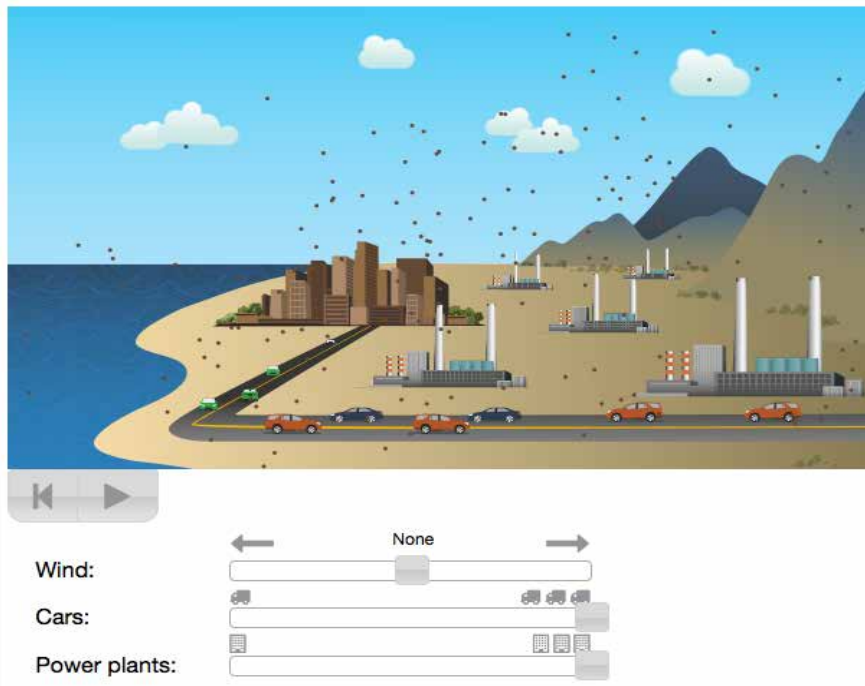


# Movement of Pollutants Answer Key

1. How can pollutants be measured and tracked?

Pollutants can be measured and tracked by monitoring stations around the landscape. Some pollution levels may be able to be monitored by satellite.

2. Take a snapshot showing a buildup of pollutants over the city. What caused the pollutants to build up over the city?



Pollutants built up over the city when there were a lot of cars and power plants and when there was no wind. Rain washed pollutants out of the air.

3. Does wind remove the pollutants from the air?

no

4. Explain your answer.

Wind does not remove pollutants from the air. The wind just pushes the pollutants around. There are still pollutants in the air; they're just going somewhere else when the wind is blowing.

5. How do rain, wind, and sunlight affect the severity of pollution in the model?

Rain will remove pollutants from the air, so rain events decrease the severity of pollution. Wind can blow them away or towards the monitoring station, so wind can have a reducing or increasing effect on the level of local pollution, depending on direction. Sunlight will act on pollutants to create more pollution, so sunlight can make pollution levels worse.

# Movement of Pollutants Answer Key, continued

6. Describe how geography can affect the severity of pollution in the model.

Geography can affect the severity of the pollution because the mountains prevent the pollution from blowing far away from the city. The pollutants have a difficult time blowing over the mountains because of their height, so the pollutants are trapped near the city. This makes the pollution level worse when the wind is blowing toward the mountains compared to when the wind is blowing toward the ocean. Then the pollutants are blown away from the city.

7. Assume that the wall is to the east of the road. On a heavy traffic day, which wind direction would result in the best air quality for the city located on the east side of the wall?

East to West wind

8. Explain your answer.

An east blowing wind would move pollutants away from the wall. This would make the city's air quality better because the pollutants would be blown away from the city (further to the west). If the wind was blowing west to east, the wind would blow pollutants up against the wall (which is on the western side of the city). A north or south wind would also be okay for air quality if there are no barriers to the north or south of the city.

9. How certain are you about your claim based on your explanation?

Student answers will vary.

10. Explain what influenced your certainty rating.

Student answers will vary. Scientific evidence includes: geographical barriers affect the flow of pollutants and the barrier is on the western side of the city. Students may state that a north or south wind would not negatively affect air quality because they don't affect the movement of air past the barrier.

