



Original Research article

Optimal Strategies in Industrial Environmental Managemant: Contribution to Air Quality Control at PT United Tractors

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Article history: Received June 05, 2024 | Revised July 05, 2024 | Accepted February 04, 2025

ABSTRACT

Air pollution is a major challenge for big cities, including Jakarta, which has experienced a significant decline in air quality. This research explores the optimal strategies implemented by PT United Tractors to control air quality in their industrial area. Primary data was collected through direct surveys and interviews with company employees, while secondary data came from the company's sustainability report and previous research studies. The results of the analysis show that industrial growth around PT United Tractors increases air pollutant emissions, causing potentially serious health impacts for employees. PT United Tractors has taken steps to reduce the impact of air pollution. This strategy demonstrates a strong commitment to environmental sustainability. By strengthening preventive approaches, raising employee awareness, and investing in green technology, PT United Tractors can continue to improve its performance in maintaining a clean and sustainable environment.

Keyword: Air pollution; Air quality; Industry; Green technology

1. INTRODUCTION

Air pollution is one of the main challenges for big cities. According to a report from the DKI Jakarta Environment Agency for 2023, there is a significant decline in air quality compared to previous years. The data collected shows that PM2.5 concentrations tend to be higher, which is caused by various factors including climate change, industrial activities, construction projects, transportation, emissions from households, and dust (Sustainability Report UT, 2023). According to Safira et al. (2022), air pollution in developing countries is becoming more serious due to overpopulation, uncontrolled urbanization, and rapid industrial growth. Rapid industrial growth leads to increased energy use, which in turn can indirectly cause air pollution. Common air pollutants in industrialized areas include particulate dust, nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO), and hydrocarbons (HC) (Budiman, 2018). Numerous studies have increasingly indicated that some countries has significant potential to achieve climate change mitigation co-benefits through air pollution control. These co-benefits

can be realized by diversifying the energy mix to incorporate more renewable sources, or by adopting advanced technologies to enhance energy efficiency, thereby lowering energy consumption per unit of total product or added value. Additionally, transforming the industrial structure by decreasing the share of energy-intensive sectors can also yield these co-benefits. Furthermore, adjusting the scale structure, such as phasing out small enterprises and fostering larger ones, presents another viable strategy to generate these co-benefits (Qian et.al., 2021).

Currently, air pollution stands as the leading cause of deteriorating environmental quality in numerous cities worldwide, with detrimental effects on public health. Recent findings from the World Health Organization (WHO) reveal that over 80% of urban residents endure air quality surpassing emission limits concerning pollution. Major atmospheric pollutants include carbon monoxide (CO), particulate matter (PM), nitrogen oxides (NO_x), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), ozone (O₃), and sulfur dioxide (SO₂). The escalating emission levels of these pollutants stem from the rapid industrialization and urbanization observed in developing nation. (Sofia *et.al.*, 2020). Human activities also produce particles such as asbestos from building materials, fly ash from steel smelting processes, and smoke from incomplete combustion processes. According to Rosyadi & Wulandari (2021), air pollution is considered very dangerous for humans because the air consists of various gases that are mixed and have an unstable composition depending on temperature, pressure, and environmental conditions. With the increasing development of industrial centers in urban areas, there are changes in air quality that result in air pollution. According to Vandyck et al. (2020), climate change and air pollution are negative results of human actions that produce greenhouse gases. Some pollutants generated from human activities play a role in causing both problems.

In the modern industrial era, environmental sustainability has become an important factor for a company's success and reputation. PT United Tractors, as one of the leaders in the mining and construction industry in Indonesia, fully understands its responsibility to the environment surrounding its operations. Amidst demands to improve production efficiency and meet market needs, the company has also committed to responsibly managing its industrial environmental impacts. One important aspect of industrial environmental management is air quality control. PT United Tractors, like many of its peers, is faced with complex challenges related to air emissions and pollution generated by its operations. The impact of these industrial activities on the air quality around their operational areas can have significant implications for public health and the environment. In this report, we will explore the optimal strategies implemented by PT United Tractors in air quality control and analyze the concrete steps taken by the company to reduce emissions and improve air quality around its facilities. In addition, it will also evaluate the impact of these strategies and consider the sustainability



aspects of industrial environmental management. Through an in-depth understanding of the environmental challenges faced and the efforts made by PT United Tractors, it is hoped that this report can provide valuable insights for stakeholders, regulators, and the general public on the importance of sustainable environmental management in the context of modern industry.

