

Hazard Literacy Center

Hazard Literacy Education Program

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How Serious Is Fine Dust Pollution in Our Neighborhood? Let's Find Out with Data!



1. Program Overview

This program was developed to help students understand particulate matter through real-world air quality data and explore evidence-based response strategies. Students learn the characteristics, sources, and health effects of PM-10, PM-2.5, and major air pollutants, and then use real-time and long-term AirKorea data to examine local air quality patterns across seasons and times of day. Based on these data, they identify possible causes of elevated particulate matter levels and explore natural and anthropogenic factors affecting air quality. Through these activities, students develop data interpretation and evidence-based reasoning skills and propose particulate matter prevention and response strategies at both individual and community levels.

Grade Level	Grades 4-6 (Elementary School)	Instructional Methods	Lecture, Discussion
Learning Environment	Classroom	Duration	45 minutes
Required Materials	Labtop		

2. Learning Objectives (Hazards Literacy Framework)

① Explain how underground cavities are formed through the movement of water beneath the ground.
② Understand sinkhole formation as the result of multiple interacting factors, including ground conditions, changes in water content, and structural influences, rather than a single cause.
③ Use scientific evidence to identify potential sinkhole hazards in everyday life and propose appropriate prevention strategies.

Learning Objectives	Knowledge & Understanding		Reasoning & Skills					Values & Attitudes			Psychology & Emotion			Behavioral & Practical Enagement		
	A1	A2	B1	B2	B3	B4	B5	C1	C2	C3	D1	D2	D3	E1	E2	E3
Objective ①	O		O													
Objective ②		O	O						O							
Objective ③					O				O					O		

3. Key Concpets

· Particulate Matter (PM-10) and Fine Particulate Matter (PM-2.5)

· Air Pollutants and Sources of Particulate Matter

· Air Quality Data and the Comprehensive Air-quality Index (CAI)

· Temporal and Seasonal Variations in Particulate Matter Levels

4. Program Sequence

Learning Activities	
Introduction	·Check students' prior understanding through an O/X quiz about particulate matter. ·Recall everyday experiences related to particulate matter and recognize the importance of particulate matter issues.
Inquiry 1	·Understand the concepts of PM-10 and PM-2.5 and compare their particle sizes. ·Explore the characteristics of major air pollutants and their effects on the human body. ·Understand natural and anthropogenic sources of particulate matter and the processes of primary and secondary formation.
Inquiry 2	·Explore real-time regional air quality data using AirKorea. ·Check PM-10, PM-2.5, and major air pollutant measurements around the school. ·Compare particulate matter concentrations by time of day and infer possible causes of variation. ·Use long-term data to graph monthly changes in PM-10 and PM-2.5 concentrations.
Conclusion	·Compare seasonal patterns in particulate matter concentrations. ·Explain when and why particulate matter concentrations are high or low based on real-world data. ·Summarize the natural and anthropogenic factors affecting variations in particulate matter levels.

5. Theoretical Background and Activity Design for Disaster Education

Particulate matter is a common form of air pollution encountered in everyday life, but it can be considered an environmental hazard because prolonged exposure to high concentrations can adversely affect respiratory and cardiovascular health. Particulate matter can be emitted directly from human activities such as vehicle exhaust, industrial facilities, heating, and fossil fuel combustion, or it can form secondarily through chemical reactions among various pollutants in the atmosphere. Its concentration also varies depending on factors such as wind, precipitation, atmospheric stagnation, and seasonal weather conditions. Therefore, particulate matter should be understood as a phenomenon resulting from the complex interaction of both natural and anthropogenic factors rather than from a single cause. Understanding particulate matter risks requires not only knowledge of relevant scientific concepts but also consideration of temporal and spatial variations in real-world environments and the relationships among multiple contributing factors.



Figure 1. Real-Time Air Quality Information on AirKorea

In this activity, students directly explore and analyze real-world air quality data provided by AirKorea. They compare current PM-10 and PM-2.5 concentrations across different regions and record real-time data from monitoring stations near their school to identify regional variations in air quality. Students then compare and graph hourly and monthly data to identify periods of high and low particulate matter concentrations and explain these patterns in relation to factors such as vehicle traffic, human activities, seasonal conditions, wind, and precipitation. Through these activities, students learn to assess particulate matter risks based on real-world data and scientifically infer the possible causes of observed changes rather than simply accepting given information.

6. Instructional Considerations

It is important to guide students not to attribute changes in particulate matter concentrations to a single factor. For example, even if particulate matter levels are found to be higher in winter, students should consider multiple contributing factors, such as atmospheric stagnation, precipitation, wind speed, and domestic and transboundary emission sources, rather than identifying heating alone as the cause. Because real-time data may vary depending on the time and location of measurement, students should also avoid interpreting data from a single day as a general trend and, whenever possible, compare them with long-term data. Teachers should encourage students to move beyond simply identifying high and low values on graphs and instead explain observed patterns based on evidence. Students should also be guided to accurately understand the units, measurement indicators, and meaning of the Comprehensive Air-quality Index (CAI) provided by AirKorea before analyzing the data.

