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# A Study on the Improvement of Fine Dust Law

- Focusing on the Cases of the Chungbuk Province

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A B S T R A C T

According to the OECD's "2017 Quality of Life Report" (How's Life 2017), the air pollution problems and health felt by Koreans remain at the bottom of the OECD countries. Fine dust is drawing the most attention among recent air pollution problems. Fine dust PM10 is dust smaller than 10/1000 mm, PM2.5 is dust smaller than 2.5/1000 mm, and fine dust, which is smaller than 1/20 to 1/30 of the diameter of hair (about 60 μm), is emitted as a mixture of solid and liquid particles in the air, chemically or naturally produced. If you look at the sources of fine dust in Korea and Chungbuk, it may appear differently depending on regional characteristics, but most of the manufacturing combustion, production processes, and road movement pollutants are pointed out as the main causes. In August 2018, a special law was enacted to reduce and manage fine dust. Therefore, this study aims to seek ways to improve laws that have prepared legal grounds for responding to fine dust but have not prepared passive administration and strong sanctions standards.

*Key words: Fine dust, a source of fine dust, Fine dust reduction, Fine dust law*

## 1. Introduction

Fine dust is called the Silent Killer (Kim Wan-gu, 2019: 188). As COVID-19 has hit the world in the past two years, various policies have been prepared to solve this problem, causing temporary reduction effects (Kim et al, 2020), but fine dust has a significant impact on health and air pollution.

According to a survey conducted by the Korea Centers for Disease Control and Prevention, the number of "excessive deaths" caused by ultrafine dust in 2019 alone will exceed 23,000 (Lee, 2022). According to the OECD report titled "Economic Results of Air Pollution" released in 2016, if Korea fails to properly cope with air pollution, the early death rate from air pollution will be the highest among OECD member countries by 2060.(Park, 2016)

In addition, the National Disaster and Safety Research Institute of the Ministry of Public Administration and Security selected types of disasters with high risk in the near future and announced the results. As a result, the top five disaster accidents were selected as the top five among natural disasters, storm and heat waves, infectious diseases and fine dust among social disasters, and industrial accidents among safety accidents. In 2013, the International Agency for Research on Cancer (IARC) under the World Health Organization (WHO) classified fine dust as a group 1 carcinogen (Group 1) carcinogen (Park, 2019: 1).

Although the fine dust problem is the biggest environmental problem felt by the people, the government has made various efforts such as the "6.3 Measures" in 2016 and the "Comprehensive Fine Dust Management Measures" in 2017, and the "Fine Dust Reduction and Management Act" in 2018. In particular, even in the absence of fine dust from China, the seriousness of domestic fine dust suggests that there is a problem in the domestic fine dust response system (JTBC, 2018)

Before the enactment of the Special Act on Fine Dust, the Air Environment Conservation Act or the Special Act on the Improvement of the Air Environment in the Seoul metropolitan area played a role in regulating fine dust. However, these laws did not provide emission standards for fine dust. Meanwhile, local governments are also enacting ordinances after the Special Act on Fine Dust, and

efforts to establish practical binding force for fine dust management are also being enhanced. (Moon et al, 2019: 87)

Therefore, this study examines the effectiveness of the fine dust law, which failed to quell public anxiety even though the special fine dust law, which took effect in 2019, and suggests measures to improve the legal system based on the source and current status of fine dust in Chungbuk. Chapter 2 is an overview of fine dust, and Chapter 3 is to analyze the Special Act on Fine Dust Reduction and Management. Chapter 4 presents measures to improve fine dust through the case of Chungbuk, and the conclusion is Chapter 5.

## 2. The opening of fine dust

### 1) The concept of fine dust

Fine dust is defined as dust under Article 2, No. 6 of the Air Environment Conservation Act, and it is classified into fine dust (PM-10) with a particle diameter of 10 micrometers or less and ultra-fine dust (PM-2.5) with a particle diameter of 2.5 micrometers or less according to the Special Act on Fine Dust.(Lee, 2021: 365).

