ASSESSMENT OF HEALTH RELATED ISSUES IN AIR POLLUTIONS AROUND INDUSTRIAL AREA: THE PERILS AND REMEDIES

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ABSTRACT

This study assessed health related issues in air pollutions around industrial area, analysing the perils and remedies. Air pollution is a significant environmental health threat, particularly around industrial zones where the concentration of harmful pollutants tends to be highest. In carrying out this research, the following subheads were explored among many others: concept of air pollution and concept of industrial areas. Respiratory diseases, cardiovascular diseases and cancer (particularly lung cancer) among many others were mentioned as the types of health related issues from air pollution around industrial areas. The study also mentioned the cases of health related issues caused by air pollution around industrial areas to include: asthma and respiratory issues in children, cardiovascular health impacts in residents of industrial areas and lung cancer in industrial workers to mention but a few. The study concluded that industrial air pollution poses serious health risks, especially in areas near manufacturing zones, where harmful substances like particulate matter and toxic gases are commonly emitted. One of the recommendations made was that governments should enforce stricter emission control laws for industries and establish continuous air quality monitoring systems in industrial areas to detect and address harmful pollutant levels promptly.

Keywords: Health Related Issues, Air Pollutions, Industrial Area, Perils and Remedies

INTRODUCTION

Air pollution is a significant environmental health threat, particularly around industrial zones where the concentration of harmful pollutants tends to be highest. Industrial activities release a mix of toxic substances such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs), and particulate matter (PM), all of which pose serious health hazards to nearby populations (WHO, 2021). These pollutants can remain suspended in the air, entering human respiratory systems and triggering a cascade of health complications, particularly for

vulnerable groups such as children, the elderly, and those with pre-existing health conditions. One of the most pressing health concerns linked to industrial air pollution is respiratory illness. Studies have shown a direct correlation between high levels of particulate matter and increased cases of asthma, bronchitis, and chronic obstructive pulmonary disease (COPD) among residents in industrial areas (Kyung & Jeong, 2020). Fine particulate matter (PM2.5), due to its small size, penetrates deep into the lungs and bloodstream, exacerbating cardiovascular conditions and even

increasing the risk of premature death. In addition, long-term exposure to air toxins has been associated with reduced lung function in children and elevated risks of lung cancer among adults. Beyond respiratory effects, industrial air pollution can also affect neurological and reproductive health. Exposure to heavy metals like lead and mercury, often emitted from industrial processes, has been linked to cognitive impairment, developmental delays in children, and decreased fertility in adults (Ramírez, González …& Pérez, 2021). Furthermore, persistent exposure can weaken the immune system, increasing susceptibility to infectious diseases. These health issues not only compromise individual well-being but also place significant burdens on healthcare systems, especially in low- and middle-income regions where industrial regulation is often weak or poorly enforced. To address these dangers, it is crucial to implement strong regulatory frameworks that limit pollutant emissions from industries. Governments should enforce environmental standards, require pollution-control technologies, and monitor air quality consistently around industrial zones (EPA, 2020). Industries, in turn, must adopt cleaner production practices and invest in green technologies that minimize their environmental footprint. In some countries, incentives such as tax breaks or subsidies are offered to companies that comply with air quality standards and switch to eco-friendly alternatives. Community engagement and public awareness also play vital roles in mitigating the health risks of industrial air pollution. Educational campaigns can inform residents of the health dangers and promote protective behaviors, such as the use of air purifiers or masks during high pollution periods. Additionally, health surveillance systems can help track pollution-related illnesses in industrial zones, allowing for timely intervention and better-informed public health policies (WHO, 2021). Such efforts can empower communities to demand accountability and advocate for cleaner, safer living environments.