2. METHOD

This research was conducted in the industrial area of PT United Tractors, Cakung, East Jakarta. This research is descriptive in nature, aiming to create an overview of the optimal strategies carried out by PT United Tractors in contributing to controlling air pollution in its industrial area. Data collection was carried out by means of direct surveys during the internship by monitoring various aspects of the company's production and operation processes, including the identification of air emission sources. In addition, short interviews were conducted with company employees to gain more specific insights into the policies and procedures that have been implemented in air quality control. These interviews helped to understand the approach the company has taken in addressing environmental issues, as well as the challenges and opportunities it faces in its efforts to improve air quality. Secondary data used are the company's sustainability report and previous research studies that serve as a foundation for improving air quality control at PT United Tractors.

3. RESULTS AND DISCUSSION

3.1. Identification of Challenges and Potential Pollutant Impacts

Rapid industrial growth around PT United Tractors' facilities may lead to increased production activities and vehicle mobility, contributing to air pollutant emissions. This challenge may include an increase in the number of industries and infrastructure that require effective air pollution management. Uncontrolled urbanization around PT United Tractors' operational areas may lead to an increase in population and vehicles, as well as dense urban development. This can increase air pollutant emissions and worsen air quality around industrial sites. Industrial and construction activities, including the use of heavy machinery and equipment, the burning of fossil fuels, and the use of potentially harmful chemicals, can cause significant emissions of air pollutants. These challenges require effective air pollution management to mitigate their negative impacts.

As an illustration, emissions from the mining contractor business sector mostly come from heavy equipment managed by PT PAMA, a subsidiary of PT United Tractors. In an effort to reduce these emissions, UNTR has implemented the use of biofuels. United Tractors' main office has also made efforts to reduce carbon emissions by successfully obtaining a net zero

healthy building. By 2030, through brief interviews conducted, UNTR believes that it can contribute to reducing emissions by 30%.

The potential impact of air pollution in the PT United Tractors (UT) area on employee health is an important concern. Production and operational processes in the UT area may generate dust particles that can be inhaled by employees. Continued exposure to dust particles can cause respiratory health problems such as throat irritation, coughing, shortness of breath, and even chronic problems such as asthma or chronic obstructive pulmonary disease (COPD). The use of operational vehicles and generators in the UT area can produce exhaust emissions containing harmful substances such as nitrogen oxides (NO_x), carbon monoxide (CO), and fine particulates (PM_{2.5}). Exposure to these exhaust emissions can cause respiratory distress, headaches, nausea, and may even increase the risk of heart and lung disease. In addition to external exposure, indoor air quality in offices or facilities in the UT area also needs to be considered. Indoor air pollution can come from various sources such as cigarette smoke, chemicals from the production process, or exhaust gas from equipment. Continuous exposure to air pollutants can have serious long-term health impacts for employees, including an increased risk of chronic diseases such as heart disease, chronic respiratory disorders, and even cancer.

To address the potential impact of air pollution on employee health, UT needs to implement effective preventive measures such as the use of improved emission control technology, the provision of indoor and outdoor air quality monitoring facilities, as well as health education to employees about the risks of air pollution and steps that can be taken to protect themselves. These measures will help maintain the health and well-being of employees in the UT work environment.

3.2. Implementation and Strategies for Air Pollution Control in Industrial Estates

Quality management itself is an activity carried out by the company to plan activities aimed at achieving quality goals (Arifah & Sunarjo, 2021). In particular, activities in quality management consist of four things, namely quality planning, quality control, quality assurance, quality improvement.

