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AIR POLLUTION AND PUBLIC HEALTH: A SOCIO- LEGAL PERSPECTIVE

AUTHORED BY - RAJEEV RAJ[1] & DR. POONAM KUMARI[2]

ABSTRACT

One of the main issues facing urbanization today is air pollution. Mankind and the natural world both contribute to this complexity. Nature causes forest fires, grass fires, and volcanic eruptions; man-made causes include burning fossil fuels, industrial smoke, and vehicle combustion. Air pollution poses a serious and dangerous threat to human health and the environment. The most important environmental issues are acid rain, global warming and ozone layer depletion. The goal of this review is to provide readers with a thorough understanding of this pressing issue facing humanity, including its causes, effects on the environment and human health, and management strategies that will help raise awareness among readers and ensure that the legacy is carried forward to future generations. The study discusses the condensed results of the information gathered from the field survey and the online survey. Humans suffer from a number of ailments that are brought on by prolonged exposure to these air contaminants. Government organizations launch a number of mitigating initiatives to raise public awareness. Programs such as urban planning, environmental laws, etc. A key suggestion is the establishment of post-disaster air pollution monitoring systems capable of swiftly identifying emerging health issues, facilitating efficient responses and curtailing potential long-term effects of the disaster. The study emphasizes how vital it is to continuously evaluate the impacted population to mitigate possible adverse impacts on human health. These strategies are essential for reducing the risk of air pollution, assisting with emergency response and recovery plan. Some recommendations should be followed by the industrial, agricultural, and shipping sectors to alleviate this problem from its root. It is everyone's duty to preserve the environment and make sustainable use of natural resources by upholding natural integrity. This is important not just to solve immediate issues but also to protect the environment for future generations.

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Introduction

Humanity enjoys contemporary, technical benefits in a more urbanized and modern society, but the environment constantly pays the price. But as civilization develops, air pollution also grows, and it frequently has a negative impact on both society and the atmosphere. Pollutants such as various particulate matter (PM) diameters between 2.5 and 10 μm, ozone, water vapor, oxides of nitrogen, carbon, and sulfur, and chlorofluorocarbons (CFCs) are said to cause air pollution when their concentration in the environment rises and eventually threatens the health of people, plants, and animals.[3] The issue of air pollution traced back to the middle ages, when England's King Edward I banned the burning of coal in London in 1307 for energy and heat. In the Meuse Valley of Belgium in 1930, sulfur dioxide, particulate matter, and high relative humidity combined to kill sixty-three more people in five days.[4] Hazardous substances that were invisible drew attention in the 1970s. Similar devastation occurred in German forests, and scientists noticed a slowdown in red spruce growth in the northeastern United States' mountains in the 1980s as a result of acid rain. This phenomenon was also known as Lake Acidification in Scandinavian nations. In the twenty-first century, other significant issues like as vehicle combustion, carbon dioxide (CO2) emissions, and the production of chlorofluorocarbons were considered viable possibilities for the problem. We have slowly and progressively exploited the environment due to urbanization and technological advancements, and now that we have reached the point of saturation, nature is responding negatively, which might be disastrous for mankind.

The Scenario of Air Pollution

The environment is influenced by anthropogenic activities, which are combined with various biotic and abiotic elements. The discharge of potentially hazardous materials into the environment that significantly harm human health is known as pollution. The concentration of this contaminant gradually rises, making the air poisonous to all earthly life. In addition to the air, anthropogenic activities also contaminate the water and soil. Lifestyle habits, social and

[3] Mary Abed Al Ahad et al., *The Effect of Air-Pollution and Weather Exposure on Mortality and Hospital Admission and Implications for Further Research: A Systematic Scoping Review*, 15 PLOS ONE e0241415 (2020).

[4] When Pollution Meant Punishment, https://www.downtoearth.org.in/indepth/when-pollution-meant-punishment-19737 (last visited Jun 9, 2024).

