

NATURAL RESOURCES AND ENVIRONMENT POLICIES AND PRACTICES



Institute of Strategy and Policy on Natural Resources and Environment

Impacts of Air Pollution



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Air pollution is a “burden” in 2020?

Compiled by HO VINH PHU

According to the Viet Nam Environment Administration (VEA), in 2019, environmental pollution was a complex issue. Air pollution is becoming more serious, especially in large cities like Hanoi and Ho Chi Minh City, which tend to have high numbers of polluting sources.

Notably, AQI sometimes exceeded safety thresholds, especially rates of PM_{2.5} fine dust. The VEA will need to take drastic action in 2020, especially to control sources of pollution and strictly handle violations of environmental regulations.

In large cities like Hanoi and Ho Chi Minh City, pollution tends to increase at certain times of the day and certain days of the year, especially when there is a combination of meteorological factors, including fog, and the increase of sources of air pollution.

Deputy Minister of Natural Resources and Environment, Vo Tuan Nhan, announced that in 2020, the VEA will take drastic action and implement breakthrough solutions. The actions will combine environmental protection and socio-economic development, and include: strict control of the sources of air pollution; reduction in plastic waste; collection and recycling of solid waste; strict handling of violations causing environmental pollution; encourage and promote environmental

industry - for example, technology, equipment, services and products to meet environmental protection requirements.

The VEA also set a goal in 2020 to continue perfecting environmental policies and laws. The VEA will review, adjust and develop new national technical regulations based on international best practice.

In particular, the VEA will promote solutions to protect and improve air quality in large cities, especially Hanoi and Ho Chi Minh City, focusing on reviewing and evaluating law enforcement and the National Action Plan on air quality management to 2020, with a vision to 2025.

In addition, the VEA aims to strictly control industrial parks, industrial clusters, and trade villages, and review requirements for investors.

Air pollution in the inner city of Hanoi
Source: ©GIZ

Air pollution in the inner city of Hanoi
Source: ©GIZ

Impacts of air pollution in Viet Nam

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I. Introduction

The rapid growth of human populations in the last few centuries, especially since the industrial revolution, has caused the deterioration of air quality in many areas, particularly in urban areas and industrial zones. The increasing number of means of production and transportation, along with the increase in the exploitation and use of fossil fuels for modern life, has made air pollution more common. At the global level, the warming of the atmosphere, the phenomenon of ozone depletion and acid rain, etc., are causing many negative consequences. Overcoming these phenomena is still a great challenge for humanity. At the national level, in many countries, especially in developing countries, air pollution is more common in urban areas and has many serious consequences for people's health.

In Viet Nam, air pollution is on the rise. In big cities such as **Hanoi and Ho Chi Minh City (HCMC)**, **air pollution has exceeded permitted level by many times**, of which dust pollution is markedly severe. Urban air pollutants include CO and NO_x which are mainly generated by the combustion of motor vehicles; SO_x arising from industrial processes; and dust generated by industrial processes, mining, and construction.

Air pollution has harmed human health, especially respiratory problems. According to statistics of the Ministry of Health, in recent years, respiratory diseases have the highest

incidence rates nationwide. **Air pollution by dust, SO₂, NO_x, CO, etc. has caused a lot of diseases such as respiratory infections, asthma, tuberculosis, allergies, chronic bronchitis, and cancer.** Apart from affecting people's health and lives, air pollution also leads to great economic losses via costs of health care, loss of time due to illness, and damage to crops, buildings as well as tourism and many other economic sectors.

II. Air pollution in Viet Nam and its impacts

2.1. Impacts on health

Air pollution is one of the main causes affecting human health in developing and developed countries. Outdoor air pollution in both urban and rural areas was estimated to cause 7 million premature deaths worldwide per year in 2014. This mortality rate is mainly due to fine dust exposure, such as PM₁₀, which causes cardiovascular, respiratory diseases, and cancer.