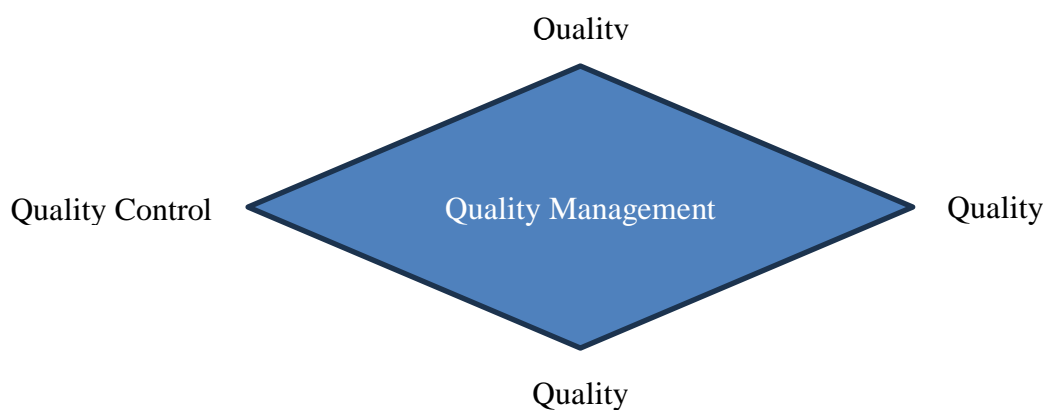


Figure 1. Description

Quality planning is the first step in identifying the quality needs and objectives to be achieved. In this planning process, the various needs to produce the objectives will be formulated. Air quality control is a series of activities aimed at preventing emission outputs from not conforming to the plans made at the quality planning stage. Essentially, in quality control, all actions are geared towards avoiding the unplanned. Quality improvement, on the other hand, is an effort to enhance or improve air quality. This improvement process aims to increase the effectiveness and efficiency of the process with the ultimate goal of improving company performance.

Periodic monitoring aims to identify the level of air pollutants in an area so that actions can be taken to maintain and improve air quality (Oktaviani & Jawwad, 2023). In response to government directives and health mitigation efforts, the company has implemented a number of measures to reduce the impact of air pollution, including providing air quality monitoring facilities that can be accessed in real-time at PT United Tractors headquarters, using water mist to water office areas to reduce dust particles in the air. As of early September 2023, United Tractors itself has installed water mist in four buildings in the UT Head Office area from a target of nine buildings. For the record, the water mist used has similar technology to that used by the National Research and Innovation Agency (BRIN). In addition, it also conducts regular emission testing on operational vehicles and generators used by the company and ensures that all emissions meet predetermined quality standards, provides vehicle emission testing services for employees at PT United Tractors head office, conducts sustainable tree planting to filter air pollution and absorb carbon, implements Work From Home (WFH) and Hybrid policies as an effort to reduce the carbon impact of company operations. By providing employees with the opportunity to work from home, the company participates in reducing air pollution generated by daily transportation (Sustainability Report UT, 2023).

According to Badreddine & Cherif (2024), renewable energy has gained significant attention worldwide amidst increasing discussions about its present and future contribution to sustainable environmental approaches (Lund, 2007; Jacobson & Delucchi, 2011). As

concerns mount over the risks associated with ongoing reliance on fossil fuels, nations and institutions are increasingly endorsing clean energy standards to protect the climate (IPCC, 2022; REN21, 2022). Algeria possesses considerable potential, especially in solar and wind energy resources, yet its economy remains heavily dependent on revenue from oil and gas.

Regarding their source, pollutants are categorized into two key groups: primary and secondary pollutants. A primary pollutant directly enters the atmosphere from both artificial and natural sources, encompassing transportation, combustion, industrial activities, solid waste, and miscellaneous materials. In contrast, a secondary pollutant arises from the interaction between primary pollutants and environmental factors (Hormati *et.al*, 2022). With reference to sustainability aspiration number 1, namely the reduction of net zero emission, PT United Tractors seeks to reduce all emissions originating from the company's operational activities in all business lines. The industry also implements several alternatives related to air quality management, such as conducting regular road watering to reduce excessive dust, installing Continuous Emission Monitoring System (CEMS) to monitor emissions on an ongoing basis, installing ambient air measuring devices, adopting tree planting programs to absorb carbon dioxide (CO₂) produced, and using CO₂ exhaust gas by third parties as raw material for liquid CO₂ (Budiman, 2018). PT United Tractors Tbk (UT) and Scania in Indonesia have introduced the latest trucks and buses that use Selective Catalytic Reduction (SCR) technology with Euro 4 and Euro 5 emission standards. This is done in an effort to support the development of a sustainable and environmentally friendly transportation system in Indonesia by reducing exhaust emissions. United Tractors has introduced Scania trucks and buses using SCR technology with Euro 4 and Euro 5 emission standards in Indonesia. This step is the company's commitment to support the Regulation of the Minister of Environment and Forestry No. P.20/MENLHK/SETJEN/KUM.1/3/2017 regarding the quality standards for exhaust emissions of new types of motor vehicles in categories M, N, and O, or known as Euro 4 Emission Standards.

