JGG-Jurnal *Green Growth* dan Manajemen Lingkungan Vol. 16 No. 1 Juli 2026
p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

Sustainable Workplace Environmental Health Management Through the Evaluation of an Industrial Hygiene Program in the Nickel Mining Industry in North Konawe

Nurcitra Rehulina Br Ginting[1], I Made Astra[2], Dwi Atmanto[3], Eliana Sari[4], Nadiroh[5], Ahman Sya[6]

[1,2,3,4,5,6] Master of Environmental Management, Jakarta State University, Jakarta, Indonesia
Komplek Universitas Negeri Jakarta Gedung M. Hatta Jl. Rawamangun Muka, Jakarta Timur, Indonesia 13220, Email: nurcitra.rehulina@mhs.unj.ac.id

Abstract

This study evaluated the implementation of the Industrial Hygiene Program in supporting sustainable workplace environmental health management in the nickel mining industry in North Konawe, Indonesia. The evaluation findings provide a basis for improving a more effective and sustainable Industrial Hygiene Program. This evaluation study employed the CIPPO (Context, Input, Process, Product, and Outcome) model using a mixed-methods approach. Data were collected through questionnaires and interviews involving 159 respondents selected by purposive sampling. The overall implementation of the program achieved a mean score of 3.23, indicating a moderate category. The context component showed an adequate program foundation, while the input, process, product, and outcome components require improvements in facilities, budget support, monitoring and evaluation, implementation of control recommendations to comply with Threshold Limit Values (TLVs), and enhancement of program benefits for workers and surrounding communities to support sustainable occupational environmental health management.

Keywords: *Industrial Hygiene Program; CIPPO Evaluation Model; Workplace Environmental Health Management; Nickel Mining Industry; Sustainability*

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

INTRODUCTION

Sustainable development requires a balance between economic growth, environmental protection, and social well-being. In the industrial sector, sustainability is not only measured by productivity and profitability but also by an organization's ability to manage the environmental impacts of its operational activities (Matiaputty et al., 2026). Industrial operations often generate waste and emissions that may contribute to environmental pollution. Uncontrolled air, water, and soil pollution can adversely affect the health of both workers and communities living near industrial areas. Consequently, environmental health management has become a fundamental component of responsible and sustainable industrial practices (Hardianti et al., 2025).

The mining sector is one of the most strategic industries contributing significantly to the national economy, particularly through the value-added processing of mineral commodities such as nickel. According to the United States Geological Survey (USGS, 2024), Indonesia is currently the world's largest nickel producer, with an annual production of 1.8 million metric tons in 2023 and approximately 42.3% of the world's total nickel reserves. Despite its substantial economic contribution, the mining industry, including nickel mining, poses considerable occupational risks to workers (Zhang, 2024). Numerous physical, chemical, and environmental hazards, including dust, heavy metals, extreme temperatures, vibration, non-ergonomic working postures, and occupational stress, have been empirically associated with increased rates of occupational accidents and work-related health problems among miners worldwide (Milosevic et al., 2024; Lecia et al., 2025). These findings indicate that mining environments, particularly nickel mining operations, continue to face significant workplace environmental health challenges, highlighting the need for an integrated environmental health management system capable of effectively controlling multiple occupational risk factors.

Environmental health management plays a critical role in maintaining the balance between human activities and the environment, thereby promoting healthy and sustainable environmental conditions (Triwibowo, 2019). Workplace environmental management constitutes an essential component of environmental health management (Judijanto et al., 2024). A healthy work environment contributes to the prevention of occupational diseases and the protection of workers' health. Workplace environmental health

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

management is a systematic approach to identifying, managing, and controlling workplace environmental factors to safeguard workers' health and safety while supporting sustainable improvements in employee performance and productivity (Abdillah et al., 2024). Furthermore, effective workplace environmental health management contributes to achieving the Sustainable Development Goals (SDGs), particularly Goal 3 (Good Health and Well-Being), which emphasizes ensuring healthy lives and promoting well-being for all. One of its key targets is to reduce illnesses and premature deaths caused by air, water, and soil pollution. Therefore, effective workplace environmental health management represents a strategic approach to supporting the achievement of sustainable development objectives (Judijanto et al., 2024).