 ISSN: 2582-6433

economic concerns, and legislative strategies are closely knitted to this problem. Environmental pollution is undoubtedly considered a major disaster for public health issues in different aspects and causes nine million deaths per year.[5] Climate change and "The price paid by humanity" are closely related to the terrible disasters caused by air pollution. The disaster of air pollution results in a change in the environment which in turn causes global warming. Sea levels rose as a result of iceberg melting, and many plant and animal species became extinct. One of the main effects of the terrible air pollution is a shortage of food because of the reduction in agricultural productivity.[6] Chronic obstructive pulmonary disease (COPD), cough, shortness of breath, wheezing, and asthma are among the respiratory disorders that are brought on by this disaster. On the other hand, long-term exposure to air pollutants can cause chronic asthma, pulmonary insufficiency, cardiovascular disease, and cardiovascular mortality. Prolonged exposure to air pollution is expected to produce chronic illnesses such as diabetes.[7] There are several detrimental effects on the circulatory, neurological, and pulmonary systems that contribute to a rise in adult chronic diseases and infant mortality. Modern urbanization and overpopulation in developing countries are facing more problems compared to developed countries. Indoor air pollution is more common in underdeveloped nations where household cooking generally uses solid fuels like wood, women are more likely to suffer respiratory disorders. The most polluted city in India is widely acknowledged to be Delhi. The majority of flights at Delhi's international airport were canceled in 2019 due to air pollution-related poor visibility.[8] One of the main causes of pollution in India is the extensive burning of biomass.

Effects of Systems on Humans in Disasters of Air Pollution

Nervous

Nervous system inflammation, microglial cell activation, and cerebral vascular-barrier disorders impair neural cells in fetuses and infants; memory loss and depression are the effects of air pollutants. It is revealed that for older people PM 2.5, PM 10, carbon monoxide (CO), sulfur dioxide (SO2), and Nitrogen dioxide (NO2) can lead to mental illness and sadness,

[5] Air pollution, https://www.who.int/health-topics/air-pollution (last visited Jun 9, 2024).
[6] Jennifer R. Marlon et al., *How Hope and Doubt Affect Climate Change Mobilization*, 4 FRONT. COMMUN. (2019), https://www.frontiersin.org/articles/10.3389/fcomm.2019.00020 (last visited Jun 9, 2024).
[7] Ikenna C. Eze et al., *Long-Term Air Pollution Exposure and Diabetes in a Population-Based Swiss Cohort*, 70 Environment International 95 (2014).
[8] Business Standard, *Delhi Air Pollution: 19 Flights Cancelled, over 550 Delayed and 37 Diverted*, (2019), https://www.business-standard.com/article/current-affairs/delhi-pollution-37-flights-diverted-100-delayed-and-19-cancelled-119110300695_1.html (last visited Jun 10, 2024).

 ISSN: 2582-6433

whereas in youngsters or adolescents, they might lead to suicidal thoughts.[9]

In this mice-based experiment, mice exposed to PM 2.5 for ten months showed increased production of pro-inflammatory cytokines in addition to memory and spatial learning deficits.[10] A subtype of ischemic stroke (IS) that affects cerebral arterioles, small artery occlusion (SAO) is more common in diabetic people and is markedly accelerated by PM 2.5.[11] In a different experiment, it was demonstrated that after exposing mice to 350µg/m3 of Nano particulate matter for ten months, the development of newborn neurons was reduced, and a depression-like reaction was seen in the tail suspension test.[12] Diesel exhaust (DE) at a concentration of 250-300 µg/m3 for 6 hours in mice caused neuro-inflammation in different parts of the brain, specifically in the hippocampus and the olfactory bulb area through elevation of microglia activated lipid peroxidation.[13] Humans' neurotoxicity from prolonged exposure to PM 2.5 decreased their capacity for memory recall and new learning. Furthermore, PM 2.5 caused multiple sclerosis in the brain, which further reduced grey matter and affected fine motor coordination, raising the likelihood of developing Alzheimer's disease.[14]

Cardiovascular

The cardiovascular system is negatively impacted by particulate matter. There is a correlation between an increased risk of dying from cardiovascular disorders such as ischemic heart disease, ischemic/thrombotic stroke, and cardiac arrest with both acute and long-term exposure to certain air pollutants. The processes by which PM air pollution causes its disastrous effects are being clarified by recent research, which supports epidemiological data showing PM air pollution negatively affects human health.[15] A better knowledge of how PM harms human health is necessary to prevent and reduce the detrimental effects of this pervasive environmental danger. It has been shown that exposure to traffic is just as likely as physical

