

Hazard Literacy Center

Where should waste treatment facilities be located?



1. Program Overview

This program is designed to help students understand the transfer and treatment of municipal solid waste generated in the Seoul Metropolitan Area to non-metropolitan regions not simply as an administrative or technical issue, but as a complex disaster phenomenon in which environmental hazards and social inequality interact.
Unlike conventional disaster education, which tends to focus primarily on natural hazards, this program examines human-induced hazards, such as waste treatment, by exploring how risks are generated, transferred, and concentrated. In particular, it highlights how, even within the same waste generation system, environmental risks and burdens can be unevenly distributed between the Seoul Metropolitan Area and non-metropolitan regions due to differences in exposure, vulnerability, and response capacity. The program adopts an approach that helps students understand disasters in terms of causes, processes, and consequences and analyze the social and spatial factors that contribute to differences in impacts.

Grade Level	Middle and High School Students	Instructional Methods	Case Study, Role-Play, and Discussion
Learning Environment	Classroom with Computers	Duration	Three 50-minute Lessons (150 minutes total)
Required Materials	QGIS / Google Maps / ArcGIS Online, Worksheets		

2. Learning Objectives (Hazard Literacy Framework)

① Students will be able to explain the structure of waste generation and treatment in the Seoul Metropolitan Area, including landfilling, incineration, and waste transfer, and analyze how the transfer of waste can spatially concentrate risks in particular regions using data, maps, and case studies.
② Students will be able to compare and evaluate the perspectives of various stakeholders, including residents, local governments, the national government, and businesses. In particular, they will be able to recognize and express emotional responses to waste-related issues among residents in non-metropolitan regions, such as anxiety, a sense of responsibility, and empathy.
③ Students will be able to critically understand imbalances in environmental burdens from the perspectives of environmental justice and disaster justice.
④ Students will be able to propose solutions at the individual and societal levels, including waste reduction, more distributed waste treatment, and policy improvements.

Learning Objectives	Knowledge & Understanding		Reasoning & Skills					Values & Attitudes			Psychology & Emotion			Behavioral & Practical Engagement		
	A1	A2	B1	B2	B3	B4	B5	C1	C2	C3	D1	D2	D3	E1	E2	E3
Objective ①		O														
Objective ②				O	O					O						
Objective ③							O									
Objective ④									O						O	

3. Key Concepts

- Waste Generation?Transfer?Treatment Structure
- Waste Generation Concentrated in the Seoul Metropolitan Area and Dependence on Non-Metropolitan Regions
- Exposure, Vulnerability, and Response Capacity
- Environmental Justice and Disaster Justice
- NIMBY and the Production of Space through Institutional Avoidance
- Spatial Inequality in Environmental Burdens

4. Program Sequence

	Activity Sequence
Introduction	-Introduce recent news videos and visual materials related to waste treatment issues in the Seoul Metropolitan Area to engage students. -Present questions such as “Where does the waste we throw away actually go?” and “Why is waste treatment a social problem?” to encourage students to critically examine waste treatment processes that they may have taken for granted in their daily lives. -Guide students to recognize that waste is not simply an issue of everyday convenience, but a problem in which the spatial transfer of risk and social inequality are interconnected. -Establish the direction of learning around the key question: “Why are the risks associated with waste transferred to particular regions?”
Activity 1	-Using GIS maps and statistical data, students examine the amount of municipal solid waste generated in the Seoul Metropolitan Area, treatment methods, and the spatial distribution of landfills and incineration facilities. -Explain that waste transfer is not simply the physical movement of waste, but a process through which environmental risks and burdens are transferred to particular regions. -Compare and analyze differences between where waste is generated and where it is actually treated, and use NIMBY-related activities to explore the structural reasons why waste moves from the Seoul Metropolitan Area to non-metropolitan regions. -Through these activities, students understand waste issues as complex hazards in which environmental, spatial, and economic factors interact.
Activity 2	-Through role-play, students experience waste issues from the perspectives of different stakeholders. -In groups, students take on the roles of residents of the Seoul Metropolitan Area, residents of non-metropolitan regions, local government officials, central government policy makers, and waste treatment companies, and discuss the questions “Where should waste treatment facilities be located?” and “Who should bear the risks and responsibilities associated with waste treatment?” -Structure the activity around the stages of problem emergence–conflict escalation–choice–outcome, allowing students to explore and express the perceptions, emotions, and responses associated with each role at each stage. Through the same situation, students experience how perceptions and responses can differ depending on their roles and recognize the unequal distribution of environmental burdens and the issue of responsibility. -This process helps students move beyond simply acquiring knowledge to experience decision-making and responsibility in disaster situations.