PM10 is dust less than 10/1000 mm, PM2.5 is dust less than 2.5/1000 mm, and fine dust, which is smaller than 1/20 to 1/30 of the diameter of hair (about 60 μm), is emitted as a mixture of solid and liquid particles in the air, chemically or naturally produced. It occurs directly from specific sources of emissions such as workplace combustion, automobile fuel combustion, and biological combustion processes.(Chungcheongbuk-do Environmental White Paper, 2021: 145)

In the case of PM2.5, a significant amount of precursor substances such as sulfur oxide (SOx), nitrogen oxide (NOx), ammonia (NH3), and volatile organic compounds (VOCs) react under specific conditions in the atmosphere to be secondary produced. Naturally present particles include mineral particles (e.g., yellow dust), salt particles, and biological particles (e.g., pollen, microorganisms). The composition of fine dust is very diverse, but it mainly consists of carbon components (organic carbon, elemental carbon), ionic components (sulfate, nitrate, ammonium), and mineral components. (Chungcheongbuk-do Environmental White Paper, 2021: 146)

### 2) Causes of fine dust

The main causes of fine dust are largely divided into natural and artificial sources. Most of the fine dust we face today is caused by man-made sources, such as exhaust gases from boilers, power plants, factories, cars, worn tire dust from cars, and dust from construction sites, and natural sources are forest fires, dust, desert sand, ash, plant pollen, and salt.(Park, 2019)

In addition, fine dust is divided into a primary source, which is solid dust from various sources such as factories and automobile exhausts, and a secondary source, which is when a substance from the primary source chemically reacts with other substances in the air to become fine dust.(Ministry of Environment, National Fine Dust Information Center)

Fine dust can be emitted directly from various sources, but sulfur dioxide (SO2), nitrogen oxides (NOx), volatile organic compounds (VOCs), and ammonia (NH4) emitted from internal combustion engines during the combustion of fossil fuels such as coal, oil, and natural gas have a large proportion of fine dust. Sulfur dioxide and nitrogen oxide are causative agents of acid rain, and nitrogen oxides and volatile organic compounds are causative agents of ozone (O3). In addition, some of the volatile organic compounds are toxic and are more strictly regulated than other pollutants in Korea and other countries around the world. Typical air pollutants are the causative agents of the second ultrafine dust, and the main sources of pollution are factories, thermal power plants, and steel. a smelter The fact that it is a refining facility and a car designed a legal system for the regulation of fine dust.(Choi, 2019: 244-245))

### 3) Symptoms of damage from fine dust

I know that fine dust causes many health problems. Among them, headaches and dizziness can occur when breathing difficulties due to fine dust or when dust enters the body. The degree of headache depends on the concentration of ultrafine dust that dissolves well in blood vessels. Experts also advised people with weak bronchial tubes to avoid going out as much as possible on days when fine dust is severe.(Bae Chul-hyun, Changwon University Newspaper, 2019)

Representative diseases in which fine dust affects the respiratory system include asthma, chronic obstructive pulmonary disease, and pneumonia. According to a study conducted on inpatients at Seattle and Washington hospitals, the hospital admission rate for asthma patients increased by 4-5% as the concentration of fine dust increased. Also, a study result was published that showed that the number of emergency hospitalizations for pneumonia increased by 3.3% when PMc (2.5~10 ㎛) among fine dust increased by 10 ㎍/㎥. (Lee, 2019: 5)

Representative eye surface diseases caused by fine dust include conjunctivitis, dry eye syndrome, and blepharitis, and damage to the eye surface is also accompanied. The mechanisms by which various

chemicals and fine particles composing fine dust cause ocular surface diseases and damage include oxidative stress, toxicity, immune response, and increased ocular surface inflammation (Choi et al., 2016: 486).