[9] Madhuchhanda Banerjee et al., *Cooking with Biomass Increases the Risk of Depression in Pre-Menopausal Women in India*, 75 SOCIAL SCIENCE & MEDICINE 565 (2012).
[10] L. K. Fonken et al., *Air Pollution Impairs Cognition, Provokes Depressive-like Behaviors and Alters Hippocampal Cytokine Expression and Morphology*, 16 Mol Psychiatry 987 (2011).
[11] Martin J. O'Donnell et al., *Fine Particulate Air Pollution (PM2.5) and the Risk of Acute Ischemic Stroke*, 22 Epidemiology 422 (2011).
[12] David A. Davis et al., *Prenatal Exposure to Urban Air Nanoparticles in Mice Causes Altered Neuronal Differentiation and Depression-Like Responses*, 8 PLOS ONE e64128 (2013).
[13] Lucio G. Costa et al., *Neurotoxicity of Traffic-Related Air Pollution*, 59 NEUROTOXICOLOGY 133 (2017).
[14] Radim J. Sram et al., *The Impact of Air Pollution to Central Nervous System in Children and Adults*, 38 Neuro Endocrinol Lett 389 (2017).
[15] Particulate matter air pollutants and cardiovascular disease: Strategies for intervention - ScienceDirect, https://www.sciencedirect.com/science/article/abs/pii/S0163725821000929?via%3Dihub (last visited Jun 11, 2024).

 ISSN: 2582-6433

exercise and consumption of alcohol to cause a significant myocardial infarction.[16] A Beijing, China study found that exposure to PM concentrations as high as 500 g/cm3 increased the chance of dying from ischemic heart disease. Even Nevertheless, at greater PM concentrations, the concentration-response curve's slope flattens.[17] For non-smokers, past smokers, and current smokers, there was a significant correlation between death from ischemic heart disease and chronic PM 2.5 exposure. PM 2.5 did not raise the risk of cardiac arrest or arrhythmia mortality in non-smokers; however, it did increase the risk in smokers, both present and former.

Respiratory

Air pollution is another major environmental hazard risk for lung cancer and asthma, among other respiratory disorders. Air pollutants, particularly particulate matter and other inhaled chemicals including dust, oxygen, and benzene, can cause harm to the respiratory system. Asthma is a respiratory condition that can be triggered by exposure to air toxicants.[18] Children with asthma may respond less favorably to short-acting beta-agonists after recent exposure to NO2 and potentially O3.[19] The risk of COPD is increased by both air pollution from industry and transportation, according to certain research.[20] Lung cancers mostly adenocarcinomas were linked to elevated traffic. The risk of lung cancer was elevated by ambient air pollution, namely by NO2 and PM.[21]

Climate Change and the Impact of Air Pollution

Acid Rain

Any kind of rain that has dissolved acid (sulphuric and nitric) as its primary dangerous component and changes the pH of the rainfall (which can range from 4-5), causing it to act corrosively when it hits the ground or another surface, is referred to as acid rain. The pH of the soil decreases as a result of protons being released into the soil as a result of acid rainwater's interaction with various atmospheric components. This is the reason that when nutritional

[16] Tim S. Nawrot et al., *Public Health Importance of Triggers of Myocardial Infarction: A Comparative Risk Assessment*, 377 Lancet 732 (2011).
[17] Wuxiang Xie et al., *Relationship between Fine Particulate Air Pollution and Ischaemic Heart Disease Morbidity and Mortality*, 101 Heart 257 (2015).
[18] Alexis M. Stoner, Sarah E. Anderson & Timothy J. Buckley, *Ambient Air Toxics and Asthma Prevalence among a Representative Sample of US Kindergarten-Age Children*, 8 PLOS ONE e75176 (2013).
[19] Leticia Hernández-Cadena et al., *Increased Levels of Outdoor Air Pollutants Are Associated With Reduced Bronchodilation in Children With Asthma*, 136 CHEST 1529 (2009).
[20] Guangqiao Zeng, Baoqing Sun & Nanshan Zhong, *Non-Smoking-Related Chronic Obstructive Pulmonary Disease: A Neglected Entity?*, 17 RESPIROLOGY 908 (2012).
[21] Paolo Vineis et al., *Air Pollution and Risk of Lung Cancer in a Prospective Study in Europe*, 119 International Journal of Cancer 169 (2006).