	Activity Sequence
Activity 3	-Based on the conclusions reached through the role-play, redefine the unequal structure of the waste problem and interpret it from the perspective of environmental justice. -Using the locations of hazardous waste treatment facilities as an example, compare the distribution of waste treatment facilities in the United States by income level and examine how these patterns are connected to social and institutional factors. -Explore policy alternatives and economic measures to reduce waste generation and promote more distributed waste treatment. Through this process, students recognize the importance of social responsibility and civic participation beyond individual responsibility.
Wrap-Up	-Reframe the waste issue not simply as an environmental problem, but as a complex hazard involving social structures, policies, and spatial inequality. -Students synthesize how risks are generated, transferred, and concentrated in particular regions through the relationship between the Seoul Metropolitan Area and non-metropolitan regions. They consider what approaches are needed to create a fairer society from the perspective of disaster justice. Finally, students reflect on their own roles in addressing these issues and recognize their role as future citizens who participate in social responsibility beyond individual efforts and contribute to reducing risk.

5. Theoretical Background and Activity Design for Disaster Education

This program integrates three theoretical frameworks to help students understand waste issues not simply as matters of environmental management, but as complex hazards involving the generation, transfer, and unequal distribution of risk.

First, the program is based on an expanded understanding of hazards. While conventional disaster education has primarily focused on natural hazards such as floods and earthquakes, risks arising from human activities, including waste treatment, industrial pollution, and energy-related issues, have become increasingly important in modern society. From this perspective, waste issues need to be understood not simply as matters of treatment technology, but as human-induced hazards shaped and reshaped by patterns of production and consumption and by policy choices. Accordingly, the program is designed to help students analyze how risks are generated through waste production and transfer and how they are shifted to particular regions.

Second, the program reflects an understanding of disaster risk as the interaction of hazard, exposure, vulnerability, and response capacity. Even within the same waste generation system, the Seoul Metropolitan Area and non-metropolitan regions may differ in their levels of exposure and vulnerability, resulting in differences in the extent and impacts of environmental burdens. In particular, regions where waste treatment facilities are concentrated may experience multiple impacts, including environmental pollution, health risks, and negative effects on the image of the local community. These impacts are shaped not simply by natural conditions but also by social and economic structures. This perspective can also be applied to natural hazards such as floods. By extending it to waste issues, the program helps students understand disasters as structural and relational phenomena.

Third, the program adopts environmental justice and disaster justice as key educational perspectives. Disasters and risks are not distributed equally among members of society, and particular regions or groups may bear greater burdens. The transfer of waste to non-metropolitan regions illustrates this imbalance, reflecting a structure of spatial inequality in which the benefits enjoyed by the Seoul Metropolitan Area are associated with burdens placed on non-metropolitan regions. The program therefore encourages students to critically analyze how risks are distributed and explore more equitable societal responses.
These theoretical frameworks are also closely connected to the concept of hazard literacy. Hazard literacy refers to the capacity of citizens not only to understand hazards scientifically, but also to make informed judgments and take action by considering their social and spatial contexts and ethical implications. To develop these multidimensional capacities, the program is designed to provide students with progressive experiences involving knowledge and understanding, analytical skills, value judgments, empathy, and practical engagement. Through the issue of waste, students are encouraged to develop an understanding of the structures of risk in modern society and recognize their roles as responsible citizens.

