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PUBLIC AWARENESS OF THE HAZARDS OF COMBUSTION RESIDUES: A QUALITATIVE STUDY

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Abstract

Combustion byproducts from both domestic waste and industrial processes are significant contributors to air quality deterioration and environmental harm. Despite the adverse long-term effects on public health and ecosystem integrity, open burning continues to be a common practice in many communities, viewed as the easiest and most cost-effective way to eliminate waste. This research seeks to evaluate how aware the public is of the risks associated with combustion byproducts and the variables that impact this awareness. Using a qualitative-descriptive method that includes observations, detailed interviews, and literature analysis, the study reveals that while a significant number of community members are generally aware of the harmful effects of burning waste openly, actions reflecting environmentally conscious practices are still minimal. Key reasons behind this discrepancy involve a lack of environmental education, insufficient waste management systems, ingrained social practices, and financial limitations. The research concludes that improving public understanding calls for unified efforts that incorporate environmental education, supportive government policies, enhancements to waste management services, and participatory initiatives involving the community. Increasing public knowledge about the risks related to combustion byproducts is anticipated to be a crucial step toward fostering a lifestyle that prioritizes health and sustainability for the environment.

Keywords: *public awareness, combustion residues, air pollution, environment, ecological behavior*

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A. Introduction

Environmental issues are becoming an increasingly pressing worldwide concern, particularly those associated with air pollution resulting from human actions. A commonly disregarded contributor to air contaminants is the ash and smoke produced from the open incineration of household refuse, agricultural waste, and small-scale industrial refuse. The practice of open burning (pembakaran terbuka) is prevalent since it is thought to be the most straightforward, quickest, and most economical way to decrease waste volume. However, this method leads to a variety of harmful effects on both human health and the balance of ecosystems.[1]

The by-products of combustion emit dangerous substances such as carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and fine particulate matter (PM2.5 and PM10). Long-term exposure to these chemicals may lead to respiratory ailments, heart diseases, and a noticeable decline in air quality. Open burning further emits greenhouse gases that play a role in global climate change. In

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PRIMA LAW JOURNAL
Vol. 1, No. 1, 31 Mater 2026, pp. 1-9

local communities, the repercussions of these impacts are often overlooked since their effects are not instantly apparent, which helps to maintain a low level of public understanding regarding the dangers posed by combustion residues.[2]

Numerous interconnected elements contribute to this diminished awareness: insufficient public understanding of the dangers of air pollution, a lack of proper waste management systems, and ineffective enforcement of local environmental laws. Long-standing practices of burning, compounded by the unavailability of proper waste disposal methods, further exacerbate the issue. Consequently, the act of burning waste is still seen as a commonplace behavior that poses no significant risks.[3]

Therefore, increasing public knowledge about the dangers posed by combustion byproducts is a crucial step in protecting environmental integrity and community health. Continuous environmental education, governmental assistance in establishing waste management facilities, and fostering eco-friendly behaviors at both the individual and community levels are vital for changing public perceptions of open burning. This research explores three key inquiries: (1) What is the existing public awareness level concerning combustion byproduct dangers? (2) What elements lead to the low levels of awareness? (3) What methods can successfully enhance environmental understanding and inspire behavioral shifts?

B. Research Methodology

This research utilizes a literature review strategy, thoroughly exploring various studies, theories, and ideas related to public understanding of the dangers of combustion waste, practices of open burning, and environmental conduct. Information was collected using three supporting techniques: observing the community's waste burning activities; conducting in-depth discussions with community inhabitants, local government officials, and environmental specialists; and performing a detailed literature review of scholarly articles, government documents, and policy reports. The collected data were analyzed qualitatively through thematic exploration and triangulation to validate the findings' accuracy and dependability. The Environmental Awareness Model and Ajzen's Theory of Planned Behavior were the key theoretical frameworks used to analyze the connection between knowledge, attitudes, and actions in relation to the environment.[4]

C. Discussion and Analysis

1. Theoretical Framework: Key Concepts

1.1 The Concept of Public Awareness

Public awareness refers to the extent of understanding and sensitivity that individuals or groups possess regarding a social or environmental issue present in their environment. Soerjono Soekanto posits that community awareness can be defined as the public's grasp of norms, values, and the consequences of their behavioral decisions on collective well-being. In terms of environmental issues, awareness includes knowledge, concern, and a sense of duty towards preserving ecosystems. A strong

[2] Yetrawati RSP, Usmita F. Prevention of forest and land burning in Kuantan Mudik District, Kuantan Singingi Regency: a case study of the Kuantan Singingi Police. Jurnal Sisi Lain Realita. 2024;2024.