Workplace hygiene factors, including air quality, lighting, noise levels, temperature, and humidity, play a crucial role in influencing workers' health and well-being (Wardono et al., 2025). In this context, workplace environmental health management is essential as part of a comprehensive risk management strategy, focusing on the prevention of diseases caused by exposure to occupational and environmental hazards in and around the workplace (Wicaksono et al., 2024). This preventive approach integrates hazard identification, exposure assessment, and control measures to minimize adverse impacts on both workers and surrounding communities. Sustainable workplace environmental health management extends beyond regulatory compliance by improving workplace conditions, preventing occupational diseases, reducing environmental impacts, and supporting long-term operational sustainability. Therefore, the effectiveness of workplace environmental health management largely depends on the successful implementation of programs designed to control workplace hazards.

One of the key initiatives supporting workplace environmental health management is the Industrial Hygiene Program. This program adopts a systematic approach involving the identification, assessment, evaluation, and control of workplace hazards that may adversely affect workers' health. Previous studies have demonstrated that comprehensive industrial hygiene practices effectively reduce occupational exposures, prevent work-related diseases, and promote safe and sustainable working environments (Achumie, 2022). According to Hardi (2021), the primary objective of industrial hygiene is to protect both workers and communities surrounding industrial

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

facilities from hazards originating in the workplace. Similarly, Poppendorf (2019) emphasized that industrial hygiene extends beyond protecting workers within the workplace by also considering the impacts of industrial emissions, waste, and physical hazards on the surrounding environment. These perspectives indicate that industrial hygiene has evolved into a multidisciplinary discipline with a strategic role in workforce protection, environmental risk management, and sustainable industrial development (Alston et al., 2018).

Despite its widespread adoption in mining companies, the implementation of Industrial Hygiene Programs continues to face several challenges. This study was conducted at PT X, a nickel mining company located in North Konawe, Indonesia. Workplace environmental monitoring at PT X revealed that noise and dust levels at several work locations exceeded the Threshold Limit Values (TLVs), lighting levels did not meet the required standards, workplace hygiene facilities were inadequate, and follow-up actions based on environmental monitoring results had not been optimally implemented. Furthermore, monitoring and evaluation activities have not fully ensured the effectiveness of existing control measures. These findings indicate that the implementation of the Industrial Hygiene Program requires a comprehensive evaluation to strengthen workplace environmental health management within the company.

Previous studies have primarily focused on measuring workplace hazard factors, such as noise, dust, lighting, and thermal conditions, or examining the relationships between occupational exposures and workers' health outcomes. Bonilla and Camargo (2022) reported that Industrial Hygiene protocols have been implemented in major mining operations to mitigate occupational exposure risks. In the non-mining sector, Gupta (2022) highlighted the importance of integrating exposure assessment, industrial hygiene, and environmental management to improve occupational and environmental risk management. However, studies comprehensively evaluating the implementation of Industrial Hygiene Programs remain limited, particularly those incorporating contextual factors, program resources, implementation processes, program outputs, and outcomes related to sustainable workplace environmental health management in the nickel mining industry. This research gap underscores the need for a comprehensive evaluation capable of providing a holistic understanding of the effectiveness of

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

Industrial Hygiene Program implementation.