In addition, harmful substances of fine dust irritate the skin and cause dermatitis, and in the case of ultrafine dust, it penetrates the body through the skin, which adversely affects skin health overall, causing acne, rash, and various dust allergies.(Bae Chul-hyun, Changwon University Newspaper, 2019)

Fine dust can cause or worsen existing ischemic heart diseases, heart failure, arrhythmia, and stroke, including myocardial infarction in relation to cardiovascular disease and cerebrovascular disease. Exposure to fine dust, especially ultrafine dust (PM2.5) with a diameter of 2.5 μm or less, causes various cardiovascular diseases, and can increase hospitalization or mortality as well as mild diseases. In addition, long-term exposure increases the risk of cardiovascular disease-related mortality compared to short-term exposure.(Information Young, Korean Medical Association, 2016)

#### 4) The effect of fine dust on the surroundings

Fine dust is known to have a significant impact on the corporate economy. Fine dust is very fatal for semiconductor and electronic companies because dust enters the manufacturing process, causing defects. As a result, the cost of preventing defects and processing products is gradually increasing. The industry analyzes that if the concentration of fine dust is more than 300 ㎍/㎥, the defect rate could increase, and in fact, the average defect rate rose 0.4% as the fine dust strengthened, according to the Ministry of Environment.

Also, fine dust has a lot of influence on the ecosystem. In the case of animals, amphibians that are sensitive to pollution in the long run and must live only in clean areas, birds with high activity and breathing volume throughout the year, and mammals may decrease their reproduction rate, decrease their development, or be exposed to diseases. In addition, insects are affected because the place where they breathe is a fine hole throughout the body. In the case of plants, fine dust is applied to the surface of the leaves, blocking pores and inhibiting photosynthesis. The components of fine dust can induce acid rain and cause wide-area heavy metal pollution. (Bae Chul-hyun, Changwon University Newspaper, 2019)

## 3. Fine dust Law

The Special Act on Fine Dust Reduction and Management was enacted on August 14, 2018 and took effect on February 15, 2019, and in March 2019, the Framework Act on Disaster and Safety Management was revised to specify fine dust as one of the social disasters.(Cho et al., 2021: 123)

The basic system of the "fine dust law" may include the purpose, conceptual definition, international cooperation, total quantity regulation, and regular measurement. The "Fine Dust Act" aims to prevent harmful effects of fine dust on public health by reducing the emission of fine dust and fine dust-producing substances and continuously managing the occurrence thereof, and to create a pleasant living environment by properly managing and preserving the atmospheric environment (Article 1 of the Act).

The "Fine Dust Act" provides a legal definition of fine dust, and the term "fine dust" means the following inhalation dust among dusts under subparagraph 6 of Article 2 of the Air Environment Conservation Act: A. Dust (PM-10: fine dust) with a particle diameter of less than 10 micrometers. Dust of 2.5 micrometers or less in diameter (PM-2.5: ultrafine dust). Fine dust generating materials converted into fine dust in the atmosphere include nitrogen oxides, sulfur oxides, and volatile organic compounds.

The Fine Dust Act shall apply preferentially to the reduction and management of fine dust, and matters not prescribed in this Act shall be governed by the Air Environment Conservation Act and the Special Act on the Improvement of Air Environment in Air Management Areas (Article 6 of the Act).

The "Fine Dust Act" is a special law that has priority over other general laws in relation to fine dust, and it is also a special law in relation to the atmospheric management area law, so the relationship between the two can work in principle. In order to reduce and manage fine dust, the government should make efforts to promote cooperation with countries such as fine dust, establish international exchange of technology, manpower and information, create financial resources to prevent fine dust damage, hold and participate in various events It will be possible. The Minister of Environment may request cooperation from the head of the relevant administrative agency to determine the route, concentration, etc. of fine dust traveling long distances, and may request related business operators, etc. to install fine dust measurement equipment on aircraft, ships, etc. (Article 15 of the Act).

It is important in relation to the basic system of the "Fine Dust Act" and that it is not governed by the "Fine Dust Act" can be referred to as total quantity management and regular measurement. These contents are not regulated in the "Fine Dust Act", but as stipulated in Article 11 of the Air Management Area Act, the total amount management can also be regarded as the main content of the "Fine Dust Act".