Specifically, air pollution has significant effects on human health, especially on the respiratory tract. Research results show that air pollution can lead to the deterioration of human health, acceleration of the ageing process in the human body, and the impairment of lung function. It can cause asthma, cough, rhinitis, sore throat, bronchitis, neurological and cardiovascular depression,

and reduce life expectancy. It is even more dangerous as a cause of lung cancer. The most sensitive community groups for air pollution are the elderly, pregnant women, children under 15, people with lung and cardiovascular diseases, and those who often have to work outdoors. The impact on each person varies depending on their underlying health conditions, the concentration and type of pollutants, and the length of exposure to the polluted environment.

In recent years, air pollution has greatly affected the health of people in urban areas and industrial parks. The number of people suffering from respiratory diseases has increased rapidly, accounting for about 4% of the total population. According to statistics from the Ministry of Health, in recent years, respiratory diseases have the highest incidence rates nationwide and one of the causes is air pollution (Table 1). **The number of people suffering from respiratory diseases in air-polluted cities is many times greater than other cities.** HCMC has the highest incidence of tuberculosis nationwide, followed by Hanoi, Dong Nai, Bac Giang and Hai Phong. The proportion of tuberculosis patients diagnosed in 2011 in these localities was 10 - 15 times higher than those with less industrial activities, such as Bac Kan and Dien Bien.

⁽¹⁾WHO (2014). *Public Health, Environmental and Social Determinants of Health (PHE)*.



Long Bien bridge - Hanoi
Source: ©GIZ

Table 1. Diseases with the highest incidence rates nationwide*Source: Health Statistics Yearbook 2016*

No.	Disease	Number of cases (per 100,000 people)
1	Pharyngitis and acute tonsillitis	672
2	Pneumonia	597
3	Other injuries due to identified trauma and multiple trauma	588

According to statistics from the Ministry of Health (2016), 597 cases of pneumonia, 672 pharyngitis and acute tonsillitis were found for every 100,000 people, ranking first among the diseases with the highest incidence. Worryingly, people of working age are often affected most directly. In particular, the number of cases of silicosis accounts for 74.5% of the total number of occupational disease cases nationwide. According to a study by the National Lung Hospital and respiratory centres in Bach Mai, Cho Ray and Can Tho hospitals, the proportion of the population with chronic obstructive pulmonary disease reached 7% and is increasing rapidly.

In fact, the rate of people suffering from respiratory diseases in large cities with rapid economic development such as Hanoi, HCMC, Hai Phong, etc., are 4 - 5 times higher than areas with slow economic development. In addition, environmental pollution also causes an average economic loss of about 729 VND/person/day in HCMC and 1,538 VND/person/day in Hanoi due to health costs as well as reduced income.



Residents wearing masks during air polluted days
Source: ©ISPONRE

In Hanoi, environmental monitoring results from the beginning of 2013 to now show that **concentrations of suspended dust in the air in some areas exceeded 11 times the permitted levels**. According to a survey, health experts said that those who have lived in Hanoi for more than 10 years had nearly twice the incidence of chronic ear, nose, and throat diseases compared to those living in the city for less than 3 years. For acute illnesses like flu, citizens who have lived in Hanoi for more than 10 years account for 11.5%; under 3 years the rate is 6.8%. The trend continues to rise.

Basically, outdoor air does not consist of a single air pollutant but many air pollutants. Air quality in polluted urban areas is often contaminated concurrently by several pollutants among the following: dust, ozone, CO, VOCs, NO₂. Studies on the effects of air pollution on human health can be conducted to determine the effect of each air pollutant or a mixture of pollutants.

The air pollutants presented below are the main ones that affect human health:

• Dust

Dust pollution is considered to be the biggest air pollution problem mainly due to its effects on health. The current level of dust in most areas of the world, including developed countries, has an adverse effect on health. There is ample evidence that dust exposure has a marked effect on human health. The effects of dust on health are quite extensive but mainly focused on the respiratory and cardiovascular systems. Everyone is affected by dust, but the level of impact depends on underlying health conditions and age.