This study employed the CIPPO (Context, Input, Process, Product, and Outcome) evaluation model as the framework for evaluating the Industrial Hygiene Program. The CIPPO model was selected because it provides a comprehensive evaluation of program implementation, enabling a deeper understanding of program performance while serving as a basis for continuous program improvement (Indarthi, 2025). The model facilitates the assessment of not only program outputs but also its outcomes in supporting sustainable workplace environmental health management. This approach is expected to generate comprehensive recommendations for improving workplace environmental health management in the nickel mining industry. Therefore, this study aimed to evaluate the implementation of the Industrial Hygiene Program using the CIPPO model in a nickel mining company in North Konawe, Indonesia. The evaluation findings are expected to provide evidence regarding the program's effectiveness, identify factors that facilitate and hinder its implementation, formulate recommendations for improvement, and contribute to strengthening sustainable workplace environmental health management in the mining sector.

METHODS

This evaluation study employed a mixed-methods approach using the CIPPO (Context, Input, Process, Product, and Outcome) evaluation model. The CIPPO model extends the CIPP model by incorporating an additional outcome component, enabling a more comprehensive assessment of program implementation and its impacts (Gustianae et al., 2025). The evaluation covered five components: context (program background, objectives, target beneficiaries, and regulatory basis), input (human resources, facilities, infrastructure, and budget), process (program planning, implementation, monitoring, and evaluation), product (compliance with workplace environmental standards and improvements in workplace environmental conditions), and outcome (internal and external impacts of the Industrial Hygiene Program).

Data were collected through questionnaires and semi-structured interviews. The questionnaire served as the primary data collection instrument and was administered to 159 respondents selected using purposive sampling. Respondents represented various job positions,

departments, and age groups. Each evaluation component consisted of several statements measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Semi-structured interviews were conducted with company management representatives and an industrial hygienist to obtain in-depth information on program implementation. To assess the external outcome component, additional interviews were conducted with members of the surrounding community and representatives of WALHI Southeast Sulawesi.

Quantitative data were analyzed using descriptive statistics. The evaluation results were interpreted using the Norm-Referenced Assessment (Penilaian Acuan Norma/PAN) approach based on the mean and standard deviation, following the six-standard-deviation classification proposed by Sulistiyono (2017, as cited in Sunaryo et al., 2024). Qualitative data were analyzed through data reduction, data display, and conclusion drawing. The assessment criteria for each evaluation component are presented in Table 1.

Table 1. Score Interpretation Criteria

No.	Interval	Category
1	X < M – 1,8SD	Very Poor
2	M – 1,8SD < X < M – 0,6SD	Poor
3	M – 0,6SD < X < M + 0,6SD	Fair
4	M + 0,6SD < X < M + 1,8SD	Good
5	M + 1,8SD < X	Very Good

Source: Sunaryo et al. (2024).

RESULTS AND DISCUSSION

This study aimed to evaluate the implementation of the Industrial Hygiene Program using the CIPPO (Context, Input, Process, Product, and Outcome) evaluation model to support sustainable workplace environmental health management in the nickel mining industry in North Konawe, Indonesia. Based on the analysis, the overall mean score (M) was 3.23, with a standard deviation (SD) of 0.85. These values were used as the basis for determining the score interpretation criteria presented in Table 2.

Table 2. Score Interpretation Criteria

No.	Interval	Category
1	X < 1,70	Very Poor
2	1,70 < X ≤ 2,72	Poor
3	2,72 < X ≤ 3,74	Fair
4	3,74< X ≤ 4,76	Good
5	X > 4,76	Very Good

1. Context Evaluation

The context evaluation focuses on analyzing the needs, problems, and objectives underlying program implementation (Indharti et al., 2024). In this study, the context component was evaluated using the indicators proposed by Robiah et al. (2023), namely: (1)

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

program background, (2) program objectives, (3) regulatory basis, and (4) target beneficiaries. The findings indicate that all four indicators were adequately established to support the company's efforts to create a healthy work environment. This is reflected in the respondents' positive assessments of each indicator.