[3] *Ibid*

[4] Soekanto S. Sosiologi Suatu Pengantar [Introduction to Sociology]. 4th ed. Jakarta: PT Raja Grafindo Persada; 2002.

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PRIMA LAW JOURNAL

Vol. 1, No. 1, 31 Mater 2026, pp. 1-9

sense of environmental awareness inspires communities to engage in practices that align with the principles of ecological sustainability and refrain from actions that may harm the environment.[5]

1.2 Combustion Residues and Their Environmental Impacts

Combustion byproducts consist of the leftover ash, smoke, and harmful particles resulting from burning both organic and inorganic substances. The Ministry of Environment and Forestry (KLHK) states that open combustion continues to be the leading cause of air pollution in residential settings. These combustion byproducts emit fine particulate matter (PM2.5), carbon monoxide (CO), carbon dioxide (CO_2), and hazardous substances like dioxins and furans, all of which can pollute air and soil.[6]

The repercussions of combustion byproducts on the environment go beyond just air quality decline; they also play a role in enhancing the greenhouse effect and speeding up global warming. Open burning can harm soil microbes and diminish land productivity. The World Health Organization (WHO) indicates that extended exposure to smoke from burning can lead to respiratory diseases, chronic pulmonary conditions, and a decline in public health in crowded regions.[7]

1.3 Ecological Behavior

Ecological behavior signifies the actions of individuals that show concern for environmental issues and are undertaken with the intention of conserving nature. Examples of such actions include effective waste disposal, refraining from open burning, and engaging in conservation efforts. A person's degree of ecological awareness is influenced by their educational experiences, availability of information, current societal values, and firsthand encounters with the impacts of environmental damage.[8]

Ajzen's Theory of Planned Behavior posits that a person's intention to engage in environmentally responsible actions is influenced by three main components: (1) attitude toward the behavior which reflects how an individual sees an action as either favorable or unfavorable; (2) subjective norms which refers to the societal pressures that motivate a person to align with community norms; and (3) perceived behavioral control which involves a person's confidence in their capability to carry out a specific action. Each of these components significantly impacts both recognition and proactive measures regarding the dangers posed by combustion residues.[9]

1.4 Approaches to Enhancing Environmental Awareness

Increasing public understanding of the dangers associated with combustion residues can be achieved via environmental education, awareness campaigns, and the enhancement of governmental and community institutional frameworks. As stated by UNESCO, the goal of environmental education should be to cultivate the knowledge, attitudes, and skills required for engaging effectively in addressing

[5] Soekanto S. Kesadaran Hukum dan Kepatuhan Hukum [Legal Awareness and Legal Compliance]. Jakarta: Rajawali Pers; 1982. p. 45.

[6] Ismainar H, Marlina H, Afriza B, Atika W. Movement to reduce plastic waste and risks of waste burning through health education. Jurnal Pengabdian Kesehatan Komunitas. 2023;1(3).

[7] Rahman FA. Community preparedness in facing fire disasters in Pondok Karya Village, Pondok Aren District, South Tangerang City. Jurnal Pendidikan Geografi. 2023;10(1).

[8] Aprilia A, Haryati N, Dewi HE, Pariasa I, Hardana AE, Hartono R, et al. Awareness of household waste management with the zero-waste concept: a preliminary study. Jurnal Habitat. 2022;33(2):122–132.

[9] Tan J. Study of the impacts of dioxins, furans, and hazardous chemical compounds from combustion residues on the environment. Jurnal Ilmu Lingkungan. 2025;14(2).

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PRIMA LAW JOURNAL

Vol. 1, No. 1, 31 Mater 2026, pp. 1-9

environmental issues. Socialization initiatives within communities can function as powerful tools for fostering collective eco-friendly behaviors.[10]

The government holds a vital role in crafting regulations, establishing waste management systems, and supervising the execution of environmental policies. However, the involvement of the community remains the essential factor that determines the effectiveness of environmental initiatives. The collaboration between personal awareness, community support, and governmental policies is crucial for diminishing practices related to open burning and mitigating their impact on life quality.[11]