The impact of dust on health basically depends on the size of the dust as well as dust constituents and their content. Dust with a diameter of less than 10 μm equivalent (PM₁₀) can enter the human respiratory system and impact on health. **Dust with a diameter of less than 2.5 μm equivalent (PM_{2.5}) can move into the lungs and can have a significant impact on health.** Nowadays, nano particles with a diameter less than 100 nm are of great concern because they can penetrate the cell's shell and cause major health effects.

Besides particle size, the composition of dust is an important factor that determines health impacts. For example, when dust contains lead, it will likely affect the nervous system.



Air pollution in Hanoi
Source: ©GIZ



Open burning of garbage
Source: ©GIZ

• O₃

Research shows that, when O₃ concentrations in outdoor air is > 240 µg/m³ it can lead to significant health consequences. This concentration may affect both healthy adults and people with asthma by impaired lung function and upper respiratory tract infection. Practical research has demonstrated that high O₃ levels will lead to an increase in child mortality. Evidence of time series data indicates that daily mortality will increase by 0.3 - 0.5% for each increase by 10 µg/m³ of O₃ concentration in the ambient air from the baseline concentration threshold 70 µg/m³ (this is the O₃ baseline concentration that WHO considers the baseline concentration in the northern hemisphere.)



Beehive stoves are one source of air pollution
Source: ©GIZ

• SO₂

The health effects of SO₂ have been extensively studied and a lot of convincing evidence has been provided. SO₂ was responsible for more than 4,000 deaths in the lethal smog in London, 1952.

SO₂ can affect the respiratory system and lung functions, and cause eye irritation. A study found that hospitalisation and death rates due to heart disease increases on days of high SO₂ levels. Recent studies have shown that air with very low SO₂ concentrations (average of 5 µg/m³ and maximum <10 µg/m³) also affects health. However, it should be emphasised that studies have not been able to distinguish the health impacts of SO₂ by the gas itself from the health impacts of the gas-induced fine dust particles. However, one thing is sure: if SO₂ levels can be controlled, there will be a positive impact on human health.



Emissions from factories causing bad effects on environment
Source: Frankie Schembri - @Science

• NO_x

NO_x includes NO and NO₂. In particular, NO₂ management is important because the NO in the atmosphere will quickly convert into NO₂. Studies on short-term exposure have shown that the concentration of NO₂ > 200 µg/m³ will cause adverse effects on the respiratory system. Some studies have indicated that exposure within 1 hour with NO₂ concentrations > 500 µg/m³ has an acute health impact. Although the lowest NO₂ exposure threshold exerting a direct effect on the lung function of people with asthma is 560 µg/m³, exposure to NO₂ concentrations > 200 µg/m³ has been found to trigger lung reactions in people with asthma.



Emissions from transport causing the increasing amount of CO
Source: ©GIZ

• CO

CO has a high affinity for erythrocytes (haemoglobin) in the blood producing carboxyl haemoglobin (COHb). This CO affinity is 200 times greater than the O₂ affinity for erythrocytes, which reduces the O₂ transport capacity of blood. When CO concentrations in the outdoor air and the time of exposure to CO content gradually rise, it will lead to increasing COHb content. At first, when COHb increases to 2 - 5%, the central nervous system begins to be affected. When COHb increases to 10 - 20%, the function of various organs in the body will be damaged. If COHb content in the air increases to 60% corresponding to the content of CO in the outer air of 1000 ppm, then life will be in danger.

2.2. Impact on climate

• Ozone depletion

The ozone layer is in the stratosphere (accounting for about 90% of the total ozone in the atmosphere), at an altitude of about 15 - 40 km. Ozone floor holes have been discovered: a hole in Antarctica (1985) with about 80% loss and a hole in the North Pole (1990) with about 40% loss. The presence of ozone layer holes has caused several environmental consequences including damage to both the land and ocean food chain; cataracts, suppressed immune systems; and an increase of 2 - 4% of skin cancer cases. It is estimated that it will take at least another 100 years for the ozone layer to recover if ozone depleting substances are controlled.

