COMMENTARY

Ozone – the earth's forcefield

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MOST people when they think of nature tend to look down rather than up. By this I mean that we look at the plants and animals that are earth-bound both terrestrial and found in bodies of water.

Granted there are some of us who appreciate winged creatures such as butterflies, birds and bats. But are we really looking up high enough and can we really see the value of our environment? We celebrated World Ozone Day last Tuesday September 16th, but besides the fact that there is a hole in the ozone layer, do we really know what ozone is, and its function? I hope in the paragraphs to follow to give an overview of exacting what ozone is, its importance and how humans are manipulating it and what we can do to alleviate the problem.

The actual amount of ozone in the atmosphere is quite small and for every 10 million oxygen molecules there are 3 ozone molecules. Ozone occupies two regions in the Earth's atmosphere, 90% forms a layer in the stratosphere, which is found between 10 and 17 km above the Earth's atmosphere and is 50 km thick. The second layer is found in the troposphere. Some of the ozone in the troposphere is transported from the higher stratosphere and created through different mechanisms.

The distribution of this ozone layer varies geographically and seasonally, being thicker towards the poles and thinner near the equator, and thicker during the spring (dry season) and thinner during autumn (wet season).

The ozone in the stratosphere is beneficial in that it absorbs and blocks waves of ultraviolet (UV) light before it reaches the Earth. This radiation can be classified into three categories according to their wavelengths.

There are UV-A, UV-B and UV-C all of which are harmful to humans, however, UV-B can cause sunburn and excess exposure causes skin cancer, UV-C is the most harmful to humans. This layer absorbs UV-B in particular and it is this absorption, which creates a source of heat and forms the stratosphere itself. Hence ozone plays a vital role in temperature structure in our planet's atmosphere, thus this type of ozone is referred to as 'good ozone". It becomes "bad ozone" when it directly contacts with biological material on the Earth's surface. This is because it reacts strongly with other molecules and hence at high levels ozone is toxic to living systems, for example, forest growth, crops, and human health. Some of the harmful effects on humans include sunburn or changes in molecular DNA.

Ground based measurements of ozone started in 1956 and satellite measurements followed in the early 1970s. The hole has been developing as far back as 1976. Over two decades of study have indicated that human-produced chemicals are responsible for the depletion of stratospheric ozone. These compounds contain a variety of chemical combinations of fluorine, chlorine, bromine, hydrogen and carbon, and are called chlorofluorocarbons (CFCs). Chlorofluorocarbons were first created in 1928 for use as non-flammable, non-toxic refrigerants, and were first produced commercially in the 1930s. Together with other ozone depleting gases like methyl chloroform and carbon tetrachloride, they are being used in a variety of applications such as air-conditioning, refrigeration and cleaning of electronic components. Halocarbons, which contain carbon, fluorine, bromine and chlorine, the latter in some cases, have mainly been used as fire extinguishants.

Most people will be familiar with holes in the stratospheric ozone layer. However, another problem, which may not be so familiar, is the increase in the tropospheric ozone, which is a key component of photochemical "smog", which is a problem in many cities worldwide.

But exactly how is ozone produced? It is created in the stratosphere where ultraviolet light strikes oxygen molecules (O_2) into two oxygen atoms, which then combine, with unbroken oxygen molecules to form ozone (O_3). So since the molecular formula of ozone is O_3 remember the oxygen we breathe is O_2 so I am sure the solution that comes to mind is why not just stick another oxygen atom to O_2 and we can fix the hole in the layer. However, the ozone molecule is unstable and will split to form O_2 and an atom of oxygen when hit by ultraviolet light, so that O_3 is continuously created in the stratosphere.

So it seems that we cannot manufacture ozone and pump it in place to patch the hole but we can regulate the chemicals that produced it the first place to prevent the problem from getting any larger. One of the first moves in this direction came in January 23, 1978 where Sweden was the first country to ban aerosols containing CFCs. This action was followed by a few other countries including, Canada, Norway and the United States of America. However, after the discovery of the ozone hole above the Antarctic in 1985, the negotiation of the Montreal Protocol, CFC production was sharply limited at the start of 1987 and phased out completely by 1996.

Although the rate of ozone depletion has declined, CFCs stay for long periods in the atmosphere usually 50 to over 100 years, so that the full effect of this action will take several generations to be seen.

Therefore this simple, invisible layer of gas affects not only to our biodiversity but also to our lives and lifestyles.