Table 3. Results of the Context Evaluation

No	Indicator	Mean	Category
1	Background	4,40	Good
2	Objectives	4,04	Good
3	Target	4,18	Good
4	Regulatory Basis	4,28	Good
Overall Mean		**4,22**	Good

The context evaluation achieved an overall mean score of 4.22, categorized as good, indicating that the Industrial Hygiene Program has a well-established foundation for its implementation. This finding is reflected in the availability of a clearly defined program background, objectives, target beneficiaries, and regulatory basis, all of which were developed according to the company's needs for controlling workplace environmental hazards and in compliance with applicable regulations. These findings are consistent with those reported by Sunaryo et al. (2024), who emphasized that the program background serves as the foundation for program implementation within the context evaluation. Likewise, Stufflebeam stated that program objectives should be formulated based on identified needs to guide effective program implementation. Furthermore, Wahyunungsih et al. (2021) argued that clearly defined objectives and a sound regulatory basis contribute to the effectiveness of program implementation. Overall, the findings indicate that the context component provides a strong foundation for implementing the Industrial Hygiene Program and supports sustainable workplace environmental health management.

2. Input Evaluation

According to Stufflebeam (1983), input evaluation assesses the resources available to achieve program objectives and address identified needs. This evaluation supports decision-making by providing information on the resources required for effective program implementation. In this study, the input evaluation examined the availability of key organizational resources, including human resources, facilities and infrastructure, and financial support, as proposed by Danil et al. (2023).

Table 4. Results of the Input Evaluation

No	Indicator	Mean	Category

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

1	Human Resources	3,97	Good
2	Facilities and Infrastructure	2,60	Poor
3	Budget	2,31	Poor
Overall Mean		**3,00**	**Fair**

The input evaluation achieved an overall mean score of 3.00, which was categorized as fair. Among the evaluated indicators, human resources received a mean score of 3.97 (good), whereas facilities and infrastructure and budget allocation were classified as poor, with mean scores of 2.60 and 2.31, respectively. These findings indicate that although the Industrial Hygiene Program has adequate human resources, limited facilities, infrastructure, and financial support remain major constraints to its effective implementation.

According to Wayan et al. (2024), the success of a program depends on the adequacy and appropriateness of available resources. Similarly Hafiz et al. (2025) emphasized that adequate financial support is a critical factor in facilitating the implementation of program activities. Sufficient budget allocation enables program activities to be carried out according to operational needs, whereas budget constraints may hinder the implementation of planned activities. Rakhmawati et al. (2016) demonstrated that effective resource management and the availability of adequate facilities and infrastructure have a significant influence on successful program implementation. Donaldson (2020) argued that inadequate program inputs may reduce program effectiveness and hinder the achievement of expected outcomes. The present study indicates that strengthening facilities and infrastructure, together with increasing budget allocation, is essential to optimize the implementation of the Industrial Hygiene Program and support sustainable workplace environmental health management. This is consistent with Wicaksono et al. (2023), who identified limited resources as one of the major challenges in environmental health management.

3. Process Evaluation

Process evaluation assesses the extent to which program activities have been implemented according to the planned objectives. It is conducted to determine the effectiveness of program implementation and to identify components that require improvement (Wahyuningsih, 2021). In the Industrial Hygiene Program, process evaluation plays an important role in monitoring program implementation, as the actions undertaken during implementation

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

directly influence program outcomes. The process evaluation indicators used in this study were adapted from Widayanto et al. (2021) and comprised three main components: (1) program planning, (2) program implementation, and (3) program monitoring and evaluation. These process evaluation indicators serve as measures for assessing the efficiency, effectiveness, and quality of program implementation (Wayan et al., 2024).

Table 5. Results of the Process Evaluation

No	Indicator	Mean	Category
1	Program Planning	3,25	Fair
2	Program Implementation	3,07	Fair
3	Monitoring and Evaluation	2,71	Poor
Overall Mean		**3,02**	**Fair**

The process evaluation achieved an overall mean score of 3.02, which was categorized as fair. This result indicates that the Industrial Hygiene Program has been implemented; however, its implementation has not yet been fully optimized. The program planning indicator obtained a mean score of 3.25 (fair), while program implementation achieved a mean score of 3.07 (fair). In contrast, monitoring and evaluation received a mean score of 2.71, which was categorized as poor. The overall process component was classified as fair because the monitoring and evaluation activities had not been implemented in accordance with the established plan.

