



PROBLEMS AND SOLUTIONS

Unit Overview

In previous units, you have studied Earth and Space Sciences. Turning now to Science and Technology, you will explore various problems on Earth and see the role that technology plays in their solutions. You may conclude that human activity and technology are a “mixed blessing” to the Earth. Sometimes our activities are harmful to delicate ecosystems, but sometimes they can actually be helpful to the environment. Solutions to problems are seldom simple and may cause unforeseen difficulties for our natural world. In this unit we will look at examples of how technology and human activity can have positive and negative impacts upon the environment and how the solution to one problem may create other problems.

Unit Directions

Read the following and study the suggested websites, then answer the questions. Important vocabulary terms and concepts will be in bold type.

Introduction

As a citizen of Earth, you have an important obligation to preserve our clean air, pure water and our natural environment, not only for yourself, but also for generations of Earth's citizens that are yet to be born. Indeed, we have a right to these things. But, as always, when we have rights, we have obligations.

The conveniences of our present life have made our lives many times easier than the lives of our ancestors. Modern inventions such as the telephone, the automobile, the computer, and even indoor plumbing have greatly improved the quality of our lives. Medicines and up to date understanding of sanitation have improved our health and increased our life spans.

The Problem with Cars



But for all of these modern conveniences,



there has been a price that has often been paid for by the earth itself. For example, automotive technology has been a good thing for many people. Transportation from one place to another is much easier than it was a century ago. The desire to own and drive a car is linked to pleasure, convenience and freedom. Automobiles *solve* many transportation problems for those who drive them. But think about the “cost” of automobiles to our earth.



Driving a car is the most polluting thing that an ordinary citizen does. Tons and tons of

pollutants are released into the air in our large cities every day. A **pollutant** is something that pollutes, especially a waste material that contaminates air, soil, or water. The main source of these pollutants is the cars and trucks that give them off. An internal combustion engine such as a car or truck uses fuel by mixing it

with air and then burning it. When this happens, some exhaust gases are left over. They go out the tailpipe and into the air. Some of the exhaust gases given off by road traffic include black smoke, carbon monoxide, lead, hydrocarbons, nitrogen oxide and sulfur oxide. These chemicals combine to produce adverse effects on the health of both car owners and innocent bystanders. **Smog** is what happens when exhaust gases mix with sunlight or fog. The more people drive, the more smog is released. Smog makes people sick, increases problems in lungs and may be one cause of asthma in children.



<http://www.hcdoes.org/airquality/Kids/Pollution.htm> and/or
[PDF](#)

To learn more about smog, read the information taken from the following web site: <http://www.epa.gov/airnow/health> Click on [Home Page](#) to see what the site looks like and has to offer.

What You Need to Know About Ozone and Your Health

Smog -- Who Does It Hurt?



On a hot, smoggy summer day, have you ever wondered: Is the air safe to breathe? Should I be concerned about going outside?

In fact, breathing smoggy air can be hazardous because smog contains ozone, a pollutant that can harm our health when there are elevated levels in the air we breathe. Read more about ozone.

What is Ozone?

Ozone is an odorless, colorless gas composed of three atoms of oxygen that is found in smog. Ozone occurs both in the Earth's upper atmosphere and at ground level. Ozone can be good or bad, depending on where it is found:

Good Ozone. Ozone occurs naturally in the Earth's upper atmosphere-10 to 30 miles above the Earth's surface-where it forms a protective layer that shields us from the sun's harmful ultraviolet rays. This "good" ozone is gradually being destroyed by manmade chemicals. An area where ozone has been most significantly depleted-for example, over the North or South Pole-is sometimes called a "hole in the ozone."

Bad Ozone. In the Earth's lower atmosphere, near ground level, ozone is formed when pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources react chemically in the presence of sunlight.

The booklet *Ozone: Good Up High, Bad Nearby*, which can be found on the web at <http://www.airnow.gov/gooduphigh>, contains additional information about both good and bad ozone.

Click on the [Home Page](#) to see what the site looks like and has to offer.



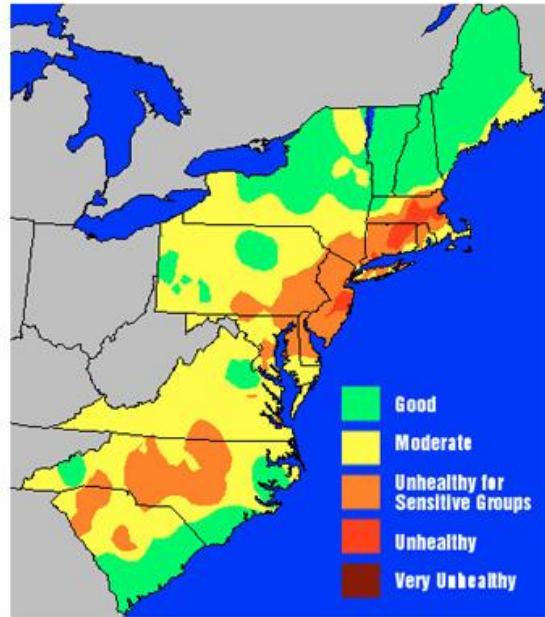
Children and adults of all ages who are active outdoors are at risk from ozone exposure.

