste Collection and Disposal, 2005	Not available
Nepal	Not Available	National Urban Development Strategy, 2017	Nepal's Long-term Strategy for Net Zero Emissions, 2021
Iraq	No direct strategy	National Solid Waste Management Plan (2014)	Climate Change Adaptation and Mitigation Strategy
Jordan	National Strategy and Action Plan for Air Quality (2020–2030)	Jordan's Action Plan on Solid Waste Management (2020-2030)	No direct strategy
China	Action Plan for Continuous Improvement of Air Quality	No strategic plan or action plan	14th Five-Year Plan for Ecological and Environmental Protection:

Policy Gaps and Recommendations

The policy matrix summarizes the existing national-level directions to address OWB. Based on policies, some countries have developed strategic plans and action plans which are included in Table 2. The following sections present the current status and the existing policy gaps concerning OWB under several subtopics, namely prohibition of uncontrolled OWB, setting standards for controlled burning, legal and regulatory frameworks, waste management infrastructure, public awareness, education and capacity building, monitoring, reporting and verification, alternative waste disposal methods, collaboration and partnerships, and R&D, with a wide review of national documents.

Prohibition of Uncontrolled OWB

An understanding of the effects of OWB on air quality, regional climate change, and public health is vital for effective policy formulation. There have been several prohibitions of OWB in Asia both at the national level and sub-national levels. Cambodia, Jordan, and Iraq have specific regulations prohibiting OWB. The Maldives have included OWB-related laws focusing on the tourism sector. In contrast, Lao PDR does not provide explicit regulation on banning OWB, resulting in continued implementation of the practice in rural and urban areas. Thailand and India allow sub-national level authorities to issue bans on OWB concerning public health. However, decentralized enforcements lead to questionable effectiveness across regions. In India, despite strict laws on OWB, cities like Bengaluru practice OWB, indicating significant gaps in enforcement and public compliance. While China has not imposed bans explicitly on municipal waste, there is a ban on the burning of straw to reduce air pollution [18].

The analysis shows that while several countries impose restrictions on OWB at national and sub- national levels, significant gaps remain in terms of enforcement. These include a lack of direct and specific regulations, as well as the limited and inconsistant scope of laws. Improving enforcement mechanisms, developing institutional capacity, and creating awareness among the general public are important factors when formulating a comprehensive approach towards addressing the issue.

Air Quality Standards

OWB significantly contributes to the levels of BC and PM, including PM2.5 and PM10, which are known to have severe health impacts. The combustion of various waste materials releases a complex mixture of pollutants, including carbon monoxide, volatile organic compounds, and heavy metals. These emissions not only degrade ambient air quality but also contribute to regional climate change. Most countries in Asia have national standards and some countries have regional air quality standards for various pollutants including BC, PM2.5 and PM10. These standards are crucial for assessing and managing air quality. For example, Thailand has regional air quality standards across different cities in the country. Conversely, while some countries have not set national standards, they use other accepted standards. The Maldives use WHO standards for policies and decision-making. Despite the existence of air quality standards, significant policy gaps remain in addressing OWB. Inconsistent enforcement at the sub-national level and the lack of explicit regulations in some countries exacerbate the issue. To effectively mitigate the impacts of OWB, it is imperative to set standards for pollutants at both national and sub-national levels considering regional contexts. The monitoring of air quality will be discussed in section 4.6.

Waste Collection

Effective waste collection plays a crucial role in reducing OWB by providing solutions to getting rid of waste in households and commercial places [19]. A significant proportion of Asian countries, specifically 57%, have not yet achieved the minimum threshold of 80% waste collection coverage [20,21]. This deficit in waste management infrastructure poses a significant impact on the environment and on public health. Insufficient waste collection services often lead to the creation of unacceptable waste disposal practices, including open burning. Enhancing waste collection systems are therefore imperative for these countries to mitigate the adverse effects of improper waste management and to promote sustainable urban development. Addressing this issue requires coordinated efforts and investment in waste management infrastructure and public awareness campaigns. Some reasons why people tend to continue OWB even after they have been provided with adequate collection services include habit, impatience in waiting for collection services, lack of storage in backyards, animal disturbances, or lack of time to meet certain segregation criteria imposed by waste collection services [1].

Public Awareness, Education and Capacity Building

Public knowledge of pollution and its causes may be the most critical factor affecting the practice of OWB. Public awareness plays a key role in conveying government decisions policies, laws, and regulations to the general public. Studies show that narrating the consequences of pollution and potential actions together is a better means of communication and results in follow-up actions from the general public. Awareness campaigns can create recognition among the general public on their role in implementing national and regional level policies and strategies [16].