Total quantity management is a system that manages the total amount of pollution in a specific area to supplement blind spots of pollution regulations that may occur due to concentration regulations, and is an important means of regulation under the environmental law. Article 3 of the Air Environment Conservation Act stipulates that the Minister of Environment shall set up a monitoring network and measure air pollution as prescribed by the Ordinance of the Ministry of Environment.(Kang, 2020: 121)

Currently, Korea's legal system consists of various structures such as basic law, individual law, general law, and special law. Among them, special laws are being made to achieve policy goals early and to exclude the application of related laws, and to take charge of the situation as much as possible with one law (Ministry of Legislation)

Originally, the special law was enacted to supplement or cope with the general law by reflecting social changes after the enactment of the general law, and its use must be temporary and limited.(Park, 2012: 25)

The "Fine Dust Act" is a special law, and in order to meet the purpose of the special law, there must be a difference between the "Fine Dust Act" existing in the air environment preservation law and the special law on improving the air environment in the air management area.(Kang, 2020: 114)

## 4. Fine dust status across the country and North Chungcheong Province

### 1) Status of fine dust nationwide

Since a few years ago, the number and concentration of fine dust, which is said to be the cause of respiratory diseases, have been increasing throughout the four seasons in Korea. Fine dust is not directly visible to our eyes and does not immediately harm the human body, but long-term exposure can not only cause various respiratory diseases but also harm lives. In Korea, PM10 measurement of fine dust has been carried out since 1995, and the figure continues to deteriorate.(Kwon, 2018: 31)

As of the end of December 2017, there are a total of 533 air pollution measuring networks in Korea. Among them, 282 urban air monitoring networks are located in 96 cities and counties nationwide, measuring environmental reference materials, and the average annual concentration of PM10 in most regions has decreased overall since 2001. In many regions, the average annual concentration of PM10 in 2003 dropped sharply, and in 2012, it was the lowest in most regions. Since then, the average annual concentration of PM10 in most parts of the country until 2017 was less than 50 μg/m3, lower than before 2010, and decreased overall from 2001 to 2017.(Yeo et. al., 2019: 252)

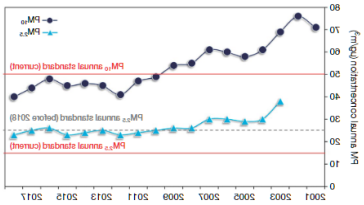
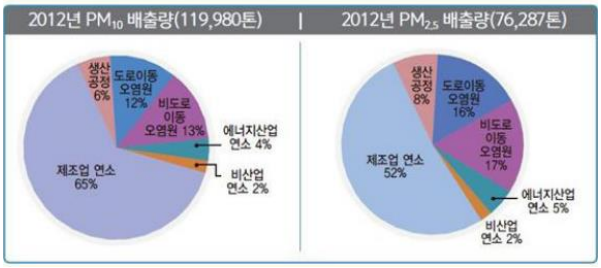


Fig. 3. Trends of annual mean $PM_{10}$ and $PM_{2.5}$ concentrations in Seoul between 2001 (2003 for $PM_{2.5}$) and 2017 (data for 2018 s before confirmation) (raw data for $PM_{10}$: KECO, 2019; for $PM_{2.5}$: SMG, 2019).

In terms of geographical location, Korea can never be free from fine dust generated by substances emitted from neighboring countries or directly emitted from these countries in addition to fine dust of its own emission origin. In addition, the impact of substances emitted from Korea on neighboring countries cannot be ignored. Experts estimate that the amount will be 30-70%, but this is also a figure that requires more scientific evidence. On the other hand, the process of emitting the most fine dust and ultrafine dust in terms of domestic origin alone was combustion of the manufacturing industry, followed by non-road pollutants such as ships, construction equipment, and agricultural machinery, and road pollutants such as trucks, RVs, vans, and buses (see Figure). The pattern differs depending on regional characteristics (the source of road movement pollution in the metropolitan area is pointed out as the main cause of manufacturing combustion and production processes in industrial and industrial areas).(Minkyung, 2016: 16)




The process of generating secondary fine dust (Source: [Ministry of Environment booklet] can be seen if you know it right away. What is fine dust?