6. Instructional Considerations

First, avoid presenting the transfer of waste between regions as a simple conflict between the Seoul Metropolitan Area and non-metropolitan regions or as an example of local or regional self-interest. Guide students to understand that waste issues result from the complex interaction of production and consumption patterns, the uneven distribution of waste treatment facilities, policy decisions, and limited opportunities for resident participation, and encourage them to focus on the structures through which risks are generated and transferred.
Second, when using news reports, maps, and statistical data, guide students to examine differences in data sources, dates of data collection, waste types, and spatial units. Avoid drawing conclusions about the actual extent of impacts based solely on the locations of waste treatment facilities. Instead, encourage students to consider factors such as treatment capacity, duration of operation, surrounding population and land use, and management practices. Students should also be encouraged not to accept sensational headlines or expressions at face value, but to critically interpret information by comparing sources that present different perspectives.
Third, during the role-play activity, avoid portraying particular stakeholders as inherently good or bad. Explain that **residents of the Seoul Metropolitan Area, residents of non-metropolitan regions, the national government, local governments, and waste treatment companies** each have different interests and constraints, and establish discussion rules in advance that emphasize respect for different perspectives. Care should also be taken to ensure that the experiences of affected communities and residents are not trivialized or treated merely as material for conflict.
Fourth, ensure that the lesson does not conclude solely with individual waste sorting and recycling practices or debates for or against the siting of waste treatment facilities. Encourage students to explore individual, societal, and policy alternatives together, including waste reduction, strengthened producer responsibility, treatment of waste closer to where it is generated, resident participation, interregional cooperation, and environmental and health monitoring. Rather than presenting a single correct answer, guide students to compare the effectiveness, limitations, and equity** of different alternatives and make evidence-based judgments.

7. References

- Blue Dot Center for Public Interest Research. (2025). Waste Atlas: Data-driven monitoring and civic action for waste justice. Blue Dot Center for Public Interest Research.
- OECD. (2024). Environmental justice: Context, challenges and national approaches. OECD Publishing.
- Pellow, D. N. (2000). Environmental inequality formation: Toward a theory of environmental injustice. American Behavioral Scientist, 43(4), 581?601.
- Schlosberg, D. (2007). Defining environmental justice: Theories, movements, and nature. Oxford University Press.

Lesson 1. Why Does Waste from the Seoul Metropolitan Area Go to Other Regions?

Topic	The reasons for and issues surrounding the transfer of waste from the Seoul Metropolitan Area to other regions
What will we learn?	① Explain how waste generated in the Seoul Metropolitan Area is transported and disposed of. ② Analyze, using data, maps, and case studies, how the transfer of waste can concentrate risks in particular regions. ③ Explore examples of waste treatment in different regions.

1 Think About It

- Where do you think the waste you throw away each day goes?

- Why do you think waste from our region is sent to other regions for disposal?

- How would you feel if a waste disposal facility were built in your neighborhood? Why?

2 Data Analysis

<그림 1> 산업폐기물 매립 앞마당 지표가 1.0을 초과한 시·군·구

	앞마당 지표	처리량(t/연)	발생량(t/연)
경남 사천시	23.6	121,738	5,156
충남 보령시	22.8	159,451	6,993
경북 고령군	22.4	162,074	7,248
충북 충주시	11.9	233,991	19,684
충북 음성군	11.5	92,872	8,104
부산 강서구	10.7	65,973	6,161
경북 구미시	7.9	399,653	50,667
경북 경주시	6.4	598,106	92,885
울산 남구	4.2	538,974	128,660
전남 여수시	3.9	345,195	88,892
충북 청주시	3.6	306,968	84,174
경남 통영시	2.4	7,808	3,235
전북 군산시	2.2	196,366	87,717
경남 창원시	1.7	155,154	91,904
충남 서산시	1.6	28,227	17,439
경북 포항시	1.2	328,426	281,751

자료: 공익연구센터 블루닷·2022 전국폐기물 발생 및 처리 현황

출처: https://www.sisain.co.kr/news/articleView.html?idxno=55248

<그림 3> 의료폐기물 앞마당 지표 1.0 초과 시·군·구

	앞마당 지표	처리량(t/연)	발생량(t/연)
경북 고령군	859.7	16,601	19
경북 경주시	37.9	31,689	836
충남 논산시	30.5	21,579	708
경기 연천군	25.4	24,079	949
전남 장흥군	23.9	32,884	1,375
경기 포천시	16.6	5,913	355
경북 경산시	15.5	14,188	916
부산 기장군	8.4	3,504	419
광주 남구	8	8,652	1,086
경기 용인시	5.9	31,001	5,277
충남 천안시	5.5	20,694	3,758
충북 진천군	4.2	26,480	6,345
경남 진주시	2.8	8,919	3,235
전북 군산시	2	1,323	678

자료:공익연구센터 블루닷·2022 전국폐기물 발생 및 처리 현황

- What does the “Backyard Index” shown in the data mean?