In quick response to the discovery of holes in the ozone layer, the Vienna Convention, adopted in March 1985 under the coordination of UNEP and the Montreal Protocol, was signed in 1987. Currently, more than 100 countries have signed the protocol, including Viet Nam.

So far, the consumption of CFCs has decreased significantly at the global scale due to the impact of the Montreal Protocol. However, the consumption of HFCs tends to increase. Increasing consumption of HFCs is also a matter of concern because they act as a factor in climate warming.

• Acid deposition

Acid deposition: Is a phenomenon formed in the atmosphere polluted by SO_2 , NO_x deposition on the Earth's surface in dry form (composition of dust, gas) and in wet form (composition of rain, snow, fog and clouds).

Acid deposition is the result of human production processes that consume large amounts of coal, oil and other fuels.

Acid deposition can be classified into:

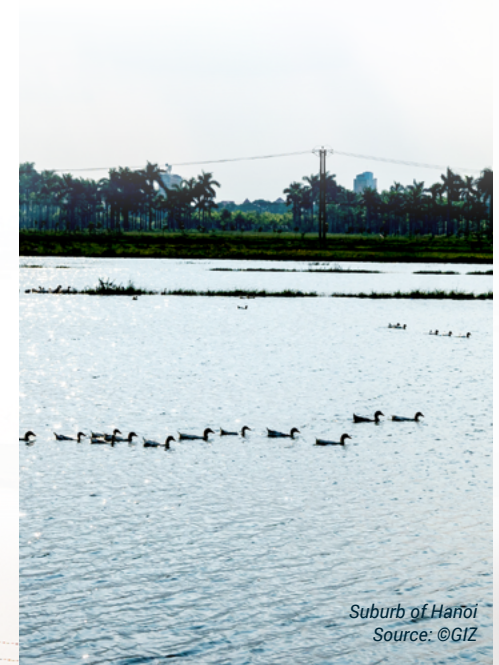
- Wet deposition: Wet deposition of acids occurs in any form of precipitation (rain, snow, etc.), removing acids from the atmosphere and carrying it to the Earth's surface.
- Dry deposition: Acid deposition also occurs in the form of dry deposition in the absence of precipitation. This happens when particles and gases are deposited or adsorbed into the ground, vegetation or other surfaces.

The harmful effects of acid deposition include:

- Acidification of lakes, leading to impacts on aquatic ecosystems
- Deterioration of forests
- Damage to building materials and construction sites
- Crop destruction

Historically, acid deposition has occurred and has led to serious consequences for some areas such as Western Europe, Taiwan, and Japan. At present, acid deposition is no longer a problem in the West thanks to effective control of SO_2 and NO_2 , which helps to gradually decrease the concentration of these two substances in the surrounding air. Data on acid rain measured in Viet Nam also shows that at present we do not have to worry about this problem.

Acid rain: Is a type of acid deposition defined as rain water with a $\text{pH} < 5.6$.



Suburb of Hanoi
Source: ©GIZ

Suburb of Hanoi
Source: ©GIZ

• Global warming

Given the long period of time, the total amount of energy entering the Earth is equal to the total amount of energy leaving the Earth. However, due to the heat retention effect of some gases in the atmosphere, the temperature of the Earth's surface is increasing. Those heat-trapping gases are called greenhouse gases (GHGs). **Natural GHGs include water vapour (mainly) and CO₂.** These natural GHGs keep the atmosphere near the ground warm, otherwise it would be about 33°C colder. Together with natural GHGs, increasing man-made greenhouse gases including CO₂, CH₄, N₂O, CFC... etc., have significantly increased the Earth's temperature. This phenomenon is called global warming.

According to these calculations, by the end of this century Earth's average temperature will increase by 1- 4°C.

The impacts of climate change vary greatly between global and regional impacts. Viet Nam is one of the countries predicted to be most severely affected by climate change. Many extreme weather events including drought, storms, and flash floods have been recorded in Viet Nam, showing the impact of climate change. Climate change leads to drought, and rising sea levels also contribute further to saline intrusion, which is already a complicated issue in the Mekong Delta. Adaptation to climate change is a major challenge facing our country. In addition, the control and reduction of global warming by means of GHG emissions reduction should also be considered.