CONCEPT OF AIR POLLUTION

Air pollution, the contamination of the atmosphere by harmful substances, is linked to various health problems, economic impacts, and environmental degradation, with studies showing correlations between pollutants and increased mortality, respiratory issues, and even reduced corporate innovation. Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere.Al-Kasasbeh, Alzghoul, and Alhanatleh, (2022),Air pollution refers to a wide range of pollutants that are produced by a single or multiple agent. According to a European Commission study, approximately 82% of Europeans are exposed to air pollution Lower air quality is a major environmental problem that has an impact on humans due to air pollutants such as ozone, nitrogen dioxide and carbon dioxide (Collivignarelli., 2020). Air pollution is more concentrated in urban areas due to increased traffic and population density (Amin, 2020). Air pollution can not only affect plant growth and animal health but also shift market equilibrium of both agro-inputs and outputs in the food supply chain and thereby affect food security indirectly. Air pollution is a major environmental issue due to its substantial effects on ecosystem dynamics and conditions. Air pollution stems from natural and anthropogenic factors, primarily the burning of fossil fuels, industrial pollutants, farming methods, and automobile emissions. According to Richard, Sawyer &Sharipov, (2024).Air pollution significantly impacts atmospheric processes. Pollutants influence Earth's radiative balance by absorbing and scattering sunlight, thus affecting weather patterns and contributing to climate change.

CONCEPT OF INDUSTRIAL AREAS

Industrial areas are geographically demarcated zones developed primarily to facilitate the concentration and growth of manufacturing and industrial enterprises. These zones serve as engines of economic development, urbanization, and technological innovation, often playing pivotal roles in

national and regional development strategies. With rapid globalization and evolving urban planning paradigms, the concept of industrial areas has undergone significant transformation driven by sustainability concerns, digitalization, and policy reforms. Industrial areas are purpose-built regions equipped with infrastructure like transportation, power supply, waste management, and communication systems to support industrial activities. According to Li. (2021), modern industrial zones are characterized by spatial planning, regulatory oversight, and incentives such as tax benefits to attract investors. These areas may include free trade zones, special economic zones (SEZs), and industrial parks. Industrial zones contribute to employment generation, foreign direct investment (FDI), and export growth. In developing countries, they serve as instruments of industrialization and economic diversification. For instance, Sarkar & Bose (2023) highlight the impact of Indian SEZs on export-led growth, showing a strong correlation between industrial zone development and regional GDP improvement. However, industrial areas also pose environmental and social challenges. Urban pollution, displacement of communities, and land degradation are frequent by-products of rapid industrial development. Zhang. (2022) argue for the integration of eco-industrial park models to reduce the carbon footprint and improve sustainability within these zones.

TYPES OF HEALTH RELATED ISSUES FROM AIR POLLUTION AROUND INDUSTRIAL AREAS

Air pollution, especially in industrial zones, poses significant risks to human health. These areas are often characterized by elevated levels of pollutants like particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and volatile organic compounds (VOCs). Prolonged exposure to these contaminants has been shown to lead to a wide array of health problems, ranging from respiratory issues to more severe long-term diseases, including cardiovascular conditions, cancer, and neurological disorders.

- **Respiratory Diseases:** Air pollution is a leading cause of respiratory problems, especially in industrial areas where high levels of particulate matter (PM2.5, PM10) and toxic gases are prevalent. Long-term exposure to these pollutants can exacerbate asthma, lead to the development of chronic obstructive pulmonary disease (COPD), and increase susceptibility to lung infections. Studies have shown that industrial pollution can reduce lung function and trigger respiratory symptoms, especially among children and the elderly (Liu, 2021). The fine particles in the air are small enough to penetrate deep into the lungs, causing inflammation and other serious respiratory conditions
- **Cardiovascular Diseases:** Exposure to air pollution has been increasingly linked to cardiovascular diseases, particularly in industrial areas where pollutants like nitrogen dioxide (NO_2) and particulate matter (PM2.5) are prevalent. The fine particulate matter from industrial emissions is a significant risk factor for conditions like hypertension, heart attacks, and strokes. These particles enter the bloodstream and cause systemic inflammation, which can lead to the thickening of artery walls and other cardiovascular issues. A recent study by Wang. (2020) emphasized that people living in high-pollution industrial regions are at a considerably higher risk of developing cardiovascular problems compared to those in cleaner environments.
- **Cancer (Particularly Lung Cancer):** Industrial air pollution, which often contains carcinogenic compounds such as benzene, formaldehyde, and polycyclic aromatic hydrocarbons, significantly increases the risk of cancer, particularly lung cancer. The World Health Organization (WHO) has classified certain air pollutants, such as benzene and formaldehyde, as carcinogens. Zhang. (2022) noted that residents living near industrial zones