According to Turner *et.al.* (2020), the pervasive nature of outdoor air pollution presents a pressing global public health challenge, impacting individuals universally and leading to various severe adverse health effects, including cancer. Primary air pollutants, predominantly emitted into the environment through the combustion of fossil and biomass fuels, encompass gaseous elements such as sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), volatile organic compounds (VOCs), and particulate matter (PM), which includes carbonaceous aerosol particles like black soot. At present, tackling the PM_{2.5} issue is the most challenging due to its complex formation, with contributions from multiple precursors and sources (Lu *et.al.*, 2020). These pollutants diminish air quality and contribute to a range of severe illnesses, such as cancer, respiratory disorders, and cardiovascular diseases.

Consequently, addressing the impact of these emissions demands an urgent adoption of environmentally friendly measures (Kumar et.al., 2022). According to data from the Ministry of Environment & Forestry of the Republic of Indonesia, the transportation sector is a major contributor to pollution in urban areas. Emissions from motor vehicles contribute 70% to nitrogen oxide (NO_x), carbon monoxide (CO), sulfur dioxide (SO₂), and particulate matter (PM) pollution in urban areas. In response to these issues, the implementation of Euro 4 Standard is expected to have a positive impact on Indonesia and all transportation businesses by helping to reduce air pollution. Scania Truck Euro 4 and Scania Bus Euro 5 have the advantage of Selective Catalytic Reduction (SCR) technology. This is an aftertreatment technology that controls residual combustion and is able to reduce NO_x and PM emissions by 85%-95%. The use of SCR technology provides a number of benefits to the vehicle, such as increased engine life, maintenance of optimal engine acceleration, efficiency in fuel consumption, and reduced risk of oil contamination.

3.3. Impact Evaluation and Sustainability

In the analysis of the air quality planning, quality control, and air quality improvement strategies at PT United Tractors (UT), there are a series of measures that have been implemented by the company to reduce the impact of air pollution from its operations. In response to government directives and health mitigation efforts, UT has adopted a series of measures such as providing real-time air quality monitoring facilities at the head office, using water mist technology to reduce dust particles in the air, and conducting regular emission testing on operational vehicles and generators used. These measures demonstrate UT's commitment to improving air quality around its operational areas. In addition, UT has also adopted Work From Home (WFH) and Hybrid policies as an effort to reduce the carbon impact of the company's operations, providing employees with the opportunity to work from home and participate in reducing air pollution generated by daily transportation. This move demonstrates UT's awareness of the environmental impact of its operations and its commitment to reducing its carbon footprint.

Renewable energy has emerged as a cornerstone of sustainable development and a critical solution to address the challenges posed by climate change and energy security. Harnessing natural resources such as sunlight, wind, water, and biomass, renewable energy technologies offer a clean and abundant alternative to fossil fuels. Solar photovoltaic, wind turbines, hydroelectric dams, and bioenergy systems are among the diverse array of renewable energy sources driving the global transition to a low-carbon future (Liu, et.al., 2021). Environmental policy regarding air pollution plays a pivotal role in mitigating the detrimental effects of pollutants on public health and the environment. With air pollution being a significant contributor to various respiratory illnesses and environmental degradation, effective policies



are crucial for curbing emissions and safeguarding air quality. These policies often involve regulatory measures, such as emission standards for industries and vehicles, as well as incentives for adopting cleaner technologies and renewable energy sources (Xu, 2020). Consequently, there is a pressing need for additional supportive policies, incentives, and initiatives to encourage further research aimed at lowering the capital and operational expenses associated with the production, transportation, and distribution of renewable energy, as well as the operation of buses fueled by renewable energy (Gunawan *et.al.*, 2021). By applying SCR technology to the latest trucks and buses, UT is also contributing to the development of a sustainable and environmentally friendly transportation system in Indonesia. This step is part of UT's efforts to support existing environmental regulations and reduce motor vehicle exhaust emissions. According to Ramadhina & Najicha (2022), in addition to reducing air pollution, the electric vehicles that UT is working on are also to develop and empower young Indonesians in participating in the manufacture and production of these electric vehicles. Overall, the strategies taken by UT in air quality control demonstrate a strong commitment to environmental sustainability. These measures not only have a positive impact on the environment, but also demonstrate UT's commitment to achieving sustainability goals, including reducing carbon emissions and air pollution, and improving air quality for community welfare and a better living environment.