In Thailand, local governments are responsible for waste collection, treatment, and disposal to control OWB, agricultural residues, and other nuisances in their jurisdictions, as outlined in the Local Administration Act, Administrative Procedure Act B.E. 2539, Decentralization Act B.E. 2542, Disaster Prevention and Mitigation Act B.E. 2550, and Public Health Act B.E. 2535. Prevention measures focus on raising public awareness about legal penalties and reporting systems for burning incidents. To convey complicated laws to the general public, the local media has published burning restrictions, penalties, and emergency contact numbers via communication materials in local areas.

To enhance public awareness and engagement, it is vital to develop comprehensive strategic measures which clearly outline key messages and specific target audiences such as rural or urban communities, youth groups, and professional networks. Local or national funds can be deployed for public campaigns tailored to unique communities ensuring that messages are relevant and effective, and that they promote sustainable practices.

Role of the Informal Waste Sector

The informal waste sector including waste collectors and junk shops could play an important role in reducing OWB, especially in terms of recyclable items. This potential is supported by several studies. For instance, in Pune, India an initiative which integrated the informal waste sector through the SWaCH cooperative has significantly improved waste segregation and collection. This initiative has multiple benefits for the parties involved in the joint agreement. The municipality was able to reduce waste pick- up points and reduce the cost of the waste collection. The informal sector collectors have improved their business and they have recognition as part of the formal sector among the public. This sort of initiative reduces the chance of OWB and mitigates any effects. The community can experience a well-organized waste collection system with frequent collection [2].

Monitoring, Reporting and Verification (MRV)

Effective MRV systems are crucial for policymakers to understand the extent of the issue and how it impacts the development of effective policies and strategies. Establishing monitoring stations to track OWB is a part of the equation since air quality is impacted by various sources. OWB is one of many causes that degrade ambient air quality. Therefore, monitoring air quality alone does not provide a clear understanding of the OWB issue. The use of community-based approaches and the application of modern technology to monitor OWB incidents are also important factors, along with air quality monitoring in OWB hotspots.

As part of the seven measures to control open burning in 2022/23, Thailand uses the "Burn Check App", which utilizes satellite data to monitor and manage burn activities across the country. It offers real-time updates on active fires and hotspots, along with maps visualizing fire-affected areas. Users receive timely alerts about fire risks and are encouraged to report incidents, fostering collaboration with local authorities. Additionally, the app provides educational resources on fire prevention and management, ultimately enhancing public awareness and response to fire-related issues in Thailand. The fixed-site and mobile measurements combined with public opinion surveys is another approach to understanding the OWB issue with a constant time interval making a robust MRV mechanism [2].

Collaboration and Partnerships

Collaborative efforts including regional waste management are important to enhance the sharing of expertise and resources, leading to implementation of better strategies, despite the limited legal foundation to formulate inter-local governmental cooperation in Asian countries. Using local experiences in Asia, a regional approach such as a roadmap to address OWB should be designed and promoted with care and attention.

Conclusion

A policy analysis of OWB across various Asian countries reveals significant gaps in policies and implementation, as well as indicating various enforcement challenges. While several nations have recognised OWB as a practice that needs to be prohibited, enforcement at the local level remains inconsistent, highlighting the ineffectiveness of policies without a robust implementation plan. To address gaps, it is crucial to design or improve implementation mechanisms, develop institutional capacity, and enhance public awareness. It is important to set national and regional air quality standards which play a crucial role in developing strategies. However, some countries simply adopt the WHO standards, so it is clear that there is a need for localized standards which reflect specific national and sub-national contexts. Public awareness combined with citizen science approaches is important to ensure public compliance with policy decisions and to develop a strong MRV mechanism. The "Roadmap on ASEAN Cooperation Towards Transboundary Haze Pollution Control with Means of Implementation" and the "Roadmap for Sustainable Waste Management and Resource Circulation in South Asia" are important sub-regional agreements for addressing the OWB issue. Such sub-regional agreements need to be strengthened by incorporating specific targets for OWB. A regional approach including a roadmap to address OWB should be carefully designed and promoted to enhance cooperation and effectiveness.