 ISSN: 2582-6433

cations mobilize and deplete, dangerous heavy metal concentrations can rise and reduce soil fertility. The crop-yielding pattern is impacted by the reduction in soil fertility, which has disastrous effects for the agriculture industry.[22] An analysis of the effects of simulated acid rain on soil fauna in China found that the treatment of the simulated acid rain altered community structure, leading to an ecological niche that was out of balance in terms of acidity, porosity, and oxygen flow. Nematodes and other dominating fauna moved southward in response to lessening acid rain stress.[23]

Global Warming

When solar radiation from the sun doesn't escape the planet's surface, the earth's average temperature gradually rises. This phenomenon is referred to as global warming. This is just another problem in an era of urbanization that is producing chaos and necessitating scholarly collaboration to find a solution. It is crucial to grasp the greenhouse effect before attempting to comprehend global warming. The wavelength of sunlight is shorter when it enters the earth's atmosphere than when it reaches the surface. This is because some of the energy is absorbed by the greenhouse gases in the atmosphere, which include CO2, water vapor, nitrous oxide, ozone, and methane. The stratosphere of the earth's atmosphere contains ozone, which shields the globe from the sun's harmful UV radiation.[24] Due to air pollution, the ozone layer has been reduced, raising global temperatures and allowing UV rays to penetrate the atmosphere and cause a variety of skin conditions. Global warming also promotes heat-generated diseases like cardiovascular problems, pulmonary diseases, and exsiccosis.[25] Not only humans but also plants are affected by global warming.

Impact on the Agricultural Sector

The anthropogenic activity which initiated air pollution has now given a deadly bite to the agricultural sector. Air pollutants include sulfur oxides, which are created by burning coal and petroleum, fluorides, which are produced by firms that make ceramics, and nitrogen oxide, which are produced from various vehicle combustions. It has been shown that these pollutants damage crops, which results in economic losses for the country. Disturbances with enzyme

[22] Improving soil fertility, (2016), https://www.iaea.org/topics/improving-soil-fertility (last visited Jun 11, 2024).
[23] Hui Wei et al., *Effects of Simulated Acid Rain on Soil Fauna Community Composition and Their Ecological Niches*, 220 Environmental Pollution 460 (2017).
[24] Ozone layer and ultra-violet radiation | Copernicus, https://atmosphere.copernicus.eu/ozone-layer-and-ultra-violet-radiation (last visited Jun 12, 2024).
[25] Medical aspects of global warming - Yoganathan - 2001 - American Journal of Industrial Medicine - Wiley Online Library, https://onlinelibrary.wiley.com/doi/abs/10.1002/ajim.1088 (last visited Jun 12, 2024).

 ISSN: 2582-6433

systems, compounds, metabolic degradation, and tissue deterioration are among the several metrics used to assess variations in crop shelf life. Fluorides, SO2, and chlorine are examples of acid gases that affect the crop's metabolomics. Chlorophyll damage is the initial target of hydrogen fluoride, which progressively induces chlorosis and finally results in cell death. They are impacted by these fluorides as they develop quickly. Particularly when the plant's stomata are open, sulfur dioxide induces necrosis. Especially conifers in the spring and early summer, are tolerant plants since they close their stomata at night.[26] More harm is done because the young needle leaves of these conifers quickly absorb the SO2. The plant suffers greatly when the leaves absorb SO2 and combine with water to generate poisonous sulfites. Bleaching and necrosis are the major effects of chlorine. A few byproducts of burning are ethylene, acetylene, and carbon monoxide. It tends to be damaged by this ethylene since it tends to accelerate life processes. Plant harm is also caused by peroxyacetyl nitrate and ozone.

Mitigation Strategies for Air Pollution

Recommendations

Industrial Sector

The amount of air pollutants that are harmful to human health has grown in emerging nations due to rapid urbanization and industrialization. It is the responsibility of urban area government officials to develop the necessary plans in order to enhance the quality of the air. Industrial processes discharge a wide range of hazardous gases into the atmosphere, such as carbon, dust, volatile chemicals, hydrogen sulfide, nitrogen oxide, and sulfur. The industries discharge the toxins into the environment as a gas, liquid, or solid if the expense of waste processing is unaffordable. Caustic soda, cement, dyes and their intermediates, fertilizers, iron and steel, oil refineries, paper and pulp, pesticides, and other sectors are among the most polluting. The primary pollutants that damage plants include ammonia, cyanides, ethylene, sulfur and nitrogen oxides, herbicides, and peroxyacetyl nitrate. Healthy plants undergo abscission, epinasty, necrosis, and chlorosis when toxins are present. Ensuring the safety of people, things, and machinery is the main objective of pollution control methods.