2. The Level of Public Awareness Toward Combustion Residue Hazards

The results obtained from field studies and interviews indicate that most members of the community recognize that open burning has detrimental effects on health and the environment. Nevertheless, this understanding has not effectively led to alterations in behavior. A significant number of individuals persist in burning waste, especially in their own yards, viewing it as the most convenient and cost-effective approach to managing waste.[12]

This observation highlights a considerable gap between knowledge and action: while community members are aware that smoke from burning contains toxic elements, persistent habits and the lack of available options like proper disposal sites, waste collection points, or consistent waste pickup services continue to encourage this behavior. Understanding has not transitioned into emotional and action-oriented awareness; in other words, awareness that results in tangible actions. This scenario corresponds with the Environmental Awareness Model, which suggests that changing behavior entails a stepwise process: acquiring knowledge, developing concern, and taking action.[13]

3. Factors Contributing to Low Public Awareness

Interviews conducted in the field uncovered four main factors that contribute to the ongoing low level of community understanding regarding the dangers associated with combustion byproducts, which are discussed in detail below.

3.1 Insufficient Environmental Education and Information

Most individuals surveyed indicated that they have not received any direct information from government bodies or environmental organizations regarding the risks associated with burning waste. The information they do access is often of a broad nature, mainly encompassing general hygiene tips without detailing the specific dangers of air pollution linked to open burning. This lack of focused environmental education signifies a major shortcoming in the community's ability to assess the enduring hazards related to waste burning methods.[14]

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[10] Andiansyah M, Winarno W, Meitasari I, Alwin A. Study of public knowledge on the impact of waste burning on air pollution in Cikopomayak Village, Jasinga District, Bogor Regency. Jurnal Pendidikan IPS. 2024;14(1).

[11] Sarjito S, Magfirona A, Wiyadi W. Implementation of incinerator technology for creative economy-based waste management in the MARDIKO scavenger community, Bantul, Yogyakarta. Warta LPM. 2023;28(2).

[12] Aprilia A, Haryati N, Dewi HE, Pariasa I, Hardana AE, Hartono R, et al. Op. cit.

[13] . Malik IA, Hardiyani R, Jaya Puspita H, Larasati NHD, Tarigan R. Improving community awareness in household waste management through environmental education. Jurnal Pengabdian kepada Masyarakat Nusantara. 2022;6(2).

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PRIMA LAW JOURNAL

Vol. 1, No. 1, 31 Mater 2026, pp. 1-9

3.2 Inadequate Waste Management Infrastructure

Waste collection services are still scarce in various areas examined. Communities that are situated far from dumping sites frequently take matters into their own hands by burning their waste. This issue is worsened by the lack of waste separation systems in the majority of neighborhoods. In the absence of proper infrastructure, even those residents who are highly aware of environmental issues might find themselves resorting to open burning due to the lack of suitable alternatives.

3.3 Deeply Rooted Social Habits and Norms

The practice of burning waste has been passed down through generations. Many individuals in the community view it as a routine action that does not pose any immediate risks. Such societal beliefs bolster a permissive mindset towards actions that are, in reality, harmful to the environment. The widespread acceptance of open burning diminishes individuals' willingness to explore or embrace better waste management options.

3.4 Economic Constraints

Responsible waste management methods, such as recycling or composting, are seen as necessitating more time and money. Members of low-income communities often opt for the quicker solution of burning their waste to save on both effort and expenses. Therefore, financial challenges work in conjunction with informational and infrastructural shortcomings to keep open burning as the prevailing waste management approach.

4. Environmental and Health Impacts of Combustion Residues

Field observations indicate that the areas under study often suffer from inadequate air quality, especially during the morning and afternoon times when residents engage in waste incineration. The smoke produced by combustion leads to mild respiratory issues such as cough and shortness of breath, which are particularly prevalent among children and older adults. Ash byproducts are usually allowed to build up in yards, which raises the potential for pollution of soil and rainwater.[15]

These findings align with the World Health Organization's research stating that open burning is responsible for around 29% of overall air pollution in residential regions. Fine particulate matter, known as PM2.5, can infiltrate the respiratory tract and heighten the chances of heart diseases and lung infections. Consequently, open burning is not only a sanitation concern but also a significant threat to public health and ecological viability.[16]

In addition to the effects on respiratory and cardiovascular health, the dioxins and furans emitted from the burning of plastics and organic materials act as persistent organic pollutants that can accumulate in food chains. Extended exposure to these substances in the environment has been associated with immune toxicity, disruption of hormonal functions, and cancer development, which makes the management of combustion byproducts essential for both public health and ecological well-being.[17]

5. Approaches to Improving Awareness and Behavioral Change

Enhancing the community's understanding of the dangers associated with combustion residues necessitates a comprehensive array of strategies. It is essential to elevate environmental education using

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[16] World Health Organization (WHO). Air pollution [Internet]. Geneva: WHO; 2020 [cited 2025 Mar 10]. Available from: https://www.who.int/health-topics/air-pollution.

