

## **MODULE 19 - ENVIRONMENT AND CLIMATE CHANGE**

### **OBJECTIVES**

By the end of the session, the students will be able to know:

1. Know about the changes in climate and their causes
2. Learn about global warming , its bad impacts and control measures
3. Learn about acid rains, their causes , bad effects& control measures
4. Know about Ozone layer depletion in stratosphere it causes & bad effects and control measures
5. Learn about Nuclear accidents & Holocaust and control measures

### **SUMMARY**

This film deals with climatic changes brought due to industrialization. Global warming, Acid rains , Ozone layer depletions , Nuclear accidents and Holocaust are the major consequences of air pollutions. Their causes effects and control measures have been explained . Climatic change is the great change is the great challenge for civilized and scientifically advanced world of today.

### **TRANSCRIPTION**

#### **Climate Change, Reasons and Effects**

The climatic changes started , the moment man was born. Natural environment is different in different parts of the earth. Which parts of the earth will be forest and which part will be grassland or desert is decided by the climate. Industrialization has very important impact on climate because several unwanted gases are added to atmosphere which result is Global Warming, Acid rainsand Ozone layer depletion. Nuclear power plants using Uranium 235 as fuel lead to nuclear accidents and ultimately the loss of human lives. In 2011 there was snowfall in New York and Canada to such an extent that the people were reminded of ice age. In 2011 Japan had to face the attack of tsunami taking toll of several lives and causing great damage to nuclear power plants at places like Fukushima . The cases of skin cancer and kidney stone trouble are increasing. The cause of skin cancer being Ozone layer depletion and that of kidney stone being global warming.

The average temperature in many regions has been increasing in recent decades. The global average temperature has increased by 0.2 to 0.6 degree Celsius during the last century.

At global level the frequency of floods as well as droughts has increased due to extreme weather. Problems of human health are also increasing day by day. Cases of cataract skin cancer and kidney stone trouble are increasing. Nile delta in Egypt, Ganga and Brahmaputra delta in Bangladesh and Islands like Marshall island and Maldives are running the risk of getting drowned in future.

To a large extent the public health depends upon safe drinking water. Sufficient food , shelter and good social conditions. All these factors are affected by climate change. Climate change may affect the supply of fresh water for drinking and washing during drought as well as floods. Water can be contaminated and sewage system may be damaged. The risk of infectious diseases like Diarrhoea will increase .

### **Reasons for Climate Change**

**[1] Industrialization** – Industrialization is considered as parameter of progress and development Industries adds to the emission of green housegases like Methane ,Chlorofluorocarbons and oxides of nitrogen as well as harmful gasses like carbon monoxide and sulphur oxide. This disturbs the natural balance of air resulting in climate change

**[2] Increase in Temperature-** Industrialization urbanization and population explosion are leading to loss of forest cover.Forest trees act as water sheds and have cooling effect .Due to loss of forest cover temperature increases .For an ideal natural climate there should be 33% forest cover ,33% animals and 33% human population. By the end of 20<sup>th</sup> country forest cover has been reduced 15 to 16%.

**[3] Green House Effect** :- Gases like carbon dioxide act like glass wall of green house. It allows sunlight to reach the earth but does not allow its reradiation the result is the increase in the temperature of Erath .

### **Harmful Effects of Climate Change**

- (a) **Decrease in Agricultural Output** : Due to increase in temperature drought result which reduces agricultural output by 10 to 25%
- (b) **Crisis of Water** :Drought conditions reduce the availability of water and countries like Kuwait, Jordan , Israel and Somalia will be unable to meet out even the requirements of drinking water. According to American defense agencies water supply in California may reduce by 7 to 6%
- (c) **EffectOn Ecosystem:-** Due to climatic changes grasslands may be converted to forest and forest to grassland. Dry climate has less humidity hence litter decomposition becomes slow and mineral cycle is

affected. Increase in temperature may lead to forest fire and danger to biodiversity. The duration summer season may increase.

**(d) Disturbance in Water Cycle :-** Due to increase in temperature the ice on poles will melt, increasing water level in sea and ocean to such an extent that coastal towns may get drowned. Amount of marine water will increase.

**(e) Increase in Contagious Diseases:-** Due to increase in temperature population of the mosquito *Aedes aegypti* will increase resulting in the increase in Dengue fever cases. Malaria will also increase. In Ravanda the increase in temperature by 1 Degree Celsius. In 1960 the frequency of Malaria doubled because Malaria mosquito prefers dry climate for its breeding. Cold countries suffer from sunstroke due to hot climate. In July 1995 Chicago had to face the attack of sunstroke due to which 50 persons died.

