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Efforts of the Health Quarantine Center in Managing Port Environmental Pollution Supervision

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ABSTRACT

Purpose of the study: Environmental pollution in domestic port areas poses increasing risks to public health and operational sustainability. As the designated authority for port environmental health, the Health Quarantine Office (BKK) is mandated to supervise, prevent, and control potential sources of pollution. Strengthening its supervision mechanisms is essential to ensure effective environmental health management. This study aims to analyze the monitoring efforts undertaken by the Health Quarantine Office Class I Tanjung Balai Karimun in controlling environmental pollution at domestic ports and to evaluate the effectiveness of its environmental monitoring activities.

Materials and methods: A descriptive qualitative research design was employed. Data were collected through field observations, in-depth interviews with BKK officers and port management personnel, and documentation review. Data analysis included data reduction, data display, and conclusion drawing to systematically describe the monitoring processes and outputs.

Results: Findings indicate that BKK implements several monitoring activities, including water quality testing, ship waste management supervision, sanitation inspections of port facilities, and environmental awareness education for port users. Despite these efforts, several challenges persist, particularly limitations in human resources, laboratory infrastructure, and the consistency of monitoring schedules.

Conclusions: The study highlights the essential role of BKK not only in safeguarding human health but also in mitigating environmental pollution within domestic ports. The results underscore the need for enhanced institutional capacity and integrated environmental monitoring policies to improve the effectiveness and sustainability of port environmental health management.

Keywords

environmental health, environmental pollution control, domestic port, health quarantine office, tanjung balai karimun.

INTRODUCTION

Ports serve as primary gateways for maritime transportation, facilitating the mobility of people, goods, and services. Activities such as loading and unloading, ship movements, and high human traffic in port areas pose significant environmental risks, including seawater and air pollution, as well as solid waste from ship operations and port facilities. These risks threaten ecosystem balance and public health in surrounding communities. In this context, the Health Quarantine Center Class I Tanjung Balai Karimun plays a strategic role in overseeing environmental health surveillance at domestic ports, focusing on ship sanitation, water quality, waste management, and pollution prevention to mitigate disease transmission risks.

Existing studies have consistently underscored the critical importance of robust environmental health monitoring in port areas, where multifaceted activities such as ship docking, cargo handling, and passenger movements generate substantial pollution risks. For instance, research by Nurhayati provides compelling evidence on how ship-generated waste, including oily bilge water and sewage discharges, leads to severe microbiological contamination in port waters (Koboević et al., 2021; Kraus et al., 2022). This contamination not only endangers the health of port workers through exposure to pathogens but also poses long-term threats to coastal communities via bioaccumulation in seafood chains, highlighting the urgent need for proactive waste management protocols.

Complementing this, Yuwono et al., (2024) and Puig & Roman, (2024) stress that the efficacy of port environmental monitoring hinges on seamless inter-agency coordination and the adoption of data-driven systems. Their work illustrates how fragmented communication between health authorities, port operators, and environmental agencies can exacerbate pollution incidents, advocating for integrated platforms that enable real-time data sharing and joint response mechanisms to enhance overall surveillance capabilities.

According to (Hadjichristodoulou & Mouchtouri, 2019), port environmental health monitoring is a comprehensive framework that encompasses several key components: ship sanitation inspections to ensure compliance with international standards like those from the World Health Organization; assessments of clean water quality to prevent outbreaks of waterborne diseases

(Cramer et al., 2003); meticulous management of solid and liquid waste to minimize ecological footprints; and ongoing surveillance of risk factors such as air quality and vector control (Olatunji et al., 2024). This holistic approach is essential in mitigating the cascading effects of pollution on both human health and marine ecosystems.

Tambunan's work further demonstrates that the success of such monitoring initiatives is heavily contingent upon regulatory integration, adequate human resources, and supporting infrastructure (Dwiasnati et al., 2024). The study cites examples where poor regulatory alignment resulted in delayed detection of pollution events, such as oil spills from vessel accidents, leading to extensive environmental damage and costly remediation efforts (Olaniyi et al., 2024). These findings emphasize the necessity for streamlined policies that bridge gaps between national guidelines and local implementation.

