

ESA 21: ENVIRONMENTAL SCIENCE EXERCISES

Ozone: Personal Impacts

Ground-level Ozone

Vehicles

In this week's exercise, you will be quantifying and analyzing your personal contributions of smog-forming compounds due to driving. You are already aware that vehicles can be a significant contributor of the compounds that cause ground-level ozone from your work with the Smog City simulation in the first exercise. In this exercise we will examine your personal contributions of smog-forming compounds from driving, and then expand this analysis to electricity and other emission sources in the Capstone Activity for this module. To begin your analysis, let's review information on vehicles and ozone with an online PDF brochure from the Federal Highway Administration of the U.S. Department of Transportation on [Transportation Air Quality](#).



Now that you are familiar with this material and the general material on smog formation from exercise one, let's examine your outputs of pollutants from driving. To do this, we will use "[Tailpipe Tally](#)" from the Environmental Defense web site. This calculator asks you enter your year, model, and make of vehicle, along with annual mileage, and it provides you with an estimate of your outputs of smog-forming nitrogen oxides and hydrocarbons (VOC's). As you learned in the Transportation Air Quality brochure, a number of factors influence NOx and VOC emissions from vehicles. While this calculator does not take all of these factors into account, it does provide a good estimation of your emissions.

Tailpipe Tally:

1.	After reviewing the information on the page, select your model year with the pull-down menu, then the make, and the model.
2.	Select your Emissions Certification with the pull-down menu. If you are presented with multiple choices and are uncertain which one applies to your vehicle, click the Emissions Certification link and follow the directions there. Always choose the most conservative (most polluting) option if you are unsure.
3.	Enter your annual mileage for the vehicle and then click Add To Selected Vehicles List .
4.	Your vehicle will appear in the Selected Vehicles box. Hit Proceed To Tally Results to calculate your emissions.
5.	View your results and answer the related questions on the Activity sheet. Proceed on to the next section when this is complete.

Air Pollution and Asthma

DO NOT COMPLETE THIS SECTION UNTIL YOU'VE COMPLETED THE ACTIVITY ABOVE.

You undoubtedly are aware that metro Atlanta has an annually reoccurring smog problem. Atlanta's ground-level ozone levels, like other metropolitan areas, often exceed federal air quality standards, posing a health risk to individuals living in the area. While all individuals can experience health problems due to smog, it is particularly severe for individuals with respiratory ailments such as asthma. Air pollution can act as a "trigger" for attacks in asthmatics. The [American Lung Association](#) states that 24.7 million individuals have been diagnosed with asthma, and about one-third of them are children. Asthma is particularly troubling in children, where it is the number one cause of hospitalization and school absenteeism. While most people are generally familiar with asthma, many do not understand the ailment and how it affects lung function. Learn about this by viewing an [animated Flash tutorial](#) on asthma from Neomedicus and Merck (requires [Macromedia Flash Player](#)). If you have a fast Internet connection, choose the version with sound. Use the "no sound" version with slower connections.

Once you've familiarized yourself with this material, proceed on to the Analysis question on "Asthma and Air Pollution" on the Activity sheet.

Internet Addresses of Linked Sites:

FHWA brochure on Transportation Air Quality:

<http://science.kennesaw.edu/biophys/gened/1101labs/modules/ozone/exercise3/doe-veh-pollutants.pdf>

Tailpipe Tally: <http://www.environmentaldefense.org/TailpipeTally/>

American Lung Association Asthma Stats: <http://www.lungusa.org/asthma/ascpedfac99.html>

Flash Asthma Tutorial: <http://www.whatsasthma.org/>

Flash Player:

http://www.macromedia.com/shockwave/download/index.cgi?P1_Prod_Version=ShockwaveFlash

ESA 21: Environmental Science Activities

Activity Sheet
Ozone: Personal Impacts

Name:

Professor:

Tailpipe Tally:

Enter your vehicle's year, make, model, emissions certification, and annual mileage below.

Year	Make	Model	Emissions Cert.	Annual Mileage

Enter your annual outputs of nitrogen oxides and hydrocarbons for your vehicle in the space below. Then use Tailpipe Tally to look up the emissions from the two listed vehicles with the same annual mileage as your vehicle. Enter the emissions for each vehicle in the appropriate space, circle whether each vehicle's emissions are **higher** or **lower** than your vehicle, and enter the difference in emissions next to **Amount**.

Vehicle	NO _x (lbs.)	Hydrocarbons (lbs.)	Difference: NO _x	Difference: Hydrocarbons
Your Vehicle			*****	*****
2001 Ford Focus (LEV)			Higher Lower Amount:	Higher Lower Amount:
2001 Toyota Prius (SULEV)			Higher Lower Amount:	Higher Lower Amount:

Analysis:

Vehicle Emissions:

The 2001 Ford Focus is a compact car and the Toyota Prius is a gas-electric hybrid vehicle, and these vehicles provide a means for comparison of your current vehicle's emissions. How did your vehicle compare to these cars? Did this surprise you?

Asthma and Air Pollution:

You've seen that asthma affects large numbers of individuals, attacks can be induced by air pollutants, pollution may act to cause individuals to develop the disease, and asthma attacks are an extremely unpleasant event to endure. You've also likely seen that your current vehicle emits more ozone-forming compounds than a gasoline-electric hybrid vehicle (Toyota Prius) and/or a typical compact car (Ford Focus). So here's the problem - you are, by choice, releasing more harmful pollutants into the atmosphere than if you were to drive these other vehicles for exactly the same distance. These pollutants induce attacks in asthmatics, and may cause children and adults to develop asthma as a result of exposure to your pollution.

Is it morally problematic for you to drive a vehicle that gets lower mileage (and hence releases more pollutants) than another vehicle when you are aware of the adverse impacts of your choice on others?

You should address the question from a variety of viewpoints (ethical, scientific, philosophical, economic, etc). Think about the question carefully before answering, and be sure to explain yourself fully.

Atlanta Emissions Testing:

As you know, vehicles registered in most counties in the Atlanta metro area must have annual emissions testing for ozone-forming compounds. Do you support this testing program? Has your view on the matter changed after completing this exercise? Explain your answer.