7. References

- Kim, Y. (2015). *Environmental Impact Assessment and Prevention of Urban "Sinkholes"*. Korea Environment Institute, Ministry of Environment.
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How Serious Is Fine Dust Pollution in Our Neighborhood? Let's Find Out with Data!

Theme	Particulate Matter Around Our School and Preventive Actions
What Will We Learn?	① Explain how underground cavities are formed through the movement of water beneath the ground. ② Understand sinkhole formation as the result of multiple interacting factors, including ground conditions, changes in water content, and structural influences, rather than a single cause. ③ Use scientific evidence to identify potential sinkhole hazards in everyday life and propose appropriate prevention strategies.

1 Let's Think

- Solve the O/X Quiz About Particulate Matter

	O	X
1. Ventilating indoor spaces is helpful even on days with high particulate matter levels.	☐	☐
2. Protective masks can be reused.	☐	☐
3. On days with high particulate matter levels, you must always wear a KF94 mask.	☐	☐
4. Pork belly is a good food for removing particulate matter from the body.	☐	☐
5. Particulate matter is not produced when cooking in the kitchen or using a vacuum cleaner.	☐	☐
6. Yellow dust and particulate matter are the same.	☐	☐

2 Understanding Particulate Matter and Air Pollutants

1) How Small Is Particulate Matter?

What is ㎛?

On a ruler we use in everyday life, the smallest division is usually 1 mm (millimeter). 1 ㎛ (micrometer) is just one of 1,000 equal parts of that tiny 1 mm—in other words, just one of those 1,000 divisions.



- Fill in the blanks.

Category	Meaning
PM	An abbreviation for _____
PM-10	Particulate matter with a diameter smaller than _____ ㎛
PM-2.5	Particulate matter with a diameter smaller than _____ ㎛

- A human hair is approximately 50–70 ㎛ thick. Compare particulate matter with the thickness of a human hair.

Category	Compared with the thickness of a human hair
PM-10	About _____ of the thickness of a human hair
PM-2.5	About _____ of the thickness of a human hair

3) What Air Pollutants Are There Besides PM-10 and PM-2.5?

Air Pollutant	What is it?	Effects on the Human Body
Ozone (O_3)	A gas formed when pollutants emitted from vehicles and factories react in sunlight	Can irritate the eyes and throat, cause coughing, and worsen respiratory conditions such as asthma
Nitrogen Dioxide (NO_2)	A gas produced when fuels are burned	Can irritate the eyes, nose, and throat, cause coughing, and lead to respiratory problems
Carbon Monoxide (CO)	A toxic gas produced when fuels do not burn completely	Can interfere with the blood's ability to carry oxygen, causing headaches and dizziness
Sulfur Dioxide (SO_2)	A gas produced when coal or petroleum is burned	Can irritate the eyes, nose, and throat, make breathing difficult, and worsen asthma

- What is the Comprehensive Air-quality Index (CAI)?

The Comprehensive Air-quality Index (CAI) is an index calculated by combining measurements of six major air pollutants, including particulate matter (PM-10 and PM-2.5). It helps us easily understand how polluted the air is and how air pollution may affect our health.

CAI	Good (0-50)	Moderate (51-100)	Unhealthy (101-250)	Very Unhealthy (251-)
Color	Blue	Green	Yellow	Red






4) How Is Particulate Matter Produced?

- Classify the following sources into natural sources and sources caused by human activities.

[Examples]

Vehicle exhaust, dust from construction sites, factory smokestacks, waste incineration, soil dust, pollen, yellow dust, fossil fuel combustion

Natural Sources	Sources from Human Activities

- Let's also classify how particulate matter is formed.