SUNU advocates strongly for multi-stakeholder collaboration, particularly involving the Environmental Agency, Port Authority, and the Health Quarantine Office (Moyo et al., 2023). By fostering partnerships, SUNU argues, these entities can pool resources, share expertise, and conduct unified inspections, thereby creating a more resilient framework against emerging pollution challenges in dynamic port environments.

Additionally, (Barus & Djamburi, 2024) describes the BKK's role in proactive and preventive supervision, characterized by routine inspections, comprehensive audits, and rapid response protocols to pollution hotspots. This preventive stance allows BKK to identify and address issues before they escalate, such as irregular waste disposal practices by vessels. Meanwhile, Boaitey & Tuck, (2020) delves into the key factors influencing the effectiveness of these efforts, pinpointing human resource capacity—including training and expertise—as a primary determinant, alongside the availability of laboratory facilities for accurate testing and the importance of policy coordination to avoid overlaps or redundancies. Deficiencies in these areas often lead to inconsistent monitoring and suboptimal outcomes.

Finally, (Puig & Roman, 2024) promotes the integration of digital tools to revolutionize port environmental supervision, such as mobile applications for real-time water quality monitoring and electronic platforms for waste reporting. These innovations enable faster detection, automated alerts, and data analytics for predictive modeling, significantly improving response times and resource allocation in pollution management.

Collectively, these studies provide a solid foundation for understanding port environmental health dynamics, yet they also reveal opportunities for deeper exploration into context-specific applications, particularly in resource-limited domestic ports.

Despite these insights, gaps persist in understanding the Health Quarantine Office's specific role in environmental pollution monitoring at high-activity domestic ports like Tanjung Balai Karimun. Prior research predominantly addresses large international ports with advanced facilities, overlooking local contexts. Limited studies explore BKK's adaptive monitoring amid resource constraints, operator awareness issues, and suboptimal inter-agency synergy, particularly the integration of environmental health surveillance in mid-sized ports.

This study addresses these gaps by empirically examining BKK's monitoring efforts, providing academic contributions to environmental health and port management literature. Practically, it offers recommendations for agencies to enhance pollution control, fostering healthy, safe, and sustainable ports. The urgency stems from rising pollution risks in domestic ports, necessitating stronger policies for public health and marine ecosystem protection.

This research aims to: analyze the efforts of the Health Quarantine Office Class I Tanjung Balai Karimun in monitoring environmental pollution in domestic ports; and evaluate the effectiveness of these activities, identifying challenges and improvement strategies.

MATERIALS AND METHODS

This study uses a descriptive qualitative approach, which aims to describe in depth the monitoring efforts carried out by the Health Quarantine Center (BKK) regarding environmental pollution in the port area. This approach was chosen because it is able to explain the phenomenon contextually and naturally according to field conditions, especially in understanding the processes, policies, and challenges faced by environmental monitoring officers at the port. The study was conducted at the Tanjung Balai Karimun Domestic Port, Riau Islands Province, from September to October 2025, which is one of the active working areas of the Class I Tanjung Balai Karimun Health Quarantine Center.

The population in this study included all Health Quarantine Office employees directly involved in port environmental health monitoring activities, as well as related parties such as Port Authority officers, the Environmental Service, and ship operators operating in the port area. Given the qualitative nature of this research, the sampling technique used was purposive sampling, namely selecting informants deemed to have relevant knowledge and experience related to the research topic. A total of 10 key informants were selected, consisting of 5 BKK officers, 2 port officers, 2 representatives of ship operators, and 1 official from the regional Environmental Service.

The primary instrument of this research was the researcher herself, who served as the primary data collector through observation, in-depth interviews, and documentation. The interview guide was semi-structured, covering questions about environmental monitoring procedures, water and waste quality monitoring methods, forms of inter-agency coordination, and obstacles and strategies for improving monitoring effectiveness. Interviews were conducted directly at the work site, lasting between 30 and 60 minutes per informant. Additionally, secondary data was obtained from the BKK annual report, policy documents, and relevant port environmental inspection results.