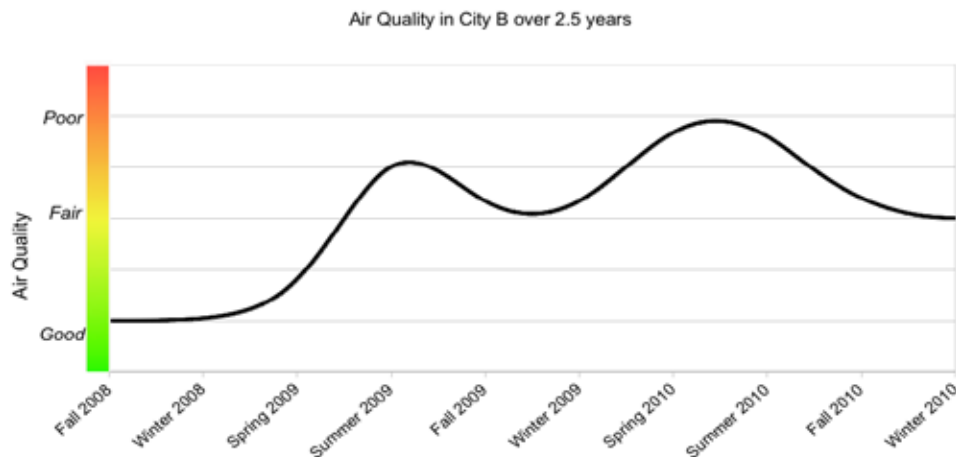
11. Take a snapshot showing the power plant locations your chose and the air conditions in the three cities during summer wind conditions. Explain how your choice of power plant locations produced fair to good air quality in all three cities.

I placed the power plants so that the wind would blow the pollutants away from all of the cities during summer and winter wind conditions. During summer wind conditions, the wind blows towards City A, but the mountains block the movement of pollutants so that the air quality in City A remains good.



## Movement of Pollutants Answer Key, continued

12. The graph below shows the air quality for City B over a two-and-a-half-year period. Develop a scenario that would explain the changes in air quality over this period of time.



Student answers will vary. Answers should be logical with the information provided in the introduction to the model, particularly with respect to wind direction during the different seasons. The air quality starts out good and gets fair to poor over the time period. Students may state that the wind direction shifted between Fall/Winter 2008 and Fall/Winter 2009 and 2010, but that is not a likely explanation as seasonal wind patterns do not change significantly year-to-year without large-scale geography and/or climate changes.

The more likely explanation is that power plants (or some other pollution-emitting entity) started operating between Fall/Winter 2008 and the subsequent two years on the graph. The locations of the power plants would have to be to the southwest of City B. In the summer, with the wind blowing from southwest to northeast, emissions from these plants would be trapped by the mountains to the north/northeast of City B and decrease the air quality in that city.

That explains why the air quality would be so much worse in the summer, but it does not explain the fair-to-poor air quality in the winter months. The increased pollution during the winter could be caused by local pollutants, such as cars and houses. The pollutants would be emitted locally at lower atmospheric levels, which might make them more difficult to be blown out of the area by the winter's west-to-east winds.

It matters where in the city the air quality is being measured. If an emitter is put next to the monitoring location (or the monitoring location is changed to be next to an emitter), the reported pollution level could change drastically even if there is no additional pollution being emitted.

## Movement of Pollutants Answer Key, continued

13. A power plant is located just to the north of City B. If the wind blows from the south, what will be the air quality in City A?  
*good air quality*
14. Explain how City A's air quality is affected by the power plant when winds blow from the south.  
*City A's air quality is not really affected by the power plant to the north of City B. This is because the mountains trap most of the pollution and prevent it from reaching City A. Thus, City A's air quality remains good (if it was good to start with).*
15. How certain are you about your claim based on your explanation?  
*Student answers will vary.*
16. Explain what influenced your certainty rating.  
*Student answers will vary. Scientific evidence includes: specific reference to experiments with the model, geographic features obstruct the flow of air pollutants, the mountains (geographic barrier) is south of City A, and the wind is blowing from the south (toward the north). Students may note that the model does not show all polluting entities in City A, so it's impossible to say if the air quality is good, fair, or poor since not all of the relevant information is supplied.*
17. How did acid rain form over the Adirondack lakes when there was no direct pollution source nearby?  
*Acid rain formed over the Adirondacks, even though there are no direct pollution sources nearby, because wind blows pollutants over long distances. There are polluting sources far away that affected the Adirondacks because the wind direction blew their pollutants toward the Adirondacks.*