Based on the questionnaire responses and interview findings, although the company has established a monitoring and evaluation system through the Preventive and Corrective Action (PICA) document, its implementation has not been effective in supporting workplace environmental health management. Weaknesses remain in the follow-up of workplace environmental monitoring results, as recommended control measures have not been fully implemented. Furthermore, the current evaluation primarily focuses on completing corrective actions rather than assessing the effectiveness of control measures in reducing exposure levels to comply with the Threshold Limit Values (TLVs). Robiah et al. (2023), who emphasized that monitoring and evaluation should not only assess program implementation but also include follow-up planning as part of continuous program improvement. Monitoring and evaluation are essential for ensuring that control measures are implemented effectively and achieve the intended outcomes.

According to Judijanto et al. (2024), workplace environmental health management is an integral part of

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

environmental health management that focuses on managing workplace environmental factors affecting human health. Its implementation requires a systematic approach involving program planning, the application of environmental standards and control measures, and continuous monitoring and evaluation. Therefore, the effectiveness of the Industrial Hygiene Program depends not only on the implementation of workplace activities but also on effective planning, monitoring, and evaluation to ensure continuous improvement in workplace environmental health management.

4. Product Evaluation

Product evaluation assesses the extent to which a program has achieved its intended objectives and expected outcomes (Wahyuningsih et al., 2021). In this study, the product evaluation describes the achievements of the Industrial Hygiene Program in supporting workplace environmental health management. Its primary purpose is to determine the level of program success following implementation, as reflected in improvements in workplace environmental conditions and compliance with workplace environmental standards. According to Hamim et al. (2022), product evaluation provides evidence for decision-making regarding whether a program should be continued, modified, further developed, or discontinued based on the results achieved.

Table 5. Results of the Product Evaluation

No	Indicator	Mean	Category
1	Compliance with Workplace Environmental Standards	2,34	Poor
2	Improvement of Workplace Environmental Conditions	2,37	Poor
Overall Mean		**2,36**	**Poor**

The product evaluation achieved an overall mean score of 2.36, which was categorized as poor. The product component was assessed using two indicators: compliance with workplace environmental standards and improvement of workplace environmental conditions, both of which were also classified as poor, with mean scores of 2.34 and 2.37, respectively.

The findings of the present study indicate that the low product evaluation was primarily attributable to the incomplete implementation of recommended corrective actions. As a result, several workplace environmental hazards continued to exceed the Threshold Limit Values (TLVs). Rosmalina (2025) stated that compliance with workplace

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

environmental standards is an important indicator of successful industrial hygiene implementation, while workplace environmental measurements provide the basis for evaluating workplace environmental conditions and planning continuous improvement efforts. However, limited budget allocation, insufficient management support, and inadequate supervision of follow-up actions reduced the effectiveness of workplace environmental improvements. Consequently, the Industrial Hygiene Program has not yet fully achieved its intended objectives of improving workplace environmental conditions and protecting workers' health. Therefore, strengthening the follow-up of workplace environmental monitoring results and implementing effective hazard control measures are essential to ensure compliance with workplace environmental standards and support sustainable workplace environmental health management.

5. Outcome Evaluation

Outcome evaluation is a process used to assess the extent to which a program contributes to achieving its intended changes and generating long-term positive impacts (Wayan et al., 2024). In this study, the outcome component was evaluated using two indicators: internal outcomes and external outcomes.