To maintain data validity and reliability, researchers applied source and method triangulation techniques. Source triangulation was conducted by comparing interview results from various informants with different positions and responsibilities, while method triangulation was conducted by combining the results of interviews, field observations, and official documentation. The collected data were then analyzed using thematic analysis, which involves identifying, grouping, and interpreting patterns of findings related to the monitoring efforts, challenges, and supporting factors in the implementation of environmental monitoring by the BKK.

This research was conducted with the assumption that all informants provided information based on actual work

experience and in accordance with applicable operational procedures. However, this study is limited by the observation area, which focused on only one port, so the results cannot be generalized to all ports in Indonesia. Furthermore, the limited timeframe may have affected the depth of observation of the periodic monitoring cycle.

Nevertheless, the methodology used is expected to provide a valid and comprehensive picture of how the Health Quarantine Center carries out its strategic role in monitoring environmental pollution in ports. With detailed procedures and techniques systematically explained, this study is expected to be replicated by other researchers in different locations to obtain empirical comparisons regarding the effectiveness of environmental health monitoring systems in Indonesian ports.

RESULTS

This research was conducted at the Tanjung Balai Karimun Domestic Port to determine the extent of the Health Quarantine Center (BKK)'s efforts in monitoring environmental pollution in the port area. Data were obtained through in-depth interviews, field observations, and a review of BKK operational documents. Analysis of the results shows that environmental pollution monitoring is carried out periodically and in an integrated manner, but still faces several technical and coordination obstacles between agencies. The purpose of the Results is to state your findings and answer the questions posed in the Introduction, explain how the results support the answers, and how the answers correspond to existing knowledge on the topic. Data should be presented clearly to support your analysis.

Research result

Table 1 Health Quarantine Center's Supervision Efforts on Environmental Pollution at Tanjung Balai Karimun Domestic Port

No	Types of supervisory activities	Frequency of Implementation	Agencies Involved	Information
1	Inspection of the quality of clean water and ship waste water	Routine every month	BKK & Port Authority	Inspections were carried out in the dock area and the ship's water tanks.
2	Port area sanitation monitoring	Every quarter	BKK & Environmental Service	Covers solid waste management, drainage, and conditions of public facilities.
3	Inspection of cleanliness and disposal of domestic waste of ships	Incidental (based on reports or findings)	BKK, Harbor Master, Ship Operator	Carried out when there are indications of violations or pollution
4	Environmental health outreach to port workers	Twice a year	BKK & Port Health Office	Focused on preventing pollution and environmental-based diseases
5	Port Sanitation Inspection	Every semester	Central BKK & Tanjung Balai Karimun BKK	Assessing the conformity of supervision implementation with WHO standards

Source: Primary data from interviews and field observations (2025).

Based on Table 1, the monitoring activities carried out by the BKK are not only limited to water and waste quality inspections, but also include educational aspects, sanitation audits, and port facility inspections. These findings indicate that the BKK's approach is comprehensive and preventive, in accordance with the mandate in *Minister of Health Regulation No. 34 of 2013*. However, some activities, such as domestic waste inspections, are still incidental, relying on reports from other parties, which indicates limitations in the early detection system for pollution. Use a table to present a summary of your results effectively.

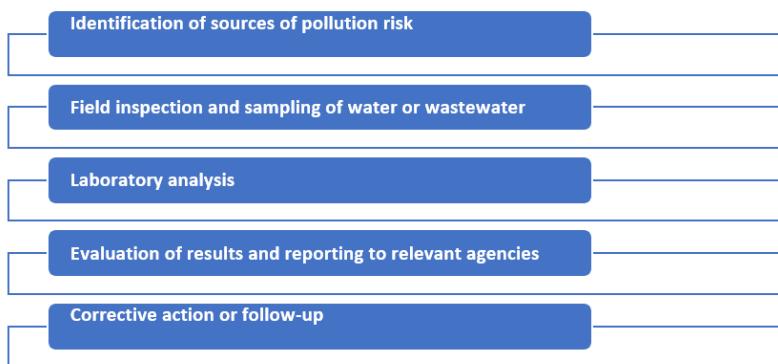


Figure 1 Environmental Health Monitoring Process by the Health Quarantine Center in

As seen in Figure 1, the monitoring process is continuous and iterative, with evaluation results used to improve the work system in subsequent periods. These results demonstrate a **cycle of continuous improvement** in the implementation of environmental health monitoring at the port.

