You have undoubtedly heard about The Ozone Layer and the hole in it.

But before we tell you about The Ozone Layer, we need to tell you a little about ozone.

Ozone

Ozone is an unstable, highly reactive molecule, which consists of three oxygen atoms bonded together (0_3).

It is made naturally in the Stratosphere when ultraviolet light from the Sun splits an oxygen (02) molecule in half and frees two single oxygen atoms. Each oxygen *atom* then binds itself to a two-atom oxygen *molecule* to form ozone.

Oxygen is colorless and odorless, but ozone has a slightly bluish cast and a strong "clean" odor (have you ever smelled Clorox ™?).

It is used as a bleach, a deodorizing agent and a sterilizing agent for air and drinking water.

But even at low concentrations, it's toxic.

Good Ozone and Bad Ozone

The ozone in the Stratosphere is called *good ozone* because it protects the surface of the Earth from dangerous ultraviolet (UV) light from the Sun. This occurs in The Ozone Layer, which we'll tell you about in a minute.

But if there's good ozone in the Stratosphere, there's *bad oz*one in the Troposphere.

Good ozone is naturally made and, as we said, protects the Earth from the from the harmful UV rays of the Sun.

Bad ozone is man-made and is the result of emissions from internal combustion engines and power plants.

These automobile exhausts and industrial emissions release nitrogen oxide gasses (NOx) and volatile organic compounds (VOC) into the air.

These NOx's and VOC's are byproducts of burning gasoline and coal. They combine chemically with the oxygen in the atmosphere to form ground-level ozone during the sunny, high-temperature conditions of late spring, summer and early fall. *This* ozone is an air pollutant that can damage human health, vegetation and many common building materials.

It is a key ingredient of urban smog, which winds and vehicles can carry to remote rural areas.

The Ozone Layer

As we told you, The Ozone Layer is a region (or layer) of the Stratosphere that contains a relatively high concentration of *good* ozone.

This ozone blocks 99% of the ultraviolet radiation from the Sun and makes it possible for humans, plants, crops and animals to survive.

It's difficult to pinpoint exactly how far The Ozone Layer is above sea level. Different measurements give different results, depending on when and where the measurement was made.

It appears, however, to be somewhere between 10-25 miles above the Earth's surface.

The standard measure for *amount* of ozone is The Dobson Unit (DU), named after G.M.B. Dobson, one of the first scientists to investigate the role of ozone in the atmosphere. Each Dobson Unit indicates the amount of ozone that can be compressed to a temperature of 0 degrees C and one atmospheric pressure.

The total quantity of ozone in The Ozone Layer is not very large. It is only a few millimeters thick -- and it's getting thinner.

In 1984 -- much to the surprise of many people -- a huge hole in The Ozone Layer was discovered over Antarctica.

The Hole in the Ozone Layer

Since the early 1970's, scientists had been warning that the use of chemicals called chlorofluorocarbons (CFC's) could cause serious damage to The Ozone Layer.

CFC's are simple organic compounds in which all of the hydrogen atoms have been replaced by chlorine or fluorine. They were widely referred to as FREONs and used as cooling agents in refrigerators and air conditioning (particularly in automobiles), as propellants for aerosols, as industrial cleaning agents and in foam packing and insulation.

They were thought to be harmless because they were unreactive in the Troposphere, which gave them extremely long atmospheric lifetimes.

Unfortunately, CFC's are broken down in the Stratosphere by high-energy ultraviolet radiation from the Sun. This turns them into very reactive chlorine and fluorine species which destroy ozone.

This primarily takes place at the poles under the following meteorological conditions:

cold temperatures during the polar winter
ice cloud formation
the formation of a polar vortex, followed by
a polar sunrise in the spring

This means that the size of the ozone hole can vary from year to year.

In 1987, it was roughly the size of the entire U.S.A.

But 2002 was a very warm year -- so no polar vortex was formed and no ozone hole was seen.

But it came back in 2003, the second largest hole ever observed.

What This Means

Why is this ozone hole such a serious development?

Well, the main importance of ozone is that it acts like a sunblock or sunscreen for the Earth -- filtering out the dangerous ultraviolent rays from the Sun.

Humans and animals exposed to excessive UV light can develop cancer, and their immune systems can be seriously compromised.

Crops, too, seem to be damaged by extra UV. Soybean crops, in particular, decline by at least 25 percent when UV radiation increases by that amount.

And in the sea it has been found that phytoplankton, the basic food in the ocean's food chain, are extremely vulnerable to UV rays. This could result in a massive reduction in fish stocks and the loss of an important food source for all of us.

At the moment, The Ozone Layer is still substantial enough to prevent one particularly damaging type of UV ray (UV-c) from reaching the Earth's surface. UV-c is known to alter and destroy DNA and proteins -- which could lead to unimaginable consequences.

International Action

As we said, the ozone hole was first discovered in 1984. By 1987, it had grown to about the size of the entire United States.

Once its significance was understood, governments, industry and society worked together to resolve the problem.

In 1987, the use of CFC's was banned throughout the world by the Montreal Protocol on Substances that Deplete the Ozone Layer.

Unfortunately, since CFC's have such a long atmospheric life (up to 100 years) it will take a number of years for all of them released to date to be destroyed in the Stratosphere.

But at least appropriate action has been taken.

Make Your Own Ozone Detector

Would you like to know the ozone levels at your school and in your own back yard?

You can easily make your own ozone detector.

To find out how, go to the end of the article on "How Ozone Pollution Works" at:
http://science.howstuffworks.com/ozone-pollution1.htm