**(f) EL – Nino & La Nina Impacts:** Due to climatic changes if the temperature of sea water rises by 0.5 Degree Celsius, it is called EL-Nino effect. EL Nino creates heat waves in Pacific ocean. Several Marine plants fish & Sea animals die. Places near sea coast face heavy storms. It is presumed that the earthquake in sea coast areas of Gujarat on 26 January 2001 was due to EL Nino effect.

La Nina effect means decrease in the temperature of coastal water. This happened in eastern shore of Pacific ocean in the year 2000-01. Several marine Animals & marine Algae died.

## **Global Warming , Effects and Control Measures**

Out of the entire solar energy being received at the earth 75% is absorbed resulting in increasing the temperature of the earth. The rest of the solar energy is radiated back to the atmosphere. Due to industrializations few greenhouse gases are added to atmosphere. These gases allow the sunrays to reach the earth but does not allow their re radiations resulting in increase in the temperature of the earth and ultimately the whole globe. This is called global warming and its cause is called greenhouse effect. The term greenhouse effect was coined by Arrhenius while the effect was discovered by Fourier in 1827. Different gases and their percentage contribution towards greenhouse gases effect is shown in this diagram.

**1. Carbon dioxide :** As shown in this diagram carbon dioxide contributes to the extent of 60 % towards the greenhouse effect. In air its percentage is 0.03% or 300 PPM. It is raw material of photosynthesis by green plants. Normally its balance is maintained through photosynthesis & respiration. Due to industrialization & deforestation its percentage has increased from 300 PPM to 368 PPM resulting in global warming.

**2. Methane :-** It is also called marsh gas and contributes towards the green house effects to the extent of 20%. It is produced during decomposition of organic substance by methanogenic bacteria, flooded rice fields and enteric fermentation in cattle. In preindustrial period it was present in air to the extent of 700 PPB (Parts per billion) but now it is 1750 PPB that means more than double. It contributes to the extent of 20% towards green house effect.

**3. Chlorofluorocarbon :-** These are nontoxic non inflammable colourless synthetic gaseous compounds of carbon and halogen. They are produced by air-conditioning, refrigeration industries, plastic foam industries and disposable glasses, cups and plate industries. Their concentrations in atmosphere is to the extent of 282 PPT (Part per trillion). They do not degrade in nature and persist in atmosphere from 45 to 260 years. Chlorofluorocarbons contribute to the extent of 14% towards greenhouse effect.

**4. Nitrous Oxide :-** It is popularly known as laughing gas. It is emitted from Nitrogen fertilizers, biomass burning, nylon production & burning live stock waste. In preindustrial era it was present in air to the extent of 270 PPB now it has increased to 316 PPB. Its contribution towards greenhouse effect is 6%.

### **Effects of Global Warming**

1. Cycle of crop plant will change. New insect pests and weeds may spread over.
2. Due to dry climate trees will be replaced by thorny bushes.
3. Glaciers on poles will melt and level of water in rivers and sea will rise. Countries like Bangladesh, Maldives may get drowned. This will be like a catastrophe.
4. El Niño effect will repeat frequently causing damage to plant, animal and human lives in places situated along sea shore.
5. Rice production will decrease by 5%. Rice is the most important staple food at world level.
6. Cases of kidney stone trouble will increase.

### **Control Measures of Global Warming**

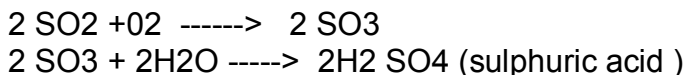
1. Fossil fuel be used in industries to limited extent so that emission of greenhouse gases is reduced.
2. Tree plantation be encouraged. Trees like Cordia allamanda be planted more because they act as sinks for carbon dioxide.
3. Limited use of Nitrogen fertilizers.
4. Chlorofluorocarbons be replaced by Hydro chlorofluorocarbons.

5. Earth hour be observed strictly throughout the world by putting off lights between 8.30 to 9.30 pm on last Saturday of march every year. This is easiest way of reduce global warming.

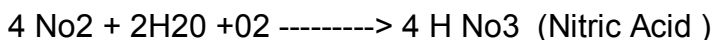
### **Acid rains, Effects and Control Measures**

When fossil fuels like coal, oil and natural gas are burnt, gases like sulphur dioxide & Nitrogen dioxide are produced. These gases move upwards in the atmosphere react with water vapour and gases like sulphuric acid & Nitric acid are formed, finally return to the ground in the form of acid rains. The word acid rain was used for the first time in 1872 by Robert Angus Smith who recorded acid rains in Manchester a place of world fame for cloth mills.