Quotes/Quotations

The following are several excerpts from interviews with key informants that describe the factual conditions in the field: "We conduct monthly wastewater tests, especially on ships docked for more than three days. Sometimes the lab results show elevated organic matter levels, so we issue a direct warning to the ship."

— BKK Officer 1 / Theme: Water Quality Inspection / W1:13.45

"Coordination between agencies is still an obstacle, for example between the BKK and the DLH, due to differences in activity schedules and inspection data."

— BKK Officer 3 / Theme: Inter-Agency Coordination / W2:09.12

"Crew members' awareness of waste management is still low. Some dump liquid waste directly into the sea because they don't understand the impact."

— Ship Operator 2 / Theme: Behavior and Compliance / W3:10.30

The interview results indicated that monitoring was running according to procedures, but still faced technical and human behavioral challenges. Coordination and environmental awareness were the dominant factors influencing the effectiveness of pollution monitoring. Which stated that human resources and inter-agency coordination are the main challenges in implementing environmental monitoring at ports.

Overall, the results of this study indicate that the Health Quarantine Center has carried out its role quite effectively, particularly in terms of environmental quality inspections and educating the port community. However, the effectiveness of supervision is still limited by limited technical personnel and the integration of environmental information systems between institutions. The success of pollution monitoring at ports is greatly influenced by the digitization of reporting systems and synergy of cross-sector policies. In the context of Tanjung Balai Karimun Port, digitalization of supervision (for example, the integration of laboratory test results with the Ministry of Health database) has not been fully implemented, resulting in manual follow-up processes. Furthermore, there remains a gap between national policy and implementation on the ground. The BKK (Regional Port Authority) maintains monitoring guidelines based on WHO standards, but laboratory facilities and analytical equipment at the regional level are still limited. This results in delays in pollution detection and response to environmental incidents that could potentially threaten the health of port communities. Overall, this study indicates that environmental pollution monitoring by the BKK has a positive impact on the quality of port environmental health, but further improvements are needed through strengthening the coordination system, training human resources, and utilizing data-based monitoring technology.

DISCUSSION

This study discusses the efforts of the Class I Tanjung Balai Karimun Health Quarantine Center (BKK) in monitoring environmental pollution in the domestic port area. Based on field observations and interviews, the BKK plays a crucial role in maintaining the health of the port environment to ensure it meets hygiene and sanitation standards, in accordance with Law Number 6 of 2018 concerning Health Quarantine and Minister of Health Regulation No. 50 of 2017 concerning Environmental Health Standards in Ports ([Mukhlasin et al., 2020](#)). However, the implementation of these regulations faces significant challenges, particularly regarding the limited capacity of port facilities and the need for more robust environmental management programs ([Tanjung, 1999](#)).

Domestic ports are areas with high activity levels, such as ship traffic, liquid and solid waste disposal, and potential contamination from chemicals and ship oil. These conditions can lead to environmental pollution, impacting the health of port residents and surrounding communities. Therefore, the Port Authority (BKK) plays a supervisory role in detecting, assessing, and controlling these risk factors. Effective monitoring by port authorities is critical for preventing widespread environmental degradation, which can be exacerbated by inadequate waste management practices and the discharge of untreated pollutants from various maritime activities ([Hendra et al., 2022](#); [Tanjung, 1999](#)).

Based on the research results, the main activities carried out by BKK include: 1) Inspection of port water quality, both sea water and clean water used by ships ([Yuwono et al., 2024](#)); 2) Monitoring of ship waste disposal, including oil, domestic waste and ballast water ([Hu & Ma, 2021](#)); 3) Sanitation inspection of port facilities, such as public toilets, cargo storage areas, and waste disposal areas ([Mouchtouri et al., 2018](#)); 4) Education to port operators and ship crews about the importance of preventing port environmental pollution ([Đelović, 2024](#)).