experience a higher incidence of lung cancer, with prolonged exposure to these toxic pollutants being a key contributor to the increased risk.

- **Neurological Disorders:** Emerging research suggests that air pollution is also linked to neurological problems, including cognitive decline, developmental issues in children, and neurodegenerative diseases such as Alzheimer's. Studies show that pollutants like fine particulate matter (PM2.5) and black carbon can cross the blood-brain barrier, causing inflammation in the brain and contributing to the development of conditions like dementia. Batey. (2023) provided a comprehensive review of how long-term exposure to industrial pollution increases the risk of mental health disorders and cognitive decline, particularly in elderly populations.
- **Premature Deaths and Reduced Life Expectancy:** Air pollution is responsible for millions of premature deaths worldwide and industrial areas are particularly at risk. Long-term exposure to high levels of air pollution can significantly reduce life expectancy due to its contribution to diseases like respiratory and cardiovascular conditions. Chen. (2024) conducted a study that found a clear correlation between air pollution levels in industrial areas and reduced life expectancy, with some regions experiencing a decrease in life expectancy by over five years compared to cleaner regions.
- **Reproductive and Developmental Issues:** Air pollution has also been found to negatively affect reproductive health. Pregnant women exposed to high levels of air pollution, especially in industrial regions, may experience complications such as preterm births, low birth weight, and developmental delays in their children. Martinez. (2021) emphasized that toxic chemicals released by industrial activities, including heavy metals and endocrine-disrupting chemicals, can impair reproductive health, affecting both male and female fertility.
- **Mental Health Disorders:** In addition to its physical health effects, air pollution has been linked to an increased risk of mental health issues such as anxiety, depression, and stress. Industrial pollution, which releases a variety of toxic chemicals into the air, can exacerbate mental health conditions. Recent studies suggest that air pollution-induced stress might contribute to the development of mood disorders, particularly in individuals with preexisting mental health vulnerabilities. Brown and Green (2022) conducted a systematic review that highlighted the mental health implications of living in high-pollution industrial zones, finding a strong association between pollution exposure and higher rates of anxiety and depression.

CASES OF HEALTH RELATED ISSUES CAUSED BY AIR POLLUTION AROUND INDUSTRIAL AREAS

Air pollution in industrial regions significantly impacts public health, leading to a variety of chronic and acute health conditions. Exposure to hazardous substances like particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) can cause a range of serious health issues. The following case studies highlight specific health-related problems linked to industrial air pollution, supported by recent academic research.

- **Asthma and Respiratory Issues in Children:** In industrial areas, high concentrations of particulate matter (PM2.5) and other pollutants have been linked to an increase in respiratory illnesses, particularly among children. A study conducted in the industrial region of the Yangtze River Delta in China examined the correlation between air pollution and the prevalence of asthma among children. The researchers found that children living in areas with high industrial emissions experienced a higher incidence of asthma and other

respiratory conditions due to the inhalation of fine particulate matter, which can cause inflammation in the lungs and airways.

