Ozone is a natural occurring gas that can be both beneficial and detrimental to organisms on Earth. It is important that sufficient amount of this pale blue gas is present in the stratosphere, where O_3 molecules would shield most of the UV radiation from reaching Earth. However, in the lower atmosphere, ozone gas is poisonous, and is a component of photochemical smog. A critical environmental issue nowadays concerns with the ozone depletion in the stratosphere. Many artificial chemicals have contributed to the "hole", and the effect of such depletion is devastating to all creations. Preventive measures from the government have been taken, and it is hoped that the ozone hole would not continue to grow.

Ozone is naturally produced in the stratosphere. When the sun supplies enough energy through radiation (UV), the following reactions occur: (Production of ozone by the sun)

$$O_{2(g)} \rightarrow 2O$$
$$O_2 + O \rightarrow O_{3(g)} \text{ (ozone)}$$

The ozone gas that is produced can effectively absorb any harmful radiations from the sun. Without the ozone layer, the UV radiations are capable of killing most life forms on Earth. It should be noted that UV radiation is used to sterilize medical equipment by killing off all the bacteria.

Even without human intervention, ozone gas would not continue to build up in the stratosphere. It is because O_3 is in equilibrium with oxygen molecules. This means that ozone gas is continually being destroyed. Photo energy from the sun promotes the following reaction: (Destruction of the ozone by the sun)

$$O_3 \rightarrow O_2 + O$$
$$O_3 + O \rightarrow 2O_2$$

Because ozone is constantly being created and destroyed at approximately the same rate, the concentration is kept relatively constant in the past. With adequate amount of the gas in the stratosphere, organisms on Earth are safe from devastating radiations from the sun.

Unfortunately, the production of certain gases in the hope that it would improves the lives of human beings has brought catastrophic effects to all living things. These gases destroy ozone at a rate that is faster than the rate ozone is produced. A worldwide ozone depletion occurs as a result. Especially in the north and south poles area, only a thin layer remains, or in some cases, no ozone is left. Ozone hole is first discovered by Rowland and Molina. NASA also confirms the existence of the hole, and later verifies that several gases are the culprits.

The greatest contributor to the destruction of ozone layer is the CFC family. CFC or chlorofluorocarbons are generally used in the production of Styrofoam. They are also used as propellants in spray bottles. CFC is produced in large amounts in the 1940's – 1950's. Initially, scientists did not recognize that CFC would cause any harm to the ozone layer. However, they did notice that CFC would stay in the atmosphere or airborne for a long time. What they assumed was that CFC would remain inert during that airborne period. Unfortunately, because sun provides and bombards the CFC molecules with such a high amount of energy, CFC molecules undergo photolysis. It is correct to say that CFC does not actually contribute to the ozone hole itself directly. CFC releases hydrogen-chlorides, and they are known as "reservoir species". They release atomic chlorine overtime, and chlorine atoms can effectively destroy vast amount of ozone molecules mainly because it stays in the air for a long time. Furthermore, chlorine acts as a catalyst, meaning that it is regenerated after the destruction of an ozone molecule. With the presence, of Cl, the destruction of ozone occurs as follow:

$$Cl + O_3 \rightarrow ClO + O_{2(g)}$$
$$ClO + O \rightarrow Cl + O_2$$

$$O + O_3 \rightarrow 2O_2$$

As shown from the chemical reactions, one chlorine atom is capable of destroying many ozone molecules. More importantly, the cycle can repeat itself over and over again before Cl finally settles to the ground. Another gas that plays a part in the destruction of ozone layer is NO gas. NO gas is another "reservoir species" and undergo a similar reactions like the chlorine atom:

$$NO + O_3 \rightarrow NO_2 + O_{2(g)}$$
$$NO_2 + O \rightarrow NO + O_2$$
$$O + O_3 \rightarrow 2O_2$$

One common property among these "ozone depleting gases" is that they all remain in the stratosphere for a long time. They are not very reactive, and they remain unreactive or inert in the lower atmosphere. However, as they reach the ozone layer, sun supplies enough energy for them to begin the reaction.

CFC is not the only evil creation that deconstruct our natural shield against the sun. Methyl bromide, an effective gas used in refrigeration, is also capable of destroying the ozone. Another family, halon, can kill O_3 at an amazing rate. Halons, relatives to the halogen family, are well known for their ability in fighting fires. They are non-toxic to humans if they are used properly.

Because CFC and those gases have such formidable effects, substitutions are used and some of the gases are banned. HCFC, for example, is us4ed in Canada. HCFC is much more reactive, and thus only few molecules can actually reach the stratosphere. It contains only 2% of CFC; but because it is more reactive, it can destroy the ozone faster. HCFC is generally used as a substitution for the "evil" CFC.

If the production of other gases is not stopped promptly, the ozone hole would continue to spread. It is obvious that a complete depletion of the ozone layer can eliminate all living things on the planet, but some effects of the depletion can already be seen. According to the statistics, a 10% decrease in the concentration of O_3, there is 20% increase in UV penetration. Because of this excess UV reaching the surface of the Earth, there would be a 40% increase in the occurrence of skin cancer among Caucasians. Cataract, an eye disease, can also develop; UV lights can also suppress the immune system of the body, making human beings more susceptible to diseases. Clearly, higher UV radiation does not only affect human, but other animals as well. UV is capable of killing the photoplankton and zooplankton in the oceans, and thereby affecting the whole food chain / web. Furthermore, the plastic can be radiated, and produces toxic gas and smog.

Obviously, the production of ozone-depleting gases must be stopped. Government has started its work at the gases that have the highest O.D.P – ozone-depleting potential. Montreal Protocol, for example, suggests the banning of CFVC. The Long-Range Tran-boundary Air Pollution Treaty also focuses on the reduction of the production of nitrogen oxides. Hopefully, these measures can prevent the ozone-depleting effect from worsening.