The findings show that most domestic ports have implemented minimum sanitation standards, but several obstacles are still found, such as the lack of waste processing facilities, non-compliance of some ship crews in disposing of waste, and the minimal frequency of routine supervision due to limited BKK human resources. These results align with research ([Yuwono et al., 2024](#)), which states that port environmental monitoring in Indonesia still faces challenges in terms of facilities and human resources. Furthermore, research ([Simbolon et al., 2023](#)) also shows that pollution levels in domestic ports increase when ship volumes are high, primarily due to weak coordination between port management, environmental agencies, and health quarantine agencies.

In terms of novelty, this study makes an empirical contribution by highlighting the role of the BKK as a controller of environmental pollution in domestic ports, not just as a monitor for infectious diseases ([Julianti et al., 2025](#)). To date, research on BKK has focused more on aspects of human disease and health, while studies of the BKK's ecological function remain very limited.

This study's limitations lie in the relatively short data collection period and the lack of comprehensive laboratory testing of pollutant parameters (e.g., heavy metals or seawater BOD-COD). Future research suggests direct measurements of port environmental quality and cross-agency collaborative analysis to assess the effectiveness of pollution control coordination.

CONCLUSION

This study concludes that the Tanjung Balai Karimun Class I Health Quarantine Center plays a strategic role in monitoring environmental pollution at domestic ports. Efforts include water quality inspections, ship waste monitoring, port sanitation inspections, and education for relevant parties. The results indicate that the monitoring has helped reduce potential pollution and maintain the health of port residents. However, the effectiveness of monitoring activities is still influenced by limited facilities and inter-agency coordination. The novelty of this study lies in its focus on the port environment in the context of health quarantine, which previously focused more on disease control. This study fills a gap in the literature by emphasizing that port health is determined not only by human factors but also by the quality of the environment in which port activities take place. The results are expected to provide input for the BKK and the Indonesian Ministry of Health in strengthening the domestic port environmental monitoring system, particularly through increasing human resource capacity, providing water and air quality testing equipment, and strengthening cross-sectoral collaboration with environmental and port agencies. For further research, laboratory analysis of the physicochemical parameters of port water is recommended, as well as a study of an integrated policy model for health and the environment in port areas.

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CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest related to the research, authorship, or publication of this article. All procedures, analyses, and interpretations were conducted independently, without any financial, institutional, or personal influence that could affect the objectivity of the study.

REFERENCES

Barus, I. N. E., & Djamburi, A. (2024). Measurement of government performance in literature review. *Journal of Infrastructure Policy and Development*, 8(13), 8964. <https://doi.org/10.24294/jipd8964>

Boaitey, K. P., & Tuck, C. (2020). Advancing health system strengthening through improving access to medicines: A review of local manufacturing policies in Ghana [Review of *Advancing health system strengthening through improving access to medicines: A review of local manufacturing policies in Ghana*]. *Medicine Access Point of Care*, 4. SAGE Publishing. <https://doi.org/10.1177/2399202620962299>

Cramer, E. H., Gu, D. X., & Durbin, R. E. (2003). Diarrheal disease on cruise ships, 1990–2000. *American Journal of Preventive Medicine*, 24(3), 227. [https://doi.org/10.1016/s0749-3797\(02\)00644-x](https://doi.org/10.1016/s0749-3797(02)00644-x)

Đelović, D. (2024). Considerations on Prevention of Pollution from Ships in a Seaport. *Sustainability*, 16(12), 5196. <https://doi.org/10.3390/su16125196>

Dwiasnati, S., Devianto, Y., Arif, S. M., & Avrizal, R. (2024). Pemodelan Wilayah Titik Api Kebakaran Hutan Menggunakan Deep Learning. *Jurnal Ilmiah FIFO*, 16(1), 1. <https://doi.org/10.22441/fifo.2024.v16i1.001>

Hadjichristodoulou, C., & Mouchtouri, V. A. (2019). Best practices for core capacities at ports. *European Journal of Public Health*, 29. <https://doi.org/10.1093/ejph/ckz185.135>