Sulphur dioxide is released from coal burning, power plants industrial boilers, smelters and petroleum refineries. It mixes with oxygen to produce sulphur trioxide which reacts with water vapour to produce sulphuric acid.



Nitrogen dioxide is produced in atmosphere during lightening in sky. It also comes out from motor vehicle exhausts & chimneys of factories. It reacts with water vapour in presence of oxygen to produce Nitric acid.



Acidity is decided on the basis of pH value. pH of normal rain water is 7 but that of acidic water is below 7. When pH of rain water is much below 5 it is called acid rains.

Acid rains are wide spread in North America, Europe, Japan, China, Canada, South East Asia.

In America coal burning in power plants contributes to about 70% sulphur dioxide. In Canada oil refineries, metal smelting & other industrial activities account for 61% of sulphur dioxide emission.

Motor vehicle exhaust fumes are the main source of Nitrogen oxides.

In India acid rains have been recorded in Vadodara, Ahmedabad, Delhi, Mumbai & Kolkata. All these are industrial cities.

Sulphuric Acid contributes up to 60 to 70% while Nitric Acid contributes to the extent of 30 to 40% towards acid rains. In 1974 acid rains in Scotland had pH 2.00, more sour than vinegar which has pH 2.4.

Snow fall in Britain is sometimes so much acidic that the snow does not melt. It is called "Pollution time bomb".

### **Effects of Acid Rains**

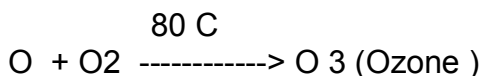
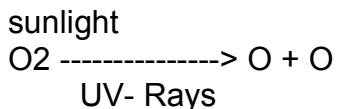
1. **Spoilage of Historical Monuments** :- Several historical monuments in Athens, Rome and London have developed cracks. In India Tajmahal Leprosy was reported. The marble become pale and soft like chalk due to sulphur dioxide fumes from methane, oil refinery causing acid rains over Tajmahal in Agra. The whole building was painted with acid proof paint involving very heavy expenses.
2. **Harm to Aquatic Life** :- Several lakes in Sweden, Norway & Canada have become unproductive. Due to death of fishes they have been converted to fish grave yards.
3. **Effect on Vegetation**:- The leaves become colorless & dry. The growth of trees is checked. In Sweden acid rains have destroyed the coniferous forest. The soil becomes acidic and non productive for crops. Nitrogen fixing bacteria are destroyed.
4. **Effect on Human Health**: Acidic water when used for drinking purposes damages kidney, bones and brain. Acid rains cause skin cancer.
5. **Spoilage of Metallic Structure** : Big boilers, fermenters and railway carriages lying in open get corroded and rusted.

### **Control Measures**

1. Coal should be washed before burning.
2. Fuel of low sulphur content be selected.
3. Along with coal lime stone be burnt in industrial chimneys. Lime stone being alkaline will reduce acidity.
4. Lime be added to Agricultural land, forest soil and lakes & ponds to reduce acidity. Addition of lime to agricultural field is called dressing.

### **Ozone Layer Depletion, Causes, Effects and Control Measures**

Ozone gas was discovered by a German chemist Christianschönbein in 1840. It is formed by the action of sunlight on oxygen -



Ozone is highly poisonous gas with fishy odour. On earth it is a very harmful air pollutant causing Asthma & bronchitis in human being. It breaks chromosomes causing genetic disorders. It also harms leafy vegetables and spoils all the articles made up of plastic & rubber.

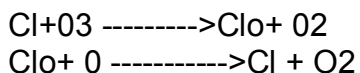
Ozone is highly useful in stratosphere or upper atmosphere from 5 to 45 kms. where it forms a protective layer called Ozone umbrella or Ozone blanket which absorbs harmful UV rays (ultraviolet rays) which damage human health by causing skin cancer and cataract. Ozone layer was discovered by two French physicists Charles Fabre & Henri Buisson in 1913.

British weather scientist G.M.B. Dobson measured the thickness of Ozone layer in DU or Dobson units.  $100 \text{ DU} = 1 \text{ mm}$ . It was noticed that the thickness of Ozone layer is decreasing. It was 225 DU in 1979 but in 1994 it was reduced to 94 DU only. The decline in Ozone layer is called Ozone hole.