Table 5. Results of the Outcome Evaluation

No	Indicator	Mean	Category
1	Internal Outcome	2,42	Poor
2	Exsternal Outcomes	2,32	Poor
Overall Mean		**2,37**	**Poor**

The outcome evaluation achieved an overall mean score of 2.37, which was categorized as poor. This finding indicates that the Industrial Hygiene Program has not yet generated the expected benefits in supporting sustainable workplace environmental health management. The internal outcomes and external outcomes indicators obtained mean scores of 2.42 and 2.32, respectively, both of which were classified as poor. These results suggest that the program has not yet delivered optimal benefits for either the company's internal work environment or the surrounding community.

According to Wicaksono et al. (2024), community participation is essential to ensure that environmental health policies and decisions reflect the needs and interests of affected communities. Likewise, OSHA (1998) stated that industrial hygiene aims to manage workplace environments that

p-ISSN: 2303-2332; e-ISSN: 2597-8020 DOI : doi.org/10.21009/jgg.161.05

may pose risks to health and well-being, not only for workers but also for surrounding communities. Interviews with local community members and representatives of WALHI Southeast Sulawesi revealed that the benefits of the Industrial Hygiene Program have not been fully perceived by communities living near the operational area. Respondents reported that dust, noise, emissions, and declining water quality associated with mining activities continue to affect the surrounding environment and may pose risks to environmental health.

These findings are consistent with Sasdi and Danim (2023), who described the outcome component as reflecting the sustained benefits achieved following program implementation. Therefore, the poor outcome evaluation indicates that the Industrial Hygiene Program has not yet produced sustainable benefits for workplace environmental health management, either within the company or for the surrounding community.

CONCLUSION

The evaluation of the Industrial Hygiene Program using the CIPPO model showed that the context component was classified as good, the input and process components as fair, and the product and outcome components as poor. These findings indicate that the Industrial Hygiene Program has established a sound planning foundation; however, its implementation has not been fully supported by adequate resources, effective implementation processes, or appropriate follow-up actions based on workplace environmental monitoring results. Consequently, the program has not yet achieved the expected outputs and outcomes in supporting workplace environmental health management.

Overall, the findings indicate that the Industrial Hygiene Program has not yet fully supported the achievement of sustainable workplace environmental health management. Therefore, improvements are required in resource availability, monitoring and evaluation, implementation of corrective actions, and enhancement of program outcomes to ensure that the program benefits not only improve workplace environmental conditions for workers but also contribute to the long-term sustainability of workplace environmental health management

ACKNOWLEDGMENTS

The author sincerely thanks all individuals and institutions who contributed to the completion of this research. Special appreciation is extended

Vol. 16 No. 1 Juli 2026
DOI : doi.org/10.21009/jgg.161.05

to the lecturers of the Master's Program in Environmental Management, Graduate School, Universitas Negeri Jakarta, for their invaluable knowledge, guidance, and continuous support throughout the preparation of this manuscript.

REFERENCES

Abdillah, W., Oktavia, V., Subagyo, H., & Febriana, E. A. (2024). Pengaruh keselamatan kerja, kenyamanan kerja, dan kesehatan lingkungan kerja terhadap kinerja karyawan pada PERUMDA Tirta Moedal Kota Semarang. *Jurnal EMT KITA: Jurnal Ekonomi dan Manajemen Teknologi, 8*(4), 1480–1491. https://doi.org/10.35870/emt.v8i4.3205

Achumie, G. O., Oyegbade, I. K., Igwe, A. N., Ofodile, O. C., & Azubuike, C. (2022). A conceptual model for reducing occupational exposure risks in high-risk manufacturing and petrochemical industries through industrial hygiene practices. *International Journal of Social Science Exceptional Research, 1*(1), 26–37. https://doi.org/10.54660/IJSSER.2022.1.1.26-37

Alston, F., Millikin, E. J., & Piispanen, W. (2018). *Industrial hygiene: Improving worker health through an operational risk approach*. CRC Press.