Hendra, H., Yuliani, F., & Adianto, A. (2022). Evaluation of Policy Impact on Household Waste Management: A Case Study of Marine Pollution at Panipahan Rokan Hilir Port. *Publica Jurnal Pemikiran Administrasi Negara*, 14(1), 98. <https://doi.org/10.15575/jpan.v14i1.15338>

Hu, Y., & Ma, M. (2021). A Study of Maritime Administration Regulation in Process and Afterwards. *IOP Conference Series Earth and Environmental Science*, 638(1), 12023. <https://doi.org/10.1088/1755-1315/638/1/012023>

Julianti, S. T., Sari, P. P., Listiyani, H., Kartika, D., Mufidah, S., Fauzi, M. A., Pardede, M. A., & Fathoni, M. (2025). Pemeriksaan EHP dan AHPND pada Litopenaeus vannamei dengan Metode PCR di BKHIT Jawa Timur.

Koboević, Ž., Mišković, D., Hrošić, R. C., & Koboević, N. (2021). Analysis of Sea Pollution by Sewage from Vessels. *Sustainability*, 14(1), 263. <https://doi.org/10.3390/su14010263>

Kraus, R., Baljak, V., Lušić, D. V., Kranjčević, L., Cenov, A., Glad, M., Kauzlić, V., Lušić, D., Grbčić, L., Alvir, M., Pećarević, M., & Jozić, S. (2022). Impacts of Atmospheric and Anthropogenic Factors on Microbiological Pollution of the Recreational Coastal Beaches Neighboring Shipping Ports. *International Journal of Environmental Research and Public Health*, 19(14), 8552. <https://doi.org/10.3390/ijerph19148552>

Mouchtouri, V. A., Reusel, D. V., Bitsolas, N., Katsioulis, A., Bogaert, R. V. den, Helewaut, B., Steenhout, I., Damman, D., Dávila, M., & Hadjichristodoulou, C. (2018). European Web-Based Platform for Recording International Health Regulations Ship Sanitation Certificates: Results and Perspectives. *International Journal of Environmental Research and Public Health*, 15(9), 1833. <https://doi.org/10.3390/ijerph15091833>

Moyo, I., Tshivhase, L., & Mavhandu-Mudzusi, A. H. (2023). Caring for the careers: A psychosocial support model for healthcare workers during a pandemic. *Curationis*, 46(1). <https://doi.org/10.4102/curationis.v46i1.2430>

Mukhlasin, Fitri, M., & Elengoe, A. (2020). Sanitation of Ro-Ro vessel at the port of ferry branch Merak Banten – Indonesia. *Enfermería Clínica*, 30, 213. <https://doi.org/10.1016/j.enfcli.2019.11.057>

Olaniyi, E. O., Solarte-Vásquez, M. C., & Inkinen, T. (2024). Smart regulations in maritime governance: Efficacy, gaps, and stakeholder perspectives. *Marine Pollution Bulletin*, 202, 116341. <https://doi.org/10.1016/j.marpolbul.2024.116341>

Olatunji, A. O., Olaboye, J. A., Maha, C. C., Kolawole, T. O., & Abdul, S. (2024). Environmental microbiology and public health: Advanced strategies for mitigating waterborne and airborne pathogens to prevent disease. *International Medical Science Research Journal*, 4(7), 756. <https://doi.org/10.51594/imsrj.v4i7.1355>

Puig, M., & Roman, R. M. D. (2024). Innovations and insights in environmental monitoring and assessment in port areas. *Current Opinion in Environmental Sustainability*, 70, 101472. <https://doi.org/10.1016/j.cosust.2024.101472>

Simbolon, V. A., Tarisa, & Horiza, H. (2023). Prediksi Tingkat Timbulan Sampah 5 Tahun Mendatang (2023-2027) di TPA Ganet Kota Tanjungpinang. *Sulolipu Media Komunikasi Sivitas Akademika Dan Masyarakat*, 23(2), 303. <https://doi.org/10.32382/sulolipu.v23i2.105>

Tanjung, S. J. (1999). Towards an institutional approach for addressing the current environmental problems in the Port of Tanjung Priok. https://commons.wmu.se/all_dissertations/450/