[17] Oleniacz M, et al. Speciation of air pollutant emissions from household waste open burning in South Africa. Atmospheric Chemistry and Physics. 2023; 23:15375–15397.

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PRIMA LAW JOURNAL

Vol. 1, No. 1, 31 Mater 2026, pp. 1-9

schools, community events, and local media; details concerning the risks tied to combustion should be presented through clear and relatable illustrations.[18] Local authorities should broaden the waste management systems by incorporating waste banks, temporary collection sites, and consistent collection schedules, thus alleviating the necessity for communities to incinerate their refuse.[19]

Involving community leaders, youth groups (karang taruna), and local organizations in hygiene initiatives is more efficient due to their close relationship with the residents. Empowering the economy through recycling waste can turn non-biodegradable materials into profitable goods, providing alternative financial opportunities while reducing the tendency to burn waste.[20]

Implementing zero-burning regulations, backed by credible penalties and supported by accessible alternative systems, can initiate changes in norms within the community. The synergy of personal education, changes in social norms, and structural policy backing reflects the principles of the Theory of Planned Behavior: substantial behavioral transformation demands the concurrent evolution of attitudes, social norms, and perceived control over actions.[21]

6. Analytical Discussion

The research results indicate that community awareness is presently at a fundamental cognitive phase where individuals recognize the threats but have not advanced to a stage of proactive ecological engagement. This situation aligns with the explanatory model of the Environmental Awareness Model, which posits that changing behavior necessitates a step-by-step advancement from knowledge to concern and then to action. Without organized interventions at each stage, awareness will remain stagnant at the cognitive level.

The Theory of Planned Behavior is particularly significant in this context: community actions are significantly influenced by societal norms and individual perceptions of their own abilities. When community members think they have no options aside from incinerating waste, their motivation to alter their behavior diminishes. Therefore, any change in behavior needs to be supported by structures such as accessible waste management systems and favorable public policies.

This examination indicates that issues related to combustion waste are not merely individual issues but also highlight fundamental flaws in environmental governance at the community level. The level of public understanding is a crucial factor in the effectiveness of environmental protection efforts, but this understanding cannot be fully realized without proper government support and infrastructure. Educational methods that actively involve the community, such as training in composting, sorting household waste, and initiating waste banks, are practical and effective measures for fostering a true collective awareness of environmental issues.

D. Conclusion

Awareness among the public about the dangers of combustion residues remains quite limited. While many community members have a basic understanding of the harmful effects of open burning, this awareness has not led to consistent behavioral changes that are environmentally friendly in everyday life. Many still view open burning as a convenient, cost-effective, and quick way to manage waste, overlooking its lasting negative impacts on health and the environment.

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[19] Sarjito S, Magfirona A, Wiyadi W. Op. cit.

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PRIMA LAW JOURNAL

Vol. 1, No. 1, 31 Mater 2026, pp. 1-9

The main reasons for the lack of awareness in this area include insufficient environmental education, poorly developed waste management systems, persistent social behaviors, and financial limitations. The byproducts of burning, such as ash, smoke, and dangerous chemical particles, are well-established sources of air pollution, soil harm, and negative impacts on public health. In the long run, these activities could worsen climate change and disturb the balance of ecosystems

To tackle this problem, a broad and inclusive approach involving multiple stakeholders is necessary. There should be an increase in environmental education and awareness regarding the dangers of combustion through various community-driven initiatives. Local governments must take a proactive stance in establishing safe, sustainable waste disposal systems and enforcing environmental laws. Adopting zero-burning initiatives, along with engaging households in waste management training and empowerment programs focused on ecological practices, represents a feasible route to gradually eradicate open burning. With improved collective understanding and a sense of shared duty among individuals, communities, governing bodies, and educational organizations, it is possible to create a cleaner, healthier, and more sustainable environment for both current and future generations.

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PRIMA LAW JOURNAL

Vol. 1, No. 1, 31 Mater 2026, pp. 1-9

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