Reduced use of fossil fuels (oil, coal, and gas) for energy production reduces local air pollution,

[26] Michał Baciak, Kazimierz Warminski, & Agnieszka Bes, *Oddziaływanie Wybranych Gazowych Zanieczyszczeń Powietrza Na Rośliny drzewiasteThe Effect of Selected Gaseous Air Pollutants on Woody Plants*, https://www.ibles.pl/web/lesne-prace-badawcze/-/doi-10-1515-frp-2015-0039 (last visited Jun 12, 2024).

 ISSN: 2582-6433

particularly microscopic and submicronic particles.[27] Burning biomass can be a viable alternative to using fossil fuels.[28] On the other hand, PM is gathered and extracted from industrial emissions and exhaust using an electrostatic precipitator (ESP). It is well knowledge that mist collectors may separate gas from liquid droplets, which are gathered in different chambers.[29] In incinerators, volatile organic compounds and dangerous air pollutants are burned to produce non-toxic byproducts.

Agricultural Sector

Agriculture is a major contributor to air pollution. It is the main source of ammonia produced by humans. Despite legal prohibitions against burning, there are strong incentives to do so. Attempts to move from rice to other crops have failed due to incentives favoring minimum support cost guarantees, a secured output trade, and rice-free electricity for irrigation. Despite legal prohibitions against burning, there are strong incentives to do so. Attempts to move from rice to other crops have failed due to incentives favoring minimum support cost guarantees, a secured output trade, and rice-free electricity for irrigation.

When fertilizers are sprayed in larger amounts than crops can absorb or are sprayed on top of the soil and then driven off, pollution may result. The choice of fertilizer type has a big impact on emissions of ammonia. When urea is used, urease inhibitors can minimize emissions by restricting the conditions under which ammonia volatilization can occur, as well as by slowing down the pace at which urea hydrolyzes and becomes ammonium carbonate. It is also beneficial to shorten the period that air and manure are in touch. Spreading manure allows the particles to interact with the atmosphere for possibly long periods of time. This type of spreading applies fertilizer and then leaves it on the soil's surface without being combined. Consequently, there may be a slower rate of ammonia volatilization and generation.

Shipping Industry

Emissions from international sea vessels have a major effect on both climate change and public health. Although ocean trade has been growing gradually, improvements in shipping's

[27] Paraskevi Karka, Stavros Papadokonstantakis & Antonis Kokossis, *Environmental Impact Assessment of Biomass Process Chains at Early Design Stages Using Decision Trees*, 24 INT J LIFE CYCLE ASSESS 1675 (2019).
[28] Giuliano Aristide et al., *A Novel Methodology and Technology to Promote the Social Acceptance of Biomass Power Plants Avoiding Nimby Syndrome*, 67 CHEMICAL ENGINEERING TRANSACTIONS 307 (2018).
[29] Ye Zhuang et al., *Experimental and Theoretical Studies of Ultra-Fine Particle Behavior in Electrostatic Precipitators*, 48 Journal of Electrostatics 245 (2000).

 ISSN: 2582-6433

environmental performance have not kept pace with the expansion of marine activities.

The International Maritime Organization, which regulates international shipping, has developed ship energy-saving management strategies with the goal of lowering CO2 emissions. In the four "emission-control areas"—the Baltic Sea, the North Sea, the US Caribbean, and the coastal seas of Canada and the US—that the International Maritime Organization has designated, ships are supposed to cut back on emissions, mostly oxides of nitrogen and sulfur. Sulfur emissions from burning naval gasoline must be reduced, and stricter International Maritime Organization emission regulations are needed.