### **The Causes of Ozone Depletion**

The main reason for Ozone layer depletion are colourless synthetic atmospheric gases chlorofluorocarbons (CFC). These gases are used in Air conditioning industry, refrigerator industry, foam formation industry and disposable crockery industry.

Sherwood Rowland, Maria Molina and Paul Crutzen pointed out that chlorine of chlorofluorocarbon reacts with  $\text{O}_3$  to produce chlorine oxide and oxygen. Chlorine oxide reacts with oxygen to produce chlorine & oxygen.



Thus Ozone gets converted to Oxygen and Ozone layer becomes thin. For establishing the relationship between chlorofluorocarbon & ozone layer depletion they were awarded Nobel prize in chemistry in 1995.

Jet aeroplane also produces oxide of nitrogen in its smoke which also causes ozone layer thinning. These days Australia, New Zealand, South Africa &

some parts of South America are facing the problems of ozone layer depletion.

### **Effects of Ozone Layer Depletion**

1. UV reach the earth and cause skin cancer of sun burn. About 2.2 million cases of skin cancer occur every year in the world.
2. Diseases like Measles , Chickenpox and Malaria increase .
3. Cataract
4. Loss of Vision
5. Damage to immune system
6. Susceptibility to herpes
7. Green house effect
8. Colour of paints and fabrics fades away
9. Photosynthesis in Phytoplankton's and Legumes and cabbage decreases

### **Control Measures**

At international level Montreal protocol took place on 16 September 1987 at Canada. According to this protocol use of chlorofluorocarbons has been totally banned. At that time 27 industrial countries had signed it. Now this number has gone up to 155. In place of chlorofluorocarbon, hydro fluorocarbon and hydro chlorofluorocarbon are to be used. They are slightly costly but they do not cause Ozone layer depletion. To create awareness against ozone depletion 16<sup>th</sup> September is observed world ozone day.

### **Nuclear Accidents & Holocaust**

Nuclear accidents are connected with the use of radioactivity discovered by Madam Curie who was awarded Nobel prize in 1911 in the field of chemistry . In her honour 2011 was celebrated as international chemistry year throughout the world.

Radioactive elements emit such radiations which have deep penetration power due to nuclear fission . These elements produce tremendous energy as per the following equation proposed by Elbert Einstein : -

$$E = mc^2$$

Here

E=Energy



M= Mass of nucleus of the radioactive element  
C= Velocity of light ( 186000 miles per second)

Uranium- 235 is such a radioactive elements whose nucleus is bombarded with neutrons to produce energy . 1 kilogram of Uranium- 235 gives electricity equivalent to 3000 tones of coal.

India has nuclear power plants at Jaitpur( Maharashtra ) ,Kalpakkam ( Tamilnadu) ,Narora (Uttar Pradesh) ,RavatBhata (Rajasthan) , Kaiga ( Karnataka )&Kakrapara( Gujrat ) .Six more nuclear power plants are to be installed in India . Radioactive elements after extraction of electricity leave radioactive ash whose disposal is a problem. If there is leakage , the radioactive rays spread in atmosphere causing mutation , blood cancer &thyroid cancer . MadamCurieherself died of blood cancer due to exposure to radiations . On 26<sup>th</sup> April 1986 there was explosion in nuclear power plant at Chernobyl in Russia. The radioactive dust spread over several kilometers ,31 persons died on spot ,6.5 lakh people were affected by thyroid cancer cataract and lowered immunity mechanism .

Radio activity can reach man through food chain such as -

grass -----> sheep -----> man  
( Goat )

During atomic explosion experiments strontium 90 is emitted in air. It replaces calcium of bones causing bone cancer.

In 11<sup>th</sup> march 2011, 4 out of 6 nuclear power plants in Japan were exploded due to Tsunami causing heavy losses to human lives & property.

Radioactive dust forms clouds which prevent sunlight from reaching the earth. The darkness spreads in day time and temperature also goes down resulting in nuclear winter.

### **Nuclear Holocaust**

Atom bomb was dropped on 6.8 1945 on Hiroshima and on 9.8 1945 on Nagasaki of Japan during second world war .Several buildings were destroyed .Screaming of human beings was noticed about one lakh people died .Thousand were admitted in hospital suffering from major injuries like bleeding , bone fracture or burning. The persons who survived were affected by mutations due to radiation resulting in genetic disorders and birth of crippled children. Radio activity not only damage the present generation but also the future generation. Ever today the birth of crippled children is maximum in Japan.