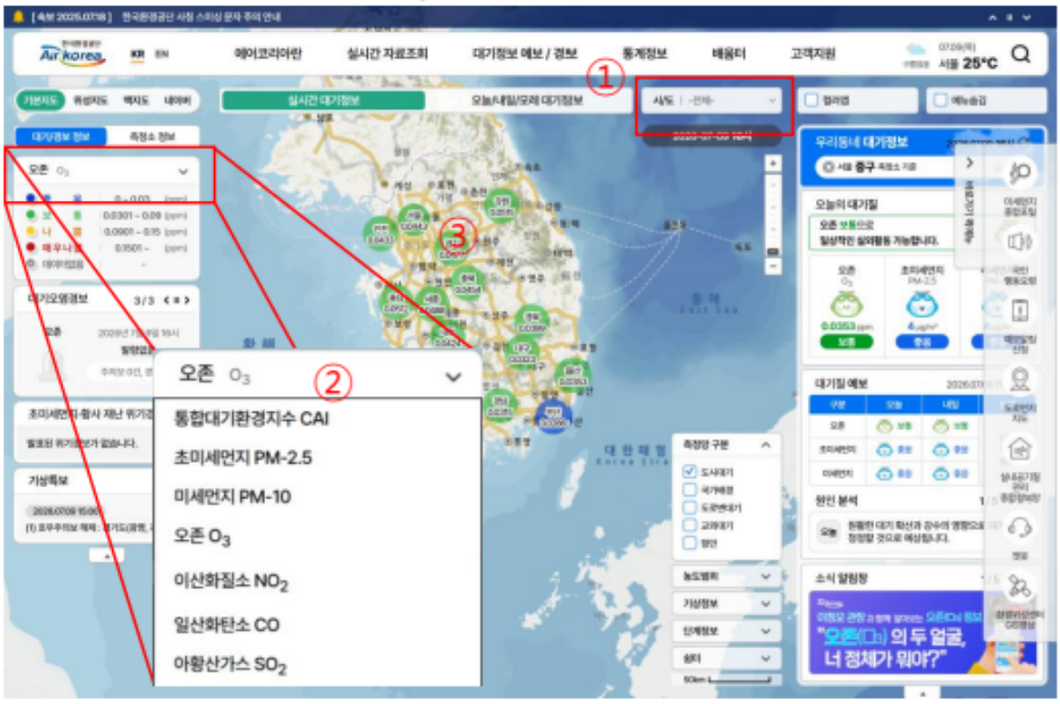
Type	Meaning
Primary Formation	Particulate matter is _____ emitted from sources such as factory smokestacks and vehicle exhaust.
Secondary Formation	Gaseous substances in the air _____ and are transformed into particulate matter.

3 Exploring Real-Time Air Quality Data

[Go to AirKorea]

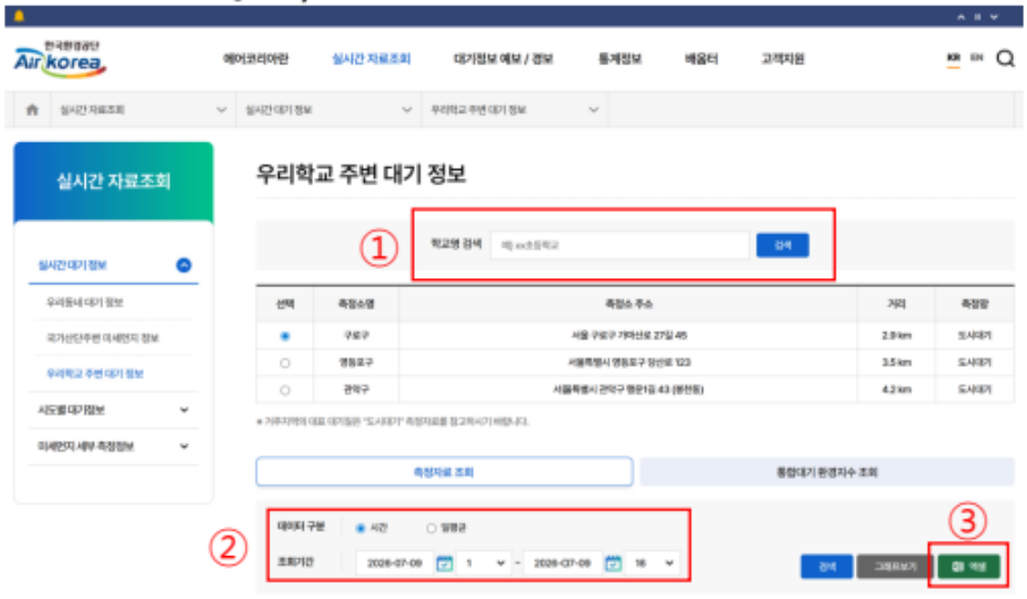
First, let's learn about AirKorea! AirKorea is a website that provides real-time information about air quality in Korea. It allows anyone to easily check information on particulate matter, ozone, and other air pollutants measured at air quality monitoring stations across the country.

1. AirKorea – Real-Time Air Quality Information



- What do we have to see in this screen?
  ① Select a region to check the air quality of Korea and our local area.
  ② Check air quality information such as PM-10, PM-2.5, and ozone (O_3).
  ③ Look at the color codes and grades (Good, Moderate, Unhealthy, Very Unhealthy) together.

2. AirKorea – Air Quality Information Around Our School



- What should we look at on the screen?
  ① Search for your school name to find the air quality monitoring station closest to our school.
  ② Select the date and time, then check the air quality information around our school.
  ③ Click Excel to download the air quality information and draw a graph.