Bonilla, A., & Camargo, R. (2022). Industrial hygiene and occupational health management: Protocols for risk reduction in the mining sector. *Saluta*. https://doi.org/10.37594/saluta.v1i6.741

Danil, M., Ambiyar, & Aziz, I. (2023). *CIPPO evaluation model for the Madrasah Tahfidz Program "Hubbul Qur'an" at MTs Negeri 6 Model Padang*. *LANGGAM Journal (International Journal of Social Science Education, Art and Culture), 2*(1), 1–10. https://doi.org/10.24036/langgam.v2i1.68

Diniah, B. N., Marsanti, A. S., & Herra, L. K. D. S. (2021). Analisis kualitas fisik lingkungan kerja dengan keluhan gangguan kesehatan pada petugas rekam medis. *JPKM: Jurnal Profesi Kesehatan Masyarakat, 2*(2), 115–121. https://doi.org/10.47575/jpkm.v2i2.230

Donaldson, S. I. (2020). Program Theory-Driven Evaluation Science: Strategies and Applications. Routledge.

Gupta, V. (2022). Exposure assessment, industrial hygiene, and environmental management. *International Journal of Innovative Research in Engineering and Management (IJIREM), 9*(Special Issue 6).

Hamim, A., Rismayanti, S., Carlos, M. G., & Hamdan, A. (2022). *Evaluasi program pemberdayaan masyarakat melalui pengelolaan bank sampah di Kota Tasikmalaya*. *Lifelong Education Journal, 2*(1), 34–46. https://doi.org/10.59935/lej.v2i1.18

Hardianti, S., Tanjung, L. S., Yusmita, Y., & Irawan, J. (2025). *Industrial environmental health as an effort to prevent environmental impacts and*

Vol. 16 No. 1 Juli 2026
DOI : doi.org/10.21009/jgg.161.05

occupational diseases. *Journal of Engineering Science and Technology Management, 5*(2). https://doi.org/10.31004/jestm.v5i2.363

Ilham, N., Hardi, I., & Ikhtiar, M. (2022). *Pengaruh lingkungan kerja dan kesehatan keselamatan kerja terhadap kinerja karyawan PLN ULP Panakkukang Makassar*. *Window of Public Health Journal, 3*(2), 359–369. https://doi.org/10.33096/woph.v3i2.394

Indarthi, A. W., Fakhruddin, Arbarini, M., Febrianto, R. A., & Agoro, S. (2025). *Implementation of the CIPPO evaluation model in culinary training*. *Journal of Nonformal Education, 11*(1), 140–152. https://doi.org/10.15294/jone.v11i1.11015

Judijanto, L., Suamas, L. Y., Rizky, W., Enyasih, Nurullita, U., Rasyid, Z., Carwadi, Sari, S. P., Susanti, N., Nugraheni, R., & Andaria, A. C. (2024). *Manajemen kesehatan lingkungan*. CV Lauk Puyu Press.

Kuntadi, I., Sutadji, E., Rizal, F., Handayani, M. N., Ramadhan, M. O., & Kamis, A. (2023). *A needs analysis of CIPPO evaluation model components as a quality escalation of cooperation program with industries: Vocational school perceptions in West Java, Indonesia*. *Journal of Southwest Jiaotong University, 58*(1). https://doi.org/10.35741/issn.0258-2724.58.1.25

Lecia, N., Wijayati, A., & Widiarty, W. S. (2025). Perlindungan hukum bagi pekerja yang mengalami kecelakaan kerja di sektor pertambangan. *Jurnal Sosial dan Teknologi (SOSTECH), 5*(9).

Matitaputty, J. S., Theotama, G., & Damayanti, A. (2026). *Pengaruh ESG dan green innovation terhadap nilai perusahaan: Analisis data panel dengan peran mediasi kinerja keuangan pada sektor energi*. *Owner: Riset & Jurnal Akuntansi, 10*(3). https://doi.org/10.33395/owner.v10i3.3417

Manivannan, J., & Raman, T. (2023). Integrated approach on industrial hygiene program for pharmaceutical industry. *International Journal for Research in Applied Science & Engineering Technology (IJRASET), 11*(4).