## **Control Measures**

1. There should be no leakage in nuclear power plants.
2. Nuclear waste also called royal waste should be diluted to harmless limits before disposal .
3. Employees working in nuclear power plants must be provided with such aprons which protect them from radio activity .
4. Atomic explosions should be totally banned .
5. C.T. B.T. (comprehensive test ban treaty) be imposed on all the countries .

## **GLOSSARY**

1. Climate - Prevailing weather conditions of an area .
2. Global Warming - Increase in the temperature of earth atmosphere .
3. Forest - Large area with trees .
4. Stratosphere - Layer of atmosphere between 5 to 45km.
5. Cataract - Progressive opacity of eye lens .
6. Kidney Stone - Deposition of calcium oxalate crystals' in kidney.
7. Delta - Triangular alluvial tract at the mouth of river .
8. Crisis - Time of acute difficulty .
9. Aedes aegypti - A type of mosquito which is vector of dengre fever virus .
10. Dengue fever - Viral infection in blood resulting in the decrease in number of platelets.
- 11 .Sun stroke - Acute prostration from excessive heat of sun .
12. Tsunami - Earth quake inside sea .
13. Fossil fuel - Coal , Petroleum & LPG .
14. Smelter - Furnace to melt metals .
15. Lighting - Flash of light as a result of discharge between clouds .

- 16. Exhaust - Expelled from engine .
- 17. Corroded - Destroyed gradually due to chemical action .
- 18. Alkaline - Neutralising acids .
- 19. Asthma - Difficulty in breathing .
- 20. Measles - Infection viral disease redact with red rashes .
- 21. Herpes - Virus infection on single nerve .
- 22. Phytoplanktons - Minute unicellular plants floating on water .
- 23. Chicken pox - Infectious disease with rash of small blisters .
- 24. Protocol - Official agreement .
- 25. Depletion - Reduction in quantity .
- 26. Holocaust - Total destruction.

### **FREQUENTLY ASKED QUESTIONS**

Q. 1 : How much has the global temperature risen in the last 100 years?

Ans. Averaged over all land and ocean surfaces, temperatures have warmed roughly 1.33°F (0.74°C) over the last century, according to the Intergovernmental Panel on Climate Change .More than half of this warming about 0.72°F (0.4°C) has occurred since 1979. Because oceans tend to warm and cool more slowly than land areas, continents have warmed the most (about 1.26° F or 0.7° C since 1979), especially over the Northern Hemisphere.

Q. 2 : What does the ozone hole have to do with climate change?

Ans. The ozone hole does not directly affect air temperatures in the troposphere, the layer of the atmosphere closest to the surface, although changes in circulation over Antarctica related to the ozone hole appear to be changing surface temperature patterns over that continent. Ozone is actually a greenhouse gas and so are CFCs, meaning that their presence in the troposphere contributes slightly to the heightened greenhouse effect. The main greenhouse gas responsible for present-day and anticipated global warming, however, is carbon dioxide produced by burning of fossil fuels for electricity, heating, and transportation.

Q. 3 : What's the difference between climate and weather ?

Ans. Weather is what's happening in the atmosphere on any given day, in a specific place. Local or regional weather forecasts include temperature, humidity, winds, cloudiness, and prospects for storms or other changes over the next few days.

Climate is the average of these weather ingredients over many years.

Q. 4 : If climate changes naturally over time, why isn't the current warming just another natural cycle?

Ans. Earth's climate does change naturally, but the current warming is not natural. Known natural causes of warming, such as the sun, have been constant in the past 30 years, so they cannot explain the warming of the past 30 years. The pattern of the current warming is also highly unnatural. For example, it is warming more at night than during the day; this is expected for CO<sub>2</sub>-caused heat trapping, because CO<sub>2</sub> works at night, whereas natural warming would be more in the day. A long list of similar patterns proves conclusively that the warming isn't natural.

Q. 5 : What is Global Warming?

Ans. Global Warming is the increase of Earth's average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from Earth. This is a type of greenhouse effect.

Q. 6 : Is the observed temperature rise due to urban heat islands?

Ans. Some weather stations are located in cities, and it is possible that changes in these cities may make the recorded temperature rise faster than the background temperature. For this reason, data from stations within 'urban heat islands' are care detrended, and their trends replaced by average trends from nearby rural stations. In other words, trends from urban stations are not used to calculate global temperature trends.