[Go to AirKorea]

3 Recording Real-Time Air Quality Data

- Access the AirKorea website and check current air quality data.

[Activity 1] Write down current PM-10 and PM-2.5 values in Korea
Scan the QR code and select "1. AirKorea - Real-time Air Quality Information".

Category	Seoul	Busan	Daegu	Chuncheon
PM-10	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
PM-2.5	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$

[Activity 2] Check real-time air quality around our school
- Scan the QR code and select "2. AirKorea - Air Quality Information Around Our School".
- Check which level today's air quality around our school falls under based on CAI standards.

☐ Good (Blue) ☐ Moderate (Green) ☐ Unhealthy (Yellow) ☐ Very Unhealthy (Red)

Item	Measured Value	Unit
Comprehensive Air-quality Index (CAI)		-
PM-10		$\mu g/m^3$
PM-2.5		$\mu g/m^3$
Ozone (O_3)		ppm
Nitrogen Dioxide (NO_2)		ppm
Carbon Monoxide (CO)		ppm
Sulfur Dioxide (SO_2)		ppm

1) How did the PM-10 and PM-2.5 around our school change over time today?

Category	Time with Highest Value	Time with Lowest Value
PM-10		
PM-2.5		

[Think About It]
Why were fine dust concentration levels high at certain times and low at others? Think about traffic, human activity, and weather factors such as wind or rain.

4 Analyzing Fine Dust Changes by Season

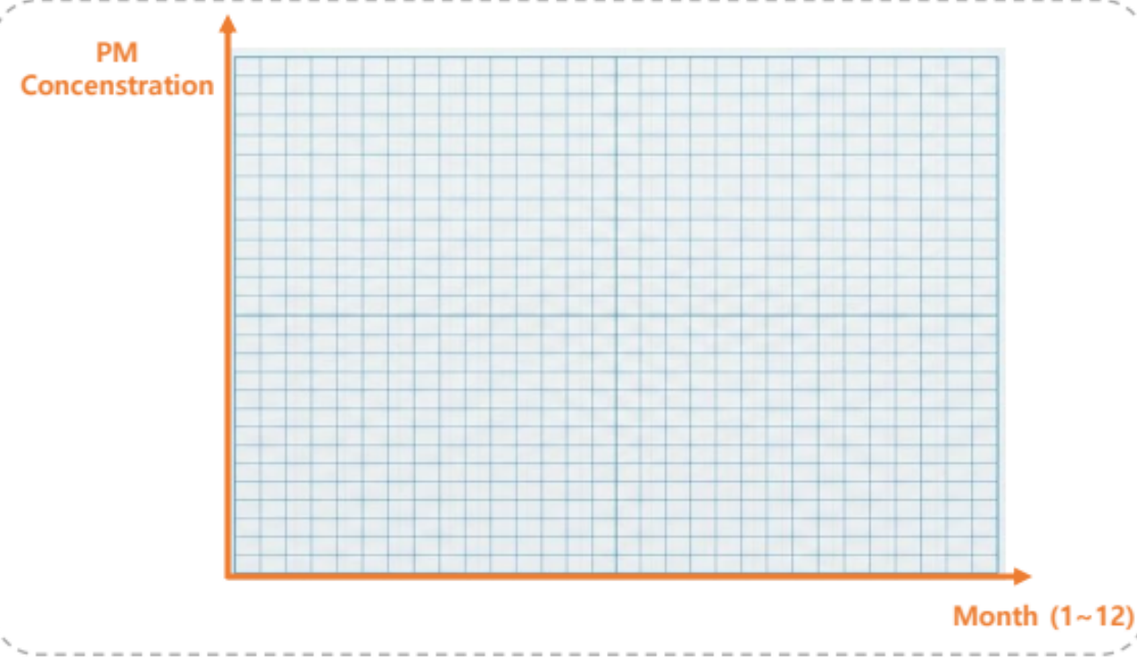
[Go to AirKorea]

2) Let's analyze the 1-year PM-10 and PM-2.5 data around our school.

- Use Excel to calculate the monthly average concentration of PM-10 and PM-2.5, and display them in a single graph.
- Scan the QR code and select "2. AirKorea – Air Quality Information Around Our School".
- ① Search for your elementary school → ② Select 'Daily Average' under Data Classification → ③ Set the search period to 60 days based on school days →④ Click Search

※ Since you can only search up to 60 days of data at a time, download a total of 6 times to obtain 1 year of data.

※ Let's plot PM-10 and PM-2.5 together on a single graph.



3) Which seasons have the highest and lowest concentrations of PM-10 and PM-2.5?

4) What do you think causes these seasonal differences around our school?