The emission of major air pollutants by domestic year has continued to increase since 2010, and increased by more than 900,000 tons in 2018, eight years after 2010. As of 2018, 232,993 tons of fine dust (PM-10) were generated, accounting for 5% of total emissions in 2017, and an average of 167,242 tons were generated over a total of nine years from 2010 to 2018. It can be seen that all of them have recorded higher emissions than the average since 015. In addition, fine dust (PM-10) increased by 14,517 tons in 2018 compared to 2017, and ul-

trafine dust (PM-2.5) also increased by 6,657 tons.(Lee, 2021: 366)

In the case of PM10, which is more affected by foreign westerly winds, the influence of wind direction and wind speed variables has decreased, which is presumed to be due to the decrease in foreign air pollutants due to China's blockade policy. By season, it was analyzed that in winter, when the temperature and humidity are high, the concentration of fine dust tends to increase together, and its influence increases further after COVID-19. In spring, the influence of wind direction and wind speed decreased due to the westerly wind and China's blockade policy. In the case of summer and autumn, when the concentration of fine dust is relatively low, the influence of CO after the outbreak of COVID-19 was analyzed to be rather high. In the future, measures to reduce fine dust based on the relationship between these air pollutants and the weather environment should be established.(Choi, et al., 2021:)

According to the Ministry of Environment's joint analysis of air quality in Seoul with the U.S. National Aeronautics and Space Administration (NASA) in 2018, the contribution rate of fine dust was 52% in Korea and 48% in foreign countries. Another survey found that factories and other workplaces (38%) were the largest major sources of fine dust nationwide, followed by construction and ships (16%), power plants (15%), and old diesel vehicles (11%).(Bae Chul-hyun, Changwon University Newspaper, 2019)

### 2) Fine dust status in Chungcheongbuk-do

The concentration of fine dust in Chungcheongbuk-do is the worst among 17 cities and provinces nationwide, ranking first in the country for eight consecutive years (2008-2015). The 2017 data were also surveyed at the same number compared to the national level. The national average concentration of fine dust was 44 ㎍/m³ in 2017, which has been continuously improving since 2008. Likewise, although Chungcheongbuk-do is on the decline to 44 ㎍/m³ in 2017, the concentration of fine dust (PM10) in Chungcheongbuk-do exceeds the annual average environmental standard of 50 ㎍/m³ by 2%. (Bae et al., 2019: 11)

〈표 Ⅱ-3〉 미세먼지(PM10) 농도 비교

(단위:㎍/m³)

| 지역 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| 전국 평균 | 52 | 51 | 49 | 47 | 45 | 48 | 47 | 45 | 46 | 44 |
| 서울 | 55 | 54 | 49 | 47 | 41 | 45 | 46 | 45 | 48 | 44 |
| 광역도시 평균 | 53 | 50 | 49 | 47 | 42 | 46 | 45 | 46 | 45 | 44 |
| 충북 | 61 | 61 | 62 | 56 | 51 | 56 | 52 | 51 | 45 | 44 |

주1 : 평균값은 황사일자 제외 평균값
주2 : 광역도시란 서울, 인천, 부산, 대구, 광주, 대전, 울산, 세종을 의미함
주3 : 광역도시 중 2016년부터 세종시가 추가됨
자료 : 환경부 대기환경 연보(2015), 각 시도별 보건환경연구원, 각 시도별 통계연보(2012~)

Looking at the size of fine dust, Chungbuk is ranked seventh in the country on average, about 1.83 times higher than Seoul, about 0.32 times higher than the metropolitan area, and about 2.18 times higher than the average of the seven metropolitan cities. Foreign factors were 43% and domestic external factors were 27%, and the factors that actually contributed to Chungbuk-do were about 30%. 40% of the 43% of fine dust from abroad came from China, especially in January, China's influence was the greatest, and Chungnam-do, where thermal power plants were concentrated, was the biggest in October. (MBC Chungbuk News, 2019)

