



**Grade Level: 6-12 | PASS Skills: Process Standard (4:6, 7a), (5:4, 5)/ Standard (1:1, 4), (5:1, 3a, 3b), (4:1c, 2 High School)**

Objectives: Students will be able to identify ways to help improve air quality and will compare different types of alternative fuel vehicles.

Materials: Computers with internet access, Alternative Fuel Vehicles Student Worksheet (.pdf)

Pre-requisite Knowledge: Content from lesson plans 1-5

Activity: Students will conduct research on alternative fuel vehicles, compare the characteristics of each vehicle, and determine which type of vehicle they would select based on the gathered information.

Implementation Tips: Review the sources that cause ground-level ozone and then have students brainstorm ways they can help reduce ground-level ozone. Follow up the brainstorming process by discussing the “10 Simple Steps to Improving Air Quality” created specifically by the Air Quality Division. Encourage students to share these steps with their parents or guardians.

Notes to Teacher: The activity can be used as a preliminary step in a full scale research project about alternative fuel vehicles. Students can be placed into groups and each group can be assigned a specific type of alternative fuel vehicle to research. The groups could then create and present PowerPoint presentations on the vehicle their group was assigned.

Additional Resources: <http://www.deq.state.ok.us/AQDnew/resources/factsheets/10steps.pdf>

### **Ozone Overview**

In the upper levels of the atmosphere ozone acts as a protective barrier, absorbing harmful ultraviolet radiation from the sun; however, at lower levels, ozone is a pollutant that causes various health issues.

Ground-level ozone is not typically emitted directly into the air; it is formed by chemical reactions that take place between VOCs and NO<sub>x</sub>. VOCs and NO<sub>x</sub> are emitted from man-made sources such as cars, refineries, power plants, industrial facilities, gasoline fumes, and chemical solvents like paint and cleaning supplies. VOCs and NO<sub>x</sub> can also be emitted from natural sources.

In addition to VOCs and NO<sub>x</sub>, solar radiation is a necessary ingredient to complete the chemical reaction; hence the increased presence of ozone in the warmer months and during the peak of the afternoon.

When the general population is exposed to unhealthy levels of ozone, a variety of symptoms can occur, such as coughing, tightening of chest, difficulty breathing, inflammation of lungs, and permanent lung damage if exposure is long-term.

To notify and advise the public of daily air quality conditions, the Oklahoma Air Quality Division monitors six criteria pollutants; ozone, particulate matter, lead, carbon monoxide, sulfur dioxide, and nitrogen dioxide. Monitoring sites across the state collect air samples, and the data are analyzed and then communicated to the public using the Air Quality Index (AQI).

## Ways You Can Help

The Oklahoma Air Quality Division has composed a list of *10 Simple Steps to Improving Air Quality* that can be easily followed and used to reduce ozone pollution:

1. Take mass transit, share a ride or carpool- Fewer vehicles on the road translate into fewer sources of NOx. A reduction in ozone-forming components may result in an overall improvement of the local air quality.
2. Trip chain more often- When running errands, it is not only time-efficient to map out your route, but it is also environmentally friendly. When you first start a car after it has been sitting for more than an hour, it pollutes up to five times more than it does when the engine's warm.
3. Have fun! Ride your bike- Again, a decrease in the number of vehicles on the road directly translates into better air quality. Twenty-five percent of all the air pollution in the United States is the result of vehicles on the road.
4. Take things in stride- Instead of driving, try walking or in-line skating. Both are good forms of exercise and cut back on emissions.
5. Maintain your vehicle- Vehicle emissions could be drastically reduced if regular maintenance were performed. When vehicles have been properly cared for, their gas mileage and emissions rate will improve.
6. Get fuel when it's cool- Refueling during cooler periods of the day or in the evening can prevent gas vapors from heating up and creating ozone.
7. Don't top off the tank- Cars are now equipped with control devices that reduce escaping vapors during refueling, so don't override the pump!
8. Telecommute- A reduction in vehicular pollution can be further accomplished by working at home when possible.
9. Know before you go- Before commuting to your destination, stay informed of travel and transit information. Traffic reports can help you avoid congested roadways that are ozone hotspots.
10. Spread the word- If everyone followed just a few of these simple, easy steps, it could make a big difference because *it all adds up to cleaner air!*

## What Else is being done?

Poor air quality costs money in terms of healthcare and the number of days lost at work. Therefore, government agencies, energy and gas companies, car manufacturing facilities, and many other organizations are taking greater measures to address the issue.

The production and use of Energy Star appliances, electronics, building products, heating and cooling systems, and water heaters is on the rise, and many states offer tax incentives for the purchase of such products. Also, hybrid and alternative fuel vehicles are making a greater appearance in the public sector, and more auto companies are offering vehicle retrofitting from petroleum to alternative fuel sources such as natural gas, propane, or clean diesel.

In the state of Oklahoma, the Department of Transportation, Department of Environmental Quality, and the gas and energy companies are among many that are utilizing hybrid and alternative fuel vehicles.

Furthermore, the Oklahoma Air Quality Division offers Clean Diesel grants to retrofit and replace diesel-fueled school buses and has succeeded in helping more than 43 school districts retrofit or replace 287 diesel buses in the last five years.

**Activity:** \* Will require the use of multiple computers with internet access

Using the U.S. Department of Energy's fuel economy and alternative fuels data web sites,  
<http://www.fueleconomy.gov/feg/current.shtml>, <http://www.fueleconomy.gov/feg/hybridtech.shtml>,

<http://www.afdc.energy.gov/fuels/index.html>, <http://www.afdc.energy.gov/fuels/electricity.html>, and other approved sources, conduct independent or group research on the alternative fuel vehicles pictured below.

- a. In the table provided, give a brief description about each of the alternative fuel types
- b. List four advantages and four disadvantages associated with the use of each fuel type
- c. Review the advantages and disadvantages listed for each alternative fuel type and write a page detailing which type you believe to be the most practical. Use details recorded in the table and *additional research* to support your conclusion.