Should I Be Concerned About Exposure to Ground-Level Ozone?

That depends on who you are and how much ozone is in the air. Most people only have to worry about ozone exposure when ground-level concentrations reach high levels. In many U.S. communities, this can happen frequently during the summer months. In general, as ground-level ozone concentrations increase, more and more people experience health effects, the effects become more serious, and more people are admitted to the hospital

for respiratory problems. When ozone levels are very high, *everyone* should be concerned about ozone exposure.

In many areas of the country, measurements of ozone concentrations are converted into color contours of the AQI categories (green, yellow, orange, red, and purple, shown above) and displayed on a map (see example below) to show ozone levels in the local area. The map is updated throughout the day and shows how ozone builds during hot summer days. In some areas, ozone maps are used to show a forecast of ozone levels for the next day. Once you understand the color scheme, you can use the maps to quickly determine whether ozone concentrations are reaching unhealthy levels in your area. Ozone maps appear on some televised weather broadcasts and are also available from EPA's web site at <http://www.epa.gov/> and/or [PDF](#).



This map shows ozone levels in the eastern United States on August 24, 1998. Ozone maps are updated several times daily to show how ozone levels change throughout the day.

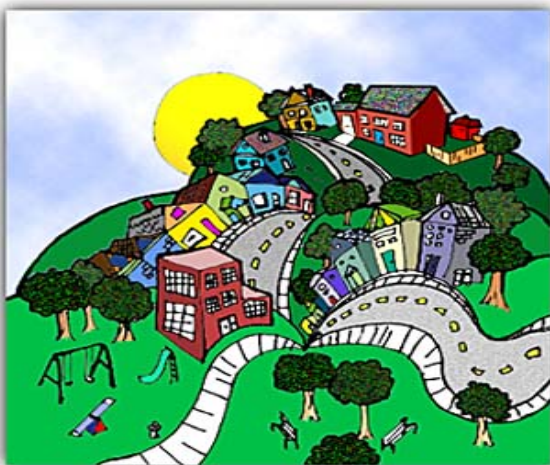
The web site information clearly showed that smog causes many problems. You might, then, wonder if the internal combustion engines in today's cars cause so many problems, why someone doesn't invent something better. Well, the answer is, they have. But the new technology has its own problems. For example, a solar car seems like a good idea. Solar engines get their power from the sun. **Solar** power is free, unlimited and has zero **emissions**. An **emission** is something discharged into the air, especially by an internal combustion engine (gasoline powered car or truck). Here's

the drawback – The sun isn't always shining and we can't control the weather. Additionally, solar cells are inefficient.

Scientists and engineers are working to develop hydrogen fuel cell cars. These cars combine hydrogen and oxygen from the air to produce an electrical current that powers a motor. However, production of the hydrogen fuel releases chlorine (**a pollutant**) as a by-product. Other methods of mass production release carbon dioxide. This type of car is very expensive and precious metals are needed for the engine.

Other solutions to this problem including cars that run by compressed air, compressed natural gas, propane, alcohol or electricity, create further problems, each in their own way.

More Problems



The pollutants released by cars and trucks are not the only problems created by our modern technology.

Technology is the practical

application of science to everyday problems. Sometime the technology itself may cause more problems. For example, household items that you or your parents use every day can cause problems for the environment. Go to the following website and explore problems created by common household products; www.epa.gov/kidshometour. Click on [Home Page](#) to see what the site looks like and has to offer. Take the home tour, then study the questions found on the side banner. Learn the definitions of **pesticide** and **toxic substance**.



Pesticides

No one is happy when insects or other pests invade his or her home. So what should we do? Are pesticides and poisons the answer? What are the consequences of pesticide use? As you discovered when exploring the “Home Tour” website, pesticides poison the household pests, but they might also poison us! Some insects are good for the environment (**beneficial**). Pesticides kill **beneficial** insects as well as those that cause damage to plants or spread disease (or sting us). So what is wrong with using non-poisonous methods for getting rid of pests in our homes? Using non-poisonous methods such as traps and “natural” baits are generally much easier on the environment.

They seem to be a solution to the problem. But, remember, when a problem is solved, other problems seem to arise. Natural methods of pest control DO work, but they work much more slowly than do pesticides that kill insects with “one shot”, and of course, non poisonous methods kill beneficial insects, also. This is seen by some people as a disadvantage to these methods, even though it is kinder alternative for our natural world.

Conclusion

Our **technology** brings us safe living conditions, comfort, convenience and efficiency, but each new development brings its own set of problems and solutions. However, it is important to think about not only the solution to the problem, but the possible consequences of the solution. Every day, scientists and engineers work to make our lives better through technology. We all must be aware of the fact that the solution to one problem may cause other problems and consider our actions carefully.