III. Conclusion

The process of socio-economic development together with the negative impacts of climate change has created pressure on the environment in general and on air quality in particular. Air quality is still on a downward trend, especially in large urban areas and areas where industrial production is concentrated. Some rural areas are also polluted by the activities of traditional trade villages, handicraft production, and the burning of post-harvest rice straw.

Regarding air pollution in Viet Nam, dust pollution continues to be the most prominent issue. Concentrations of other gases such as NO_x, SO₂, CO are also increasing.

Besides, noise pollution in urban areas and manufacturing areas is an issue that has been unresolved for many years. In addition, odour pollution is also a pressing issue, but is largely considered a local issue. Recently, a number of studies have shown that Viet Nam is at high risk of being affected by a number of transboundary air pollution sources. Some transboundary air pollution issues that are of great interest to many countries are fine dust pollution, mercury pollution, acid deposition and photochemical smog due to emissions from neighbouring countries.

According to an assessment by the Ministry of Health, in recent years, the incidence of respiratory diseases is high and one of the causes is air pollution. According to statistics, the proportion of people suffering from respiratory diseases in traditional trade villages, areas near industrial parks, intersections, etc., is higher than other areas. Air pollution also causes significant economic losses, adversely affects natural ecosystems and is one of the underlying causes of climate change, increasing Earth's surface temperature, rising sea levels, increasing extreme weather events and natural disasters in many countries around the world, including Viet Nam.

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Limited visibility due to the worsening air quality
Source: ©GIZ

Does air pollution have an effect on aquatic ecosystem?

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I. Introduction

Air pollution occurs when chemicals, dust particles, or biological materials are released into the atmosphere and cause negative impacts on human health and living organisms, damaging crops and destroying the natural and built environment.

Air pollutants exist in many states such as solid dust particles, small droplets, or gaseous droplets. These materials may originate from artificial sources such as volcanic eruptions, wildfires, etc., or may be created from human activities such as farming, industrial production, etc. Air pollutants are able to spread rapidly over a large areas, away from the source of emissions. These pollutants can be deposited directly into the water, or fall onto the surface of the soil and then follow overflows into the aquatic

environment. The deposition of pollutants takes place in two forms: wet deposition (rain water, snow, dew, etc.) and dry deposition (dust, gas, etc.) (Swackhamer et al, 2004). During atmospheric transport, pollutants can continue to convert into more hazardous substances.

Scientists have recognised that air pollution is a factor leading to the decline of biodiversity, in which freshwater ecosystems are most affected (Bui Duc Hien, 2016). Although not yet a direct cause of extinction, **air pollution is mainly related to the decline of species**. However, with increasing pollution, the loss of some plants and animals is inevitable.

II. The impact of air pollutants on the water environment

According to research by Swackhamer et al. (2004), **the three air pollution agents that have the greatest impact on the water environment are organic compounds, mercury and inorganic nutrients**.

- Organic pollutants
- Mercury
- The inorganic nutrients

• Organic pollutants

Most of the volatile organic pollutants transported in the air often have properties that allow them to survive in the environment for a very long time, are bio-accumulating and toxic to low-level organisms in the water environment as well as other creatures like shrimp and fish. These compounds may range from a wide range of chemicals from pesticides and polychlorinated biphenyls (PCBs) to brominated flame retardants, waterproof paints and stains, and synthetic fragrances.

The three main roads in the atmosphere where organic pollutants enter the water environment are:

- Wet deposition through rain, snow and fog
- Deposition through solid particles
- Gas exchange between air and water.