References

1. Ramadan B S, Rachman I, Ikhlas N, Setyo Kurniawan B, Machmuddin Miftahadi F, et al. (2022) A comprehensive review of domestic-open waste burning: recent trends, methodology comparison, and factors assessment. Journal of Material Cycles and Waste Management 24: 1633-1647.
2. Krecl P, de Lima C H, Dal Bosco T C, Targino A C, Hashimoto E M, et al. (2021a) Open waste burning causes fast and sharp changes in particulate concentrations in peripheral neighborhoods. Science of The Total Environment 765: 142736.
3. Agamuthu P, Babel S (2023) Waste management developments in the last five decades: Asian perspective. In Waste Management and Research SAGE Publications Ltd. 41: 1699-1716.
4. Kutzner R D, Von Schneidemesser E, Kuik F, Quedenau J, Weatherhead E C, et al. (2018) Long term monitoring of black carbon across Germany. Atmospheric Environment 185: 41-52
5. Premakumara D G J, Menikpura S N M, Singh R K, Hengesbaugh M, Magalang A A, et al. (2018) Reduction of greenhouse gases (GHGs) and short-lived climate pollutants (SLCPs) from municipal solid waste management (MSWM) in the Philippines: Rapid review and assessment. Waste Management 80: 397-405.
6. Reyna Bensusan N, Wilson D C, Davy P M, Fuller G W, Fowler G D, et al. (2019) Experimental measurements of black carbon emission factors to estimate the global impact of uncontrolled burning of waste. Atmospheric Environment 213: 629-639.
7. World Health Organization (2013) International classification of diseases for oncology (ICD-O), 3rd ed., 1st revision. Https://Iris.Who.Int/Handle/10665/96612. https://iris.who.int/handle/10665/96612
8. Department for Environment Food & Rural Affairs (2024) Emissions of air pollutants in the UK – Particulate matter (PM10 and PM2.5). https://www.gov.uk/government/statistics/emissions-of-air-pollutants/emissions-of-air-pollutants-in-the-uk-particulate-matter-pm10-and-pm25
9. Afifa Arshad K, Hussain N, Ashraf M H, Saleem M Z (2024) Air pollution and climate change as grand challenges to sustainability. Science of The Total Environment 928: 172370.
10. Chavan D, Arya S, Kumar S (2022) Open dumping of organic waste: Associated fire, environmental pollution and health hazards. In Advanced Organic Waste Management: Sustainable Practices and Approaches 15-31.
11. Hu S, Zeng L, Zhao G, Chen S, Zhao C, Zhao W, Hu M (2025) Significant changes in the physicochemical properties of BC-containing particles during the cold season in Beijing. Journal of Environmental Sciences (China) 151: 667-676.
12. Healy R M, Sciare J, Poulain L, Kamili K, Merkel M, et al. (2012) Sources and mixing state of size-resolved elemental carbon particles in a European megacity: Paris. Atmospheric Chemistry and Physics 12: 1681-1700.
13. Wiedinmyer C, Yokelson R J, Gullett B K (2014) Global emissions of trace gases, particulate matter, and hazardous air pollutants from open burning of domestic waste. Environmental science & technology 48: 9523-9530.
14. Kodros J K, Wiedinmyer C, Ford B, Cucinotta R, Gan R, et al. (2016) Global burden of mortalities due to chronic exposure to ambient PM2. 5 from open combustion of domestic waste. Environmental Research Letters 11: 124022.
15. Gordon J N, Bilsback K R, Fiddler M N, Pokhrel R P, Fischer E V, et al. (2023) The effects of trash, residential biofuel, and open biomass burning emissions on local and transported PM2. 5 and its attributed mortality in Africa. GeoHealth 7: e2022GH000673.
16. Pathak G, Nichter M, Hardon A, Moyer E (2024) The Open Burning of Plastic Wastes is an Urgent Global Health Issue.

Annals of Global Health 90: 1-5.

17. Talang R P N, Sirivithayapakorn S (2021) Environmental and financial assessments of open burning, open dumping and integrated municipal solid waste disposal schemes among different income groups. Journal of Cleaner Production 312: 127761.
18. Akahoshi K, Zusman E, Hanaoka T, Kim Oanh N T, Huy L N, et al. (2024) The Prospects of Controlling Open Burning of Crop Residues in Thailand: A Quantitative Assessment of Implementation Barriers and Costs. Atmosphere 15: 1309.
19. Wilson D C, Paul J, Ramola A, Filho C S (2024) Unlocking the significant worldwide potential of better waste and resource management for climate mitigation: with particular focus on the Global South. Waste Management and Research 42: 860-872.
20. Kaza S Y L C B-T, Perinaz Van Woerden F (2018) What a Waste. https://openknowledge.worldbank.org/entities/publication/d3f9d45e-115f-559b-b14f-28552410e90a.
21. Koller H, Shrestha S, Tanaka M, Themelis N J, Fernando Juca J (2014) Antonis Mavropoulos-CEO of D-waste and Project Director Scientific Committee waste atlas team waste atlas 2014 Report http://www.atlas.d-waste.com/.

Copyright: ©2025 Lakshitha Chathuranga Paranagamage. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.