3 Spatial Distribution of Waste Treatment Facilities in South Korea

- Using QGIS, Google Maps, or ArcGIS Online, plot the following data on a map.

- Locations of waste incineration facilities and landfills in South Korea
- Population density and industrial population distribution (1 km grid)•
- Residential land values (1 km grid)

- Where are waste treatment facilities concentrated? Why do you think they are concentrated in these areas?



Lesson 2. Exploring Cases and Planning a Role-Play

Topic	Understanding the perspectives and needs of different stakeholders
What will we learn?	① Explain the perspectives and needs of different stakeholders involved in waste treatment issues. ② Explore the causes of conflicts surrounding the location and operation of waste treatment facilities through different cases. ③ Understand how waste treatment facilities can become concentrated in particular regions and communities, creating spatial inequalities.

1 Exploring and Identifying Cases

[Case 1]

Beginning in 2026, direct landfilling of household waste will be prohibited in the Seoul Metropolitan Area. This means that waste must be incinerated first, and only the ash remaining after incineration may be sent to landfills. However, the Seoul Metropolitan Government has not yet secured sufficient incineration capacity, making it difficult to treat all of its waste within the city. As a result, Seoul has contracted with private incineration facilities in other regions to treat some of its waste. In one city in the Chungcheong region, a private incineration facility contracted to handle waste from Seoul was found to have processed waste from the Seoul Metropolitan Area accounting for more than 30% of its total waste intake. The waste was transported over long distances to another region for incineration. As this situation became known, local residents raised concerns that "waste generated in Seoul is being sent to our community." This has raised concerns about the long-distance transport of waste and the transfer of waste to other regions.

[Case 2]

In a rural area in the Chungcheong region, a plan was proposed to build a landfill in a mountainous area, and local residents strongly opposed the project. Residents argued that the area was close to their homes and farmland and expressed concerns about possible groundwater contamination. Although the project was legally permitted and the developer planned to install pollution control facilities, residents argued that the landfill should be located farther away from residential areas.

[Case 3]
In a rural area of the Gyeongsang region, a plan was proposed to convert a former quarry into an industrial waste landfill. The site had previously been used for quarrying, but after quarrying ended, a plan was developed to use the site as a waste treatment facility. Local residents expressed concerns that groundwater contamination could affect nearby villages and streams. The local environmental authority rejected the project, citing a high risk of water pollution.

[Case 4]
In an industrial city in Gyeonggi Province, a waste landfill and sewage treatment facility were planned together as part of the development of a large industrial complex. These facilities were designated as essential infrastructure for the industrial complex and were planned near residential areas. Local residents argued that the burden associated with environmental facilities was being concentrated in their community and called for the plan to be reconsidered.

• What do the conflicts in these cases have in common? How are the cases different from one another?

2 Choosing Roles and Positions

Representative of Seoul Residents

- Waste is generated every day in the Seoul Metropolitan Area.
- Waste should be treated safely and efficiently at facilities that meet appropriate standards.
- Incineration facilities are difficult to build near residential areas because of opposition from local residents.
- Sending waste to other regions is currently an unavoidable option.
- Main position: Maintain daily life in Seoul while ensuring that waste is treated safely and efficiently.

Representative of Residents in an Area Planned for a Waste Treatment Facility

- Concerns about odors and air pollution may increase if an incineration facility or landfill is built.
- Residents are concerned about possible health effects, as well as declining land and housing values.
- Residents should not be forced to bear the burden simply because the area is relatively sparsely populated.
- The issue is not simply opposition to the facility; safety must be ensured first.
- Main position: Reconsider the construction of the facility or provide reasonable compensation and support to residents if the project proceeds.