Milošević, I., Stojanović, A., Nikolić, Đ., Mihajlović, I., Brkić, A., Perišić, M., & Spasojević-Brkić, V. (2024). Occupational health and safety performance in a changing mining environment: Identification of critical factors. *Safety Science*. https://doi.org/10.1016/j.ssci.2024.106745

Popendorf, W. (2019). *Industrial hygiene control of airborne chemical hazards* (2nd ed.). CRC Press.

Rakhmawati, D., Prasetyo, A. P. B., & Ngabekti, S. (2016). Peran Program Adiwiyata dalam Pengembangan Karakter Peduli Lingkungan Siswa: Studi Kasus di SMK Negeri 2 Semarang. *Unnes Science Education Journal, 5*(1), 1137–1148. https://doi.org/10.15294/usej.v5i1.9648

Vol. 16 No. 1 Juli 2026
DOI : doi.org/10.21009/jgg.161.05

Robiah, Hendarman, & Hidayat, R. (2023). *Evaluasi program literasi anak dengan pendekatan model CIPPO. Murhum: Jurnal Pendidikan Anak Usia Dini, 4*(1), 528–539. https://doi.org/10.37985/murhum.v4i1.262

Sasdi, M., & Danim, S. (2024). *Establishing knowledge centers: Applying the CIPPO evaluation model to enhance the efficiency of libraries at Islamic schools. Nidhomul Haq: Jurnal Manajemen Pendidikan Islam, 9*(1), 117–132. https://doi.org/10.31538/ndh.v9i1.4652

Sunaryo, Sumaryanto, Nugroho, S., Amajida, A., & Fakhrurozi, Z. A. (2024). Evaluation of tennis development program enhancements at SELABORA. Medikora, 23(1), 67–78. https://journal.uny.ac.id/index.php/medikora

Triwibowo, C., & Pusphandani, M. E. (2019). *Kesehatan lingkungan dan K3*. Nuha Medika.

Wahyuningsih, T., Darmawan, I. A., & Hamid, M. A. (2021). *Evaluation of electrical installation training conducted by the Employment Training Center of Pandeglang Regency, Banten, Indonesia. JPPM (Jurnal Pendidikan dan Pemberdayaan Masyarakat), 8*(2), 169–185. https://doi.org/10.21831/jppm.v8i2.42116

Wardono, H. R. I., Putri, K. A., Budiono, Z., & Ardiansyah, I. (2025). Kelembaban dan kecepatan angin sebagai masalah utama kesehatan lingkungan kerja hotel. *Jurnal Penelitian Kesehatan Suara Forikes*, 16(3), 720. https://doi.org/10.33846/sf16305

Wayan, D., Isnandar, & Widiyanti. (2024). *Evaluasi program uji tingkat kompetensi (UTK) Departemen Otomotif SMKN 1 Blitar menggunakan model CIPPO. Briliant: Jurnal Riset dan Konseptual, 9*(3), 590–601. https://doi.org/10.28926/briliant.v9i3.1591

Wicaksono, R. H., Putri, M. S. A. G., Solistiono, E., Ibad, I., Hanif, M., Aniriani, G. W., Prasidya, D. A., Syakbanah, N. L., Rifandhana, R. F., & Ikhlasiah, M. (2023). *Manajemen kesehatan lingkungan*. Yayasan Cendikia Mulia Mandiri.

Widayanto, L. D., Soeharto, Sudira, P., Daryono, R. W., & Nurtanto, M. (2021). *Implementation of the education and training program seen from the CIPPO perspective. Journal of Educational Research and Evaluation, 5*(4), 614–623. https://doi.org/10.23887/jere.v5i4.36826

Zhang, B., Yin, X., Guo, Y., & Tong, R. (2024). *What occupational risk factors significantly affect miners' health: Findings from meta-analysis and association rule mining. Journal of Safety Research, 89*, 197–209. https://doi.org/10.1016/j.jsr.2024.02.010