Q. 7 : What is acid rain?

Ans. Without getting into a lot of complicated chemistry, acids are substances that taste sour, such as vinegar or lemon juice. They are both weak acids. Stronger acids, such as the acid in a car battery, can be extremely dangerous because they can burn you. Acid rain refers to any precipitation, rain or snow, that's more acid than ordinary rain or snow. Acid is measured on the "pH" scale with normal rain or snow having a pH of 5.5. Precipitation with a value of less than pH5.5 is considered "acid."

Q. 8 : How does acid rain affect lakes and ponds?

Ans. In some parts of the world, the lakes are in limestone, which neutralizes acid from rain. But in other areas, including parts of the northeastern United States and eastern Canada, the lakes are in granite, which does not weaken the acid. While the acid in such lakes is relatively weak, it is enough to kill fish, salamanders, frogs and many bacteria in lakes. Tiny water plants might also die.

This is why the water in a lake that's acidic might look very pure while a healthy lake might have cloudy water because of the natural plant life thriving in it.

Q. 9 : What are the environmental effects of ozone depletion?

Ans. Biologically, UV affects terrestrial and aquatic ecosystems, altering growth, food chains and biochemical cycles. In particular, aquatic life occurring just below the surface of the water, where plant species forming the basis of the food chain are most abundant, are adversely affected by elevated levels of UV radiation. Depletion of stratospheric ozone also alters the temperature distribution in the atmosphere resulting in indeterminate environmental and climatic impacts.

Q. 10 : What are the acute health effects of radiation exposure?

Ans. •If the dose of radiation exceeds a certain threshold level, it can produce acute effects, including skin redness, hair loss, radiation burns, and acute radiation syndrome (ARS).

•In a nuclear power plant accident, the general population is not likely to be exposed to doses high enough to cause such effects.

•Rescuers, first responders, and nuclear power plant workers are more likely to be exposed to doses of radiation high enough to cause acute effects.

Q. 11 : Why does the thyroid gland need special protection after a release of radioactive material?

Ans. The thyroid gland needs iodine to produce the hormones that regulate the body's energy and metabolism. The thyroid absorbs available iodine from the bloodstream. The thyroid gland cannot distinguish between stable (regular) iodine and radioactive iodine and will absorb whatever it can.

In babies and children, the thyroid gland is one of the most radiation-sensitive parts of the body. Most nuclear accidents release radioactive iodine into the atmosphere which then can be absorbed into the body. When thyroid cells absorb too much radioactive iodine, it can cause thyroid cancer to develop several years after the exposure. Babies and young children are at highest risk. The risk is much lower for people over age 40.

Q. 12 : How can we cut global warming pollution?

Ans. It's simple: By reducing pollution from vehicles and power plants. Right away, we should put existing technologies for building cleaner cars and more modern electricity generators into widespread use. We can increase our reliance on renewable energy sources such as wind, sun and geothermal. And we can manufacture more efficient appliances and conserve energy.

Q. 13 : Is global warming a natural process?

Ans. We know that there have been many variations in global temperatures over the history of the Earth. For example, we know that the Earth has experienced ice ages. However, a wide variety of evidence indicates that the increase in global temperatures since 1800 are the result of human activities, primarily the release of CO<sub>2</sub> from burning oil, coal, natural gas, and forests. The carbon

dioxide levels today are higher than they have been at any time in the past 450,000 years. This suggests that this is more than just a natural process.

Q. 14 : What are Governments and Other Nations Doing to Reduce Greenhouse Gas Emissions?

Ans. One hundred and seventy-three nations have ratified the Kyoto Protocol, a 1997 international agreement that seeks to reduce emissions of greenhouse gases. California, Hawaii, and New Jersey have mandatory greenhouse gas reduction laws and at least 11 other states have set reduction targets, including Colorado. The European Union has committed to reducing its overall emissions to at least 20% below 1990 levels by 2020, and is ready to scale up this reduction to as much as 30% under a new global climate change agreement if other developed countries make comparable efforts. It has also set itself the target of increasing the share of renewables in energy use to 20% by 2020.

Q. 15 : Does the "ozone hole" contribute to global warming?

Ans. Stratospheric ozone absorbs energy from the ultraviolet part of the solar spectrum, heating the lower stratosphere. This part of the spectrum accounts for less than one percent of the total solar energy reaching our atmosphere. Stratospheric ozone is important because it prevents dangerous ultraviolet rays from harming plants and animals on Earth's surface, but reductions in the amount of radiation absorbed does not have a measurable impact on temperatures below.