Seoul Metropolitan Government Official

- Waste generated in the Seoul Metropolitan Area must be treated safely.
- Existing treatment facilities are already operating at capacity, and it is difficult to build new facilities because of opposition from local residents.
- Waste treatment should be shared among different regions rather than handled by a single region.
- Main position: Develop a policy that can actually be implemented while balancing waste treatment needs with the concerns of local residents.

Local Government Official from an Area Planned for a Waste Treatment Facility

- Waste treatment is necessary for the region, but the need for the facility should be reconsidered.
- It is important to communicate with residents and protect the interests of the local community.
- If sufficient financial support and community development plans are provided by the central government or the Seoul Metropolitan Government, the project could be considered.
- Main position: Decide whether to approve the facility and, if it is approved, establish conditions for financial support and compensation.

Environmental and Public Health Expert

- Waste treatment facilities may affect the environment and the health of local residents.
- The location and operation of facilities should be based on clear scientific evidence.
- Scientific data should be used to explain possible environmental and health impacts.
- Main position: Conduct environmental impact assessments, health surveys, and monitoring.

Representative of a Waste Treatment Company

- The company specializes in collecting, transporting, incinerating, and landfilling waste.
- It contracts with the Seoul Metropolitan Area to operate incineration and landfill facilities.
- The company argues that it can minimize environmental risks by complying with environmental standards.
- However, building new facilities requires a significant amount of money.
- Main position: Explain the need for and safety of the facility and seek a reasonable agreement with the local community to proceed with the project.

Central Government Policy Official

- Waste should be treated safely nationwide, and conflicts between regions need to be addressed.
- The central government should prevent certain regions from bearing a disproportionate share of waste treatment.
- The need for facilities should be reviewed based on waste generation, treatment capacity, and regional conditions.
- Main position: Establish principles for sharing the burden of waste treatment across regions and develop national policies.

Lesson 3. Discussion and Debate

Topic	Developing Fair Solutions for Waste Treatment
What will we learn?	① Explain how the burden of waste treatment is distributed across different regions, considering where waste is generated, transported, and treated. ② Compare the positions and evidence of different stakeholders involved in waste treatment issues and explain your own opinion logically. ③ Propose fair waste treatment solutions by considering environmental impacts, the distribution of burdens, residents' participation, regional cooperation, and other relevant factors.

1. Reviewing Our Roles

- Our group's role:
- What was most important to our role?
- What issue was our role most concerned about?

2. Comparing Different Positions

Role	Most Important Values	Main Concerns	Proposed Solutions
Seoul Residents			
Residents in Areas Planned for Waste Treatment Facilities			
Local Governments			
Central Government			
Waste Treatment Companies			
Environmental and Public Health Experts			

- Which issues showed the greatest differences of opinion among the roles?
- Why do you think their positions were different?

3. Analyzing Inequalities in Waste Treatment Issues

- Where is most of the waste generated
- ?Who mainly bears the burden of odors, pollution, traffic, and health risks associated with waste treatment?
- Who receives the benefits of waste treatment facilities, and who bears the costs?
- Were residents in areas planned for waste treatment facilities given enough opportunities to participate in the decision-making process?
- Do you think it is fair for waste treatment facilities to be concentrated in particular areas? Why or why not?

4. Developing a Shared Solution

Propose a fair approach to waste treatment by considering the following factors.

- ✔ Responsibility of the regions where waste is generated
- ✔ Environmental and health impacts on residents near waste treatment facilities
- ✔ Resident participation and access to information
- ✔ Waste reduction and recycling
- ✔ Fair sharing of responsibilities and burdens across regions

Our Group's Policy Proposal

- ➢ Policy name:
- ➢ Key points:

- People or regions that would benefit most from this policy:
- Potential problems:
- Ways to reduce these problems:

5. Individual Reflection

✔ What did you think differently about after the role-play?

✔ What did you learn or understand better from the perspectives of other roles?

✔ What should individuals, companies, and the government each do to help address waste issues?

- ➢ Individuals:
- ➢ Companies:
- ➢ Government:

✔ Write down one action you can take.