Public Awareness Programs and Urban Planning

The constant devaluation of air quality becomes a worldwide disaster. Numerous air pollution emission sources are linked to human social activities, such as excessive traffic smoke, poisonous gas emissions from homes, businesses, farms, shipping lanes, and uncontrolled urbanization, all of which pose serious risks to both the environment and human health.[30] It is now essential to raise people's knowledge and awareness in order to control and preserve the quality of the air. By implementing little adjustments to everyday activities, such as cutting back on the number of unnecessary personal cars, domestic energy usage, and supply and transportation, every homeowner may help reduce the amount of air pollution. Mitigating the issue of air pollution may need adaptation to the scientific concepts that are beneficial for the environment. When citizen science is used properly, it can contribute to a better public knowledge of air pollution.[31] In particular, citizen science refers to scientific research conducted by members of the general public and community organizations through a series of organized phases that include experiment design, data gathering and analysis, and problem-solving techniques.[32] The public's solutions to issues might be a crucial first step in reducing air pollution. Enforcing environmental standards is essential, and it must be done appropriately. The connection between environmental health and human health must be understood by everybody. The climate is one of the most often used indicators, and they need to be aware of it as it might represent the state of the nation's air. In order to reduce air pollution, it is

[30] Hizbullah Rahmani, Wafaurahman Wafa & Fayaz Gul Mazloum Yar, *The Importance of Public Awareness in Environmental Protection: A Case Study in Paktika, Afghanistan*, 20 NEPT (2021), https://neptjournal.com/upload-images/(24)D-1219.pdf (last visited Jun 12, 2024).
[31] Sachit Mahajan et al., *A Citizen Science Approach for Enhancing Public Understanding of Air Pollution*, 52 Sustainable Cities and Society 101800 (2020).
[32] Citizen science project characteristics: Connection to participants' gains in knowledge and skills | PLOS ONE, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0253692 (last visited Jun 12, 2024).

 ISSN: 2582-6433

imperative that decisions be made with an emphasis on both community- and individual-level activities and that information on air quality be shared. To address this issue, environmental health literacy is a crucial "tool." Environmental health literacy includes analyzing public opinion, raising awareness through adult and school-based teaching, and focusing public attention on measures that reduce air pollution. The daily air quality status is projected by radio, television, and print news.

Developing industrialization and urbanization, together with a growing population, produce air pollution that is detrimental to human health. In addition to improving living standards, urbanization has emerged as a significant source of PM 2.5 pollution.[33] Therefore, the first step toward a healthy, pollution-free existence is reducing pollutant emissions, which calls for a well-planned “smart city” development strategy. For effective urban planning, a number of significant governing organizations, including municipal, provincial, and national authorities, must have been engaged. At the local level, modifications to urban design planning may have an impact on air pollution rates. It has been demonstrated that improving the amount of green space and reducing fragmentation—that is, adjusting to the patterns of green landscapes—help regulate the quality of the air. By assessing the air pollution tolerance index, anticipated performance index, and carbon sequestration potential of the plants that can be used in urban planning through "Green Belt Development" and aid in aesthetic rejuvenation, research has been done on air pollution and its mitigation strategies. At various levels, "greenness" can shield human health from contaminated air. It has been demonstrated that certain plants' waxy leaf surfaces may be used to retain and collect particulate matter. Growing those specific plant species next to the road and in the most polluted region may thus be beneficial.[34] It is necessary to implement a scientific zonation plan in metropolitan and sub metropolitan regions that reduces the level of pollution emissions.[35] It is necessary to consider traffic flow control, vehicle access restrictions, reducing the dispersion of pollutants in space by growing tree canopies, and roadway width. Diesel-related particles, such as NO2, have been shown to have more negative effects on health than petrol. Plans for long-term urbanization will undoubtedly contribute to improving air quality. If a strategy is not implemented, the quality of the air will

[33] Jingjing Shao et al., *Study on the Relationship between PM2.5 Concentration and Intensive Land Use in Hebei Province Based on a Spatial Regression Model*, 15 PLOS ONE e0238547 (2020).
[34] B. Kończak et al., *Assessment of the Ability of Roadside Vegetation to Remove Particulate Matter from the Urban Air*, 268 Environmental Pollution 115465 (2021).
[35] Jerry A. Kurtzweg, *Urban Planning and Air Pollution Control: A Review of Selected Recent Research*, 39 Journal of the American Institute of Planners 82 (1973).