- **Cardiovascular Health Impacts in Residents of Industrial Areas:** A significant case of cardiovascular health issues was observed in residents of a major industrial city in India. Research by Kumar. (2021) found that long-term exposure to high levels of nitrogen dioxide (NO_2) and particulate matter (PM2.5) in industrial zones led to increased rates of hypertension, heart attacks, and stroke. The study showed that individuals living in these areas had a 40% higher incidence of cardiovascular diseases compared to those in non-industrial zones. This case emphasizes the link between industrial pollution and cardiovascular risk factors, especially due to the long-term exposure to pollutants that promote systemic inflammation and damage blood vessels.
- **Lung Cancer in Industrial Workers:** A tragic case of lung cancer in industrial workers was investigated in a steel manufacturing plant in the United States. The plant, known for emitting high levels of airborne toxins such as benzene and formaldehyde, showed a higher than average rate of lung cancer among workers who had been employed there for over 20 years. A study by Johnson. (2023) found that the incidence of lung cancer among workers in the plant was 25% higher than the general population, which was attributed to prolonged exposure to carcinogenic chemicals released during industrial processes.
- **Neurological Disorders Linked to Industrial Pollution:** In a case study conducted in a chemical manufacturing region in South Korea, researchers examined the health records of individuals living near the industrial area, focusing on neurological disorders. A significant increase in cases of cognitive decline and early onset of Alzheimer's disease was found in the population exposed to high levels of PM2.5 and other industrial pollutants. The study by Bae. (2022) highlighted that air pollution in these regions contributed to the acceleration of neurodegenerative diseases, particularly in elderly populations. The researchers concluded that exposure to fine particulate matter is a significant risk factor for neurological impairment and cognitive dysfunction.
- **Reproductive Health Issues in Industrial Areas:** A study conducted in an industrial city in Argentina focused on the reproductive health of women living near factories that emitted heavy pollutants. The study found a significant correlation between exposure to industrial pollution and increased rates of miscarriage, preterm births, and low birth weight. The chemical pollutants, including lead and mercury, were identified as key contributors to these adverse reproductive outcomes. Research by Alvarez, (2020) concluded that women living near industrial zones faced a higher risk of these complications, likely due to the endocrine-disrupting chemicals present in the air.
- **Premature Deaths Due to Air Pollution in Industrial Cities:** In a 2023 study, researchers analyzed the impact of air pollution on premature deaths in a major industrial city in China. The study found that industrial air pollution was responsible for over 30% of premature deaths in the city, primarily from respiratory and cardiovascular diseases. The findings of this case study were supported by evidence from satellite data and local health records, showing that long-term exposure to air pollution significantly shortened life expectancy in the region. The researchers estimated that individuals living in the most polluted areas had their life expectancy reduced by up to 7 years compared to those in cleaner areas.
- **Mental Health Problems in Residents Near Industrial Plants:** A case study from an industrial region in Mexico examined the mental health effects of air pollution on local residents. In the study, individuals living near industrial plants showed significantly higher rates of anxiety,

depression, and stress. The pollutants, particularly sulfur dioxide (SO_2) and nitrogen oxides (NO_2), were found to contribute to increased levels of psychological distress. The research by Hernandez. (2021) indicated that long-term exposure to air pollution could exacerbate mental health conditions, leading to higher rates of psychiatric disorders in these populations.

CONCLUSION

Industrial air pollution poses serious health risks, especially in areas near manufacturing zones, where harmful substances like particulate matter and toxic gases are commonly emitted. These pollutants contribute to respiratory, cardiovascular, neurological, and reproductive issues, significantly affecting vulnerable populations. To combat these dangers, strong government regulations, cleaner production methods, and investment in green technology are essential. Additionally, raising public awareness and enhancing community health monitoring can help reduce exposure and prevent long-term health impacts. A combined effort from industries, policymakers, and citizens is crucial to protecting public health and creating safer, cleaner industrial environments.

RECOMMENDATIONS

1. Governments should enforce stricter emission control laws for industries and establish continuous air quality monitoring systems in industrial areas to detect and address harmful pollutant levels promptly.
2. Industries should be encouraged or mandated to adopt eco-friendly technologies and pollution control equipment that minimize the release of toxic gases and particulate matter into the environment.
3. Public health campaigns should be launched to educate residents on the risks of air pollution and preventive measures, alongside providing access to regular health screenings and medical support in affected areas.

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