Looking at the sources of fine dust in Chungbuk, fine dust (PM10) accounts for 4.72% of the nation's emissions, with 65.47% of the manufacturing years in the large category, followed by road transport pollution sources with 17.91%. In terms of ultrafine dust (PM2.5) emissions, it accounts for 4.54% of the nation's emissions, with manufacturing combustion accounting for 50.74% in the majority view, followed by road transport pollution sources accounting for 26.45%.(Chungcheongbuk-do, 2021 Environmental White Paper: 152)

Looking at the average fine dust concentration ranking, Cheongju ranked 6th and Jeungpyeong 3rd in 2018, indicating the highest concentration of fine dust among cities and counties in the country, while Danyang, Jincheon, Eumseong, and Jecheon also ranked 10th to 30th, indicating that fine dust pollution in Chungcheongbuk-do is serious. (Son et al., 2021: )

Looking at the monthly change in air pollution, the trend is repeated with high concentrations in January-March and September-December, and it is predicted that there will be climatic and regional influence factors. It is judged that factors such as fine dust produced in Chungcheongbuk-do and external fine dust are influencing in addition to climatic and regional factors. (Son et al., 2021: )

In addition, the average annual concentration of PM2.5 in Chungcheongbuk-do continued to increase from 2016 to 2018, and it is urgent to identify the main influencing factors and causes of increase in PM2.5 concentration in Chungcheongbuk-do (Yeo et al., 2019:)

## 5. Conclusion

According to the World Health Organization (WHO), air pollution is the biggest environmental risk to health, with more than 3 million people dying every year due to air pollution. According to the OECD's "2017 Quality of Life Report" (How's Life 2017), the air pollution problems and health felt by Koreans remain at the bottom of the OECD countries.(Moon Myung-jae, 2018:)

Korea has applied the ultrafine dust (PM2.5) environmental standard since 2015, but the daily average is 50 ㎍/㎥, which is higher than the World Health Organization's recommended standard of 25 ㎍/㎥ and is higher than that of major countries. In fact, in Korea, the health threat caused by fine dust is reported to be at a serious level internationally. (Park, 2019: 35)

The damage caused by fine dust, which has emerged as a social disaster to be actively managed, varies from human to economic damage to social damage. (Cho, et al., 2021: 123) In the event of a disaster, the law will be newly enacted or revised.

In August 2018, a special law on fine dust was enacted. In Korea, ultrafine dust concentration decreased by about 17% on average in 2020 compared to 2019 (based on Seoul), which showed a significant improvement in ultrafine dust concentration compared to the previous year, but in January 2022, an ultrafine dust crisis warning was issued for the first time this year. As an emergency reduction measure for fine dust, 31 coal power plants were reduced and operated, and fine dust emission sites and construction sites were shortened.(KBS, 2022.)

Chungcheongbuk-do has established a fine dust management implementation plan to re-duce fine dust by 34 ㎍/㎥ and ultrafine dust by 17 ㎍/㎥ by 2024 to wash away the stigma of the worst regions of fine dust. Most of the sources of fine dust (PM10) and ultrafine dust (PM2.5) in Chungbuk are combustion in the manufacturing industry. Looking at the na-tional industrial complex designation status in 2020, Chungbuk was ranked 1st (7 locations, 6,428,000 m2), Gwangju 2nd (3 locations, 3,533,000m2), and Gyeonggi 3rd (3 locations, 808,000m2). It was announced that 16 new industrial complexes would be built in 2022

This is where questions arise about the effectiveness of the special fine dust law. In order to fundamentally reduce fine dust, it is a priority to identify and monitor emission sources that can suppress the occurrence as a policy part.(Park, 2019:1).

The fine dust problem is an environmental problem that directly affects the quality of life. The government's strategy for responding to fine dust is urgently needed to make practical efforts for the quality of life of the people. Based on the legal basis for establishing an active administrative management system, such as regional characteristics, causes, regular management and supervision of local governments, it is necessary to change the perception of fine dust of local industries, and a tight environmental monitoring network should be established. Even at the legal and institutional level, a more precise approach is needed to solve the fine dust problem.

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