These compounds can:

- Move from the ground and water into the atmosphere and vice versa
- Are highly stable under the action of ultraviolet light and oxidants
- Creating a relatively high affinity for the adipose tissue and its ability to resist decomposition in the body, thus allowing them to accumulate in organisms and bioaccumulate in the food chain

Compounds accumulate in living organisms whenever they are absorbed and accumulate at a much faster rate than they are broken down or excreted. The accumulation of an organic pollutant increases in organisms as it moves up and down a food chain. In particular, the monitoring and control of these compounds in water faces many obstacles, the reason being that the concentration of organic pollutants may be low in the water environment but in fact is very high in the cells that turn on in that water. In some cases, bioaccumulation has not had a significant effect on lower organisms, but negative effects have been observed in higher animals, such as chlorine compounds, a decrease in reproduction, embryo malformation and behavioural problems in birds of prey in North America (Swackhamer, 2004).

Air pollution in the inner city of Hanoi
Source: ©GIZ

• Mercury

Mercury has become a global pollutant and can be released into the atmosphere as a result of many human activities, including burning waste and burning high-sulphur coal in factories, metallurgy, chlorine alkali production, cement production, gold mining, as well as mercury fungicide use in latex paint and pulp and paper industry. The total amount of mercury in the atmosphere is estimated at 5,000 to 6,000 tons, and about half of that is generated by human activities (Fitzgerald & Watras, 1989). Artificial processes contribute to 70-80% of annual mercury emissions into the atmosphere, of which 95% of mercury exists in the atmosphere in elemental form (Fitzgerald, 1995).

In its elemental state, mercury has a low reaction rate and a long lifetime in the atmosphere, so it can be diffused in the atmosphere on a global scale, while the oxidized forms of metals have wet and dry deposition ability. For example, reactive gaseous (RGHg) are highly soluble in water and deposited on soil surfaces and water by snow and rain. Mass balance calculations indicate that the dry deposition of RGHg from the atmosphere can account for up to 35% of total ocean mercury input (Mason & Sheu, 2002).

Several studies have shown that methylmercury is considered a compound that has a significant effect on aquatic organisms. In anaerobic environments such as lake sediments or wetlands, mercury is converted to methylmercury by microbial activity, especially desulfurizing bacteria. Methylmercury diffuses in water

and is absorbed by fish, accumulating in their muscle tissue by binding to thiol or mercaptans organic compounds. In general, this pollutant will cause impacts on internal organs of domestic organisms such as fish, negatively impacting the reproduction of the polluted body. More dangerous, mercury build-up in tissues can spread to predators like wild mammals or humans. Methyl mercury damages nerves, the liver and kidneys, and affects neurodevelopment in children (Grandjean & Weihe, 1997).

• The inorganic nutrients

Inorganic nutrients such as nitrogen, phosphorus, iron and trace elements such as iron, zinc, manganese, copper, cobalt, molybdenum, boron and selenium, etc., can be deposited in the atmosphere in the form of rain or snow or particles and gases. Until now, the greatest attention has been focused on nitrogen because it is the most common restricted nutrient in the sea, estuaries and some freshwater systems. Nitrogen compounds include inorganic reducing forms (ammonia, ammonium), inorganic oxidizing

forms (nitrous oxide, nitrate, nitrite) and organic forms (urea, amino acids and other compounds). Over the past century, nitrogen deposition in the atmosphere has increased tenfold, due to trends in urbanization, industrial expansion and agricultural intensification (Howarth & Billen, 1996).

Excessive nitrogen content entering estuaries and coastal waters is a major cause of increased eutrophication and associated environmental consequences, including blooming algae (red tide, toxic blue-green algae), reduced water transparency, increased toxicity, lack of oxygen. Aquatic organisms may die due to habitat loss. In coastal and oceanic saltwater environments, nitrogen and iron enhance primary and secondary production - the driving factor for algal blooms. In addition, nitrogen compounds in the atmosphere, such as NO_x, are agents that cause acid rain, which changes the pH of the water environment, which in turn leads to changes in the aquatic organism population.

Phosphorus is also a component of atmospheric deposition, mainly entering the water by dry deposition because phosphorus is often associated with particles such as dust and soil. Therefore, water environments near agriculture or arid areas are more likely to receive phosphorus. Phosphorus is also a factor that affects the growth of plants in water, but the effect is unclear when many studies show that the amount of phosphorus entering water from the air is negligible compared to nitrogen (Bergametti et al., 1992).