 ISSN: 2582-6433

deteriorate due to the growing human population. A pollution-free air that is consistent with a prosperous and healthy lifestyle is the goal of the action plan, which the government and its officials must monitor and implement. Political officials must urge the community to use bicycles, public transportation, and other clever, environmentally friendly tiny cars that don't emit smoke. Therefore, it can be concluded that in order to ensure a sustainable future for all people, long-term urban planning must incorporate enough green space, a well-organized public transportation system, a walk or bicycle to work strategy, appropriate solid waste management systems, the use of Nano-scale filters in cars and various industrial plants as well as indoors, air purifiers, etc.

Approach to the Problem

According to the World Health Organization (WHO), lead is one of the six primary air pollution agents, along with particle emissions, CO, ground-level ozone, sulfur oxides, and nitrogen oxides.

People can suffer a range of catastrophic consequences from both short-term and long-term exposure to airborne toxicants, including effects on their neurological, cardiovascular, and respiratory.[36] Given the detrimental impacts of air pollution, various environmental impact and public awareness campaigns must to be implemented in order to reduce this social issue. It is important to start advancing technical instrumentation that prioritizes reducing pollution emissions into the environment. In order to reduce pollution, topographical and meteorological data should be taken into account. Local, regional, and international air control regulations ought to be implemented in a number of ways. Reducing or getting rid of air pollutants from the environment is the goal of air control management. Strict measures should be taken by government agencies to combat pollution. The World Health Organization has established distinct quality criteria for several contaminants as a preventative precaution. Cars with catalytic converters should reduce vehicle combustion. In order to address this issue, a number of initiatives on the development of the green belt and the air pollution tolerance index have received funding for the purpose of environmental restoration and aesthetic revitalization. The terrible COVID-19 epidemic that began in 2020 and the subsequent proclamation of total lockdown claimed many lives and increased the pace of transmission, but they also proved to be beneficial for the environment. The absence of industrial pollutants, car emissions, and

[36] Adel Ghorani-Azam, Bamdad Riahi-Zanjani & Mahdi Balali-Mood, *Effects of Air Pollution on Human Health and Practical Measures for Prevention in Iran*, 21 Journal of Research in Medical Sciences 65 (2016).

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pollution from vehicles allowed the ecosystem to recover from its declining state over a longer period of time. It has been discovered that the Antarctic Circle has a smaller ozone hole.[37] A clean atmosphere supported the various locations' flora and animals. Limiting cross-border travel, enforcing stringent quarantines, banning public assemblies, and reducing human activity contributed to the recovery of the ecosystem.

During the first WHO Global Conference on Air Pollution and Health in 2018, WHO General Director Dr. Tedros Adhanom Ghebreyesus called air pollution "the new tobacco" and a "silent public health epidemic". Without a doubt, children are more vulnerable to air pollution, particularly during their formative years. Air pollution negatively impacts human health in a variety of ways. In addition to having a significant financial cost, diseases linked to air pollution also have a detrimental social impact since they prevent people from attending school and working. An effective solution might involve authorities, organizations, and medical specialists working together closely to restore normalcy to the situation, even if eliminating the issue of environmental pollution caused by humans is a challenging task. To successfully prevent the problem from occurring, governments must provide sufficient information, educate the public, and involve professionals in these areas.

Conclusion

In addition to efficiently treating the severe health impacts associated with air pollution, a global preventative program should be developed to counteract anthropogenic pollution. In order to properly address the fatal problem, knowledge based on research should be used in concert with sustainable development methods. This may be effectively accomplished by making local awareness campaigns more widely known, encouraging family members to take the initiative to reduce their emissions. Even at the home level, individuals in third-world nations need to be made more aware of the emission pattern. Creating green energy and using sustainable energy sources might be great ways to reduce the threat of air pollution. As was previously noted, legislators should be able to effectively enact legislation that limit emissions in order to contribute to the decrease of air pollution. As a result, although thinking locally and acting internationally is necessary, global governance also needs to adequately support ongoing efforts to reduce air pollution-related disasters for the benefit of all people.

[37] Shefali Arora, Kanchan Deoli Bhaukhandi & Pankaj Kumar Mishra, *Coronavirus Lockdown Helped the Environment to Bounce Back*, 742 Science of The Total Environment 140573 (2020).

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