Outdoor air pollutants encompass a diverse array of harmful substances emitted into the atmosphere from various natural and human-made sources. These pollutants include gases such as nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO), volatile organic compounds (VOCs), and ozone (O₃), as well as particulate matter (PM) comprised of tiny particles suspended in the air. Originating from sources like vehicle emissions, industrial processes, agricultural activities, and natural phenomena such as wildfires and dust storms, outdoor pollutants pose significant risks to human health and the environment (Sulaiman & Kumar, 2024). The increasing occurrence of various environmental challenges like global warming, water contamination, and air pollution has drawn the focus of governments and scholars worldwide to the significant role of big data and internet smart technology in enhancing resource management and environmental monitoring (Yang *et.al.*, 2021). While the strategies adopted by PT United Tractors (UT) in air quality control demonstrate a strong commitment to environmental sustainability, there are still some shortcomings and areas that can be developed to improve the effectiveness of these strategies. Although UT has adopted various air quality control measures, there is room to improve a more proactive preventive approach. UT can identify and address potential sources of air pollution earlier, thereby reducing the risk of negative impacts on the environment and public health.

Global value chain engagement has a profound impact on air pollution dynamics, as the production and transportation processes involved often contribute significantly to emissions. As multinational corporations source materials and manufacture products across borders, they inadvertently contribute to air pollution through industrial activities, transportation, and energy consumption (Hua *et.al.*, 2022). While UT has implemented Work From Home (WFH) and Hybrid policies to reduce the carbon impact of daily transportation, it is important to strengthen employee awareness and participation in emission reduction efforts. Training and environmental awareness campaigns can increase employee commitment in adopting environmentally friendly practices. UT can continue to research and invest in green technology and the latest innovations in air quality control. The application of more advanced technologies, such as the use of renewable energy or more efficient emission control technologies, can help UT to achieve emission reduction targets more effectively. It is important for UT to conduct detailed performance measurement and evaluation of the effectiveness of the implemented air quality control strategies. Data obtained from air quality monitoring, emission measurements, and their effects on the environment and public health can provide valuable insights for further improvement. According to Heydari *et.al.* (2022), crafting an effective air pollution strategy demands a multi-faceted approach that addresses the complexity of this pervasive environmental challenge. Such a strategy typically involves a combination of regulatory measures, technological innovations, public awareness campaigns, and collaborative efforts among governments, industries, and communities. Key components may include setting stringent emission standards for industries and vehicles, incentivizing the adoption of cleaner technologies, investing in renewable energy sources, enhancing monitoring and enforcement mechanisms, and promoting sustainable transportation options. Additionally, robust urban planning initiatives that prioritize green spaces, pedestrian-friendly infrastructure, and public transit systems can help mitigate pollution hotspots in densely populated areas. Public education and engagement play a crucial role in fostering behavior change and promoting individual actions, such as reducing energy consumption, carpooling, and adopting eco-friendly practices. By implementing a comprehensive air pollution strategy, societies can work towards achieving cleaner air, healthier communities, and a more sustainable future for all. By identifying shortcomings and potential developments of the implemented air quality control strategy, UT can continue to improve its commitment and performance in maintaining a cleaner and more sustainable living environment.

4. CONCLUSION

The conclusion of this report is that air pollution is a serious problem faced by major cities, including Jakarta. PT United Tractors (UT), as a leader in the mining and construction



industry in Indonesia, has recognized its responsibility to the environment surrounding its operations. In an effort to responsibly manage the environmental impact of the industry, UT has implemented various strategies to control air quality around its facilities. From the analysis, the air quality control strategies taken by UT show a strong commitment to environmental sustainability. However, there are some shortcomings and things that can be developed from the strategy. UT needs to improve a more proactive preventive approach in identifying and addressing potential sources of air pollution earlier. In addition, it is important to strengthen employee awareness and participation in emission reduction efforts by conducting training and environmental awareness campaigns. UT also needs to continue researching and investing in green technology and the latest innovations in air quality control. By identifying shortcomings and potential developments from the strategies that have been implemented, UT can continue to improve its commitment and performance in maintaining a cleaner and more sustainable environment.

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