Table 1. Contaminated compounds of nitrogen in the air and emission sources
(Swackhamer et al. 2004)

Forms of nitrogen compounds in the air	Emission source
Inorganic denituated nitrogen (ammonia, ammonium)	- Ammonia evaporating from animal waste and chemical fertilisers - Burning biomass - Dust from shifting cultivation and deforestation - Ammonia evaporating from the wastewater treatment process - Burning fuel in engines - Decomposing biomass in nature - Volcanoes - Dust and aerosol
Inorganic oxidized nitrogen (nitrous oxide, nitrate, nitrite)	- Burning fuel - Photolysis of N₂O - Dust and aerosol generated by storms
Organic nitrogen (urea, amino acids)	- Dust and evaporation from waste - Photochemical reaction in the atmosphere - Aerosol

III. Conclusion

Air pollution has become one of the leading concerns in the world. This situation has affected all aspects of the environment, of which the water ecosystem is not outside the sphere of influence. Organic and inorganic pollutants from the atmosphere are absorbed into the water, causing changes in the environment, leading to extreme phenomena such as algal blooms, oxygen depletion, and biological factors, all of which not only cause damage to aquatic organisms, but also affect land creatures, including humans. Therefore, the study of the potential impacts of air pollution on water ecosystems is extremely important to create a basis to manage and limit the harm caused by this phenomenon.

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Preliminary studies on the causal relationship between air pollution and the Covid-19 pandemic

Compiled by LE THI VAN NGA

In the US

Coronavirus patients who lived in highly polluted areas before the pandemic are more likely to die than patients in cleaner parts of the country, according to a new nationwide study in the US.

To conduct the study, Harvard University researchers collected particulate matter data for the past 17 years from more than

3,000 counties and Covid-19 death counts for each county through April 4 from the Coronavirus Resource Center at the Johns Hopkins University. The researchers also carried out 6 secondary analyses to adjust for factors they felt might compromise the results. For example, as New York is the hardest-hit by the outbreak with a mortality rate 5 times higher than any other areas, the researchers have repeated the analysis excluding all of the counties in the state. They have also run the model excluding counties with less than 10 confirmed Covid-19 cases. Furthermore, they adjusted for various other factors affecting health, such as smoking rates, population density and poverty rates. Afterwards, they discovered that higher concentrations of PM_{2.5} are linked to the higher death rates from the disease.

For many weeks, public health authorities have surmised a relationship between air pollution and deaths or severe COVID-19 infections. The Harvard analysis is the first nationwide study to show a statistical link, revealing a "large overlap" between Covid-19 deaths and other diseases associated with long-term exposure to fine particulate matter.

A lot of studies have pointed out that long-term pollution exposure increases people's vulnerability when exhibiting the most severe symptoms of Covid-19. For instance, a research group found that a person living for decades in a county with high levels of fine particulate matter is 15 percent more likely to die from the coronavirus than someone in a region with one unit less of fine particulate pollution.

"This research provides evidence that counties that have more polluted air will experience higher risks of death for Covid-19", said Francesca Dominici, a professor of biostatistics at Harvard who led the study. She stated that counties with higher pollution levels will be the ones that will have higher numbers of hospitalizations, higher numbers of deaths.

The study's focus is on why breathing polluted air can increase the likelihood of being infected with Covid-19 - the disease which has killed more than 10,000 people in the US and 74,00 worldwide (Last updated on August 2020).

The analysis did not look at individual patient data and did not answer why some parts of the country have been hit harder than others.



Map of USA
Source: ©Freepik

It also remains unclear whether particulate matter pollution plays any role in the spread of the coronavirus or whether long-term exposure directly leads to a greater risk of falling ill.

In addition, the study emphasised the importance of enforcing existing air pollution regulations to protect human health both during and after the Covid-19 crisis.

A few studies previously carried out by the US Government also demonstrated that there would be premature deaths due to increased air pollution, with the Environmental Protection Agency acknowledging that the relaxed regulations on carbon pollution from coal-fired power plants are likely to result in about 1,400 additional premature deaths a year due to pollution.

Most fine particulate matter comes from fuel combustion from automobiles, refineries and power plants, as well as some indoor sources like tobacco smoke. Breathing in such microscopic pollutants, experts say, inflames and damages the lining of the lungs over time, weakening the body's ability to fend off respiratory infections.

Multiple studies have found that exposure to fine particulate matter puts people at heightened risk for lung cancer, heart attacks, strokes and even premature death. In 2003, Dr. Zuo-Feng Zhang, the Associate Dean for research at the University of California,

(Fielding School of Public Health) found that SARS patients in the most polluted parts of China were twice as likely to die from the disease as those in places with low air pollution. During an interview, Dr. Zhang found the Harvard study to be very much consistent with his findings.

Dr. John R. Balmes, a spokesman for the American Lung Association and a professor of medicine at the University of California, San Francisco, said although the findings needed verification, they were particularly important for hospitals in poor neighbourhoods and communities of colour, which tend to be exposed to higher levels of air pollution than affluent, white communities.



Air pollution due to fine particulate matter in USA
Source: Kevin Schafer - ©Wired

In Canada

As cases of coronavirus in British Columbia continue to increase, the Centre for Disease Control recommends implementing measures that help to reduce excess air pollution to protect communities. Open

burning restrictions have been issued across British Columbia's high smoke sensitivity zones, which include the Okanagan. The Ministry of Environment and Climate Change Strategy in collaboration with provincial public health partners has issued the restrictions until Wednesday, April 15, 2020.

"There is strong evidence that exposure to air pollution increases susceptibility to respiratory viral infections by decreasing immune function," said Daniel Bings of the Ministry of Environment and Climate Change Strategy. *This means:*

- ▶ Deterioration in air quality may lead to more COVID-19 infections overall;
- ▶ Deterioration in air quality may lead to more cases of severe COVID-19 infections, adding further pressure on our healthcare system; and
- ▶ Improvements to air quality may help to protect the whole population from COVID-19 and its potentially severe effects.

Evidence suggests that air pollution from combustion sources is most heavily connected with increased risk of viral infection, particularly vehicle emissions and biomass burning.

At this time the BC Centre for Disease Control strongly recommends that open burning of biomass fuels be restricted in areas with high or moderate risk of population exposure to the resulting smoke. While the focus should remain on social distancing to prevent the spread of infection and reduce the number of cases, keeping our air as clean as possible will also help to protect the population during this difficult period. The Ministry of Environment and Climate Change Strategy is restricting open burning in some parts of the province. These measures will be evaluated on a daily basis; the areas to which they apply may grow or diminish accordingly.

Map of Canada
Source: ©Freepik

CN Tower, Bremner Boulevard, Toronto, ON, Canada
Source: Ibrahim Alonge - ©Unsplash



Air pollution from transportation
Source: ©GIZ



Residents burning votives outdoor affecting air quality
Source: ©GIZ



Doctor Bui Thao
Source: ©ISPONRE

Ms. Bui Thao (Doctor and Practitioner of traditional Vietnamese medicine)

Air pollution in Hanoi is now at an alarming rate. In the morning, the pollution can be clearly felt as emissions from transport vehicles gather, becoming a thick haze. These are actually fine particles.

Fine particles account for a large percentage of emissions from transport vehicles and from construction sites. They can get deep into lungs and cause damage, especially for people with respiratory issues including asthma, chest pain and breathing difficulties.

The doctor has received many patients with asthma, allergic rhinitis, chest pain and breathing difficulties, providing evidence for the severe health impacts on patients, including elderly people and children.

For this reason, Doctor Thảo advised people to keep healthy by exercising regularly, which also helps reduce the risks caused by air pollution.

At the same time, there needs to be an intervention and collaboration between authorities including on the control of construction sites by the Ministry of Construction. On the other hand, the reduction or avoidance of fine particulate pollution caused by transport vehicles will need intervention by the Viet Nam Register or the Ministry of Transport.

Everyone joins together for a cleaner environment.



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