GHG- Greenhouse Gas Emission Reduction and Ozone Depletion as per Montreal and Kyoto Protocols - Audit Course [20 Hrs].		
Sr. No.	**TOPICS**	**Required time**
1	Montreal Protocol [on Substances that Deplete the Ozone Layer] Kyoto Protocol To The United Nations Framework Convention On Climate Change and Other International Treaties Regarding Environment / Climate Change	3hrs
2	Ozone Depletion - Causes, Effect and Remedies	3 hrs
3	Global Warming Potential - Causes, Effect and Remedies	3 hrs
4	Greenhouse Gas Emission - Causes, Effect and Remedies	3hrs
5	Carbon footprint	4 hrs
6	Action Plan - Alternative -Refrigerants # e.g. R-134a	4 hrs
	Total	20 hrs

Module Overview:

 # Montreal Protocol

The **Montreal Protocol on Substances that Deplete the Ozone Layer** (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion. It was agreed on 26 August 1987, and entered into force on 26 August 1989, followed by a first meeting in Helsinki, May 1989. Since then, it has undergone eight revisions, in 1990 (London), 1991 (Nairobi), 1992 (Copenhagen), 1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), 1998 (Australia), 1999 (Beijing) and 2016 (Kigali, adopted, but not in force). As a result of the international agreement, the ozone hole in Antarctica is slowly recovering. Climate projections indicate that the ozone layer will return to 1980 levels between 2050 and 2070. Due to its widespread adoption and implementation it has been hailed as an example of exceptional international co-operation, with Kofi Annan quoted as saying that "perhaps the single most successful international agreement to date has been the Montreal Protocol". In comparison, effective burden sharing and solution proposals mitigating regional conflicts of interest have been among the success factors for the ozone depletion challenge, where global regulation based on the Kyoto Protocol has failed to do so. In this case of the ozone depletion challenge, there was global regulation already being installed before a scientific consensus was established. Also, overall public opinion was convinced of possible imminent risks.

The two ozone treaties have been ratified by 197 parties, which includes 196 states and the European Union, making them the first universally ratified treaties in United Nations history.[1]

These truly universal treaties have also been remarkable in the expedience of the policy making process at the global scale, where bare 14 years lapsed between a basic scientific research discovery (1973) and the international agreement signed (1985 & 1987). When comparing this very success story with attempts to establish an international policy on the Earth's climate or atomic energy, the entire process from a problem formulation to a global acceptance supported by a legal framework took less than a quarter of a single human generation life span.

The treaty is structured around several groups of halogenated hydrocarbons that deplete stratospheric ozone. All of the ozone depleting substances controlled by the Montreal Protocol contain either chlorine or bromine (substances containing only fluorine do not harm the ozone layer). Some ozone-depleting substances (ODSs) are not yet controlled by the Montreal Protocol, including nitrous oxide (N2O) For a table of ozone-depleting substances controlled by the Montreal Protocol

For each group of ODSs, the treaty provides a timetable on which the production of those substances must be shot out and eventually eliminated.

Chlorofluorocarbons (CFCs) Phase-out Management Plan

Hydrochlorofluorocarbons (HCFCs) Phase-out Management Plan (HPMP)

Under the Montreal Protocol on Substances that Deplete the Ozone Layer, especially Executive Committee (ExCom) 53/37 and ExCom 54/39, Parties to this Protocol agreed to set year 2013 as the time to freeze the consumption and production of HCFCs. They also agreed to start reducing its consumption and production in 2015. The time of freezing and reducing HCFCs is then known as 2013-2015.

The HCFCs are transitional CFCs replacements, used as refrigerants, solvents, blowing agents for plastic foam manufacture, and fire extinguishers. In terms of ozone depletion potential (ODP), in comparison to CFCs that have ODP 0.6 – 1.0, these HCFCs have lower ODPs (0.01 – 0.5). In terms of global warming potential (GWP), in comparison to CFCs that have GWP 4,680 – 10,720, HCFCs have lower GWPs (76 – 2,270).

Hydrofluorocarbons (HFCs)

Produced mostly in developed countries, hydrofluorocarbons (HFCs) replaced CFCs and HCFCs. HFCs pose no harm to the ozone layer because, unlike CFCs and HCFCs, they do not containchlorine. They are however greenhouse gases, with a high global warming potential (GWP), comparable to that of CFCs and HCFCs

The Montreal Protocol as it is currently in effect does not currently address HFCs, but these substances figure in the basket of six greenhouse gases under the Kyoto Protocol. Developed countries following the Kyoto Protocol report their HFC emission data to the UNFCCC; parties to the Montreal Protocol have no such obligation.

In November 2015 in Dubai, at the 27th Meeting of Parties of the Montreal Protocol, the 197 countries and other parties which participate in the Montreal Protocol agreed to begin working on an amendment to the Protocol which will reduce production and consumption of HFCs.

On 15 October 2016, negotiators from over 170 nations meeting at the summit of the United Nations Environment Programme reached a legally-binding accord to phase out hydrofluorocarbons (HFCs) in an amendment to the Montreal Protocol. The amendment has not entered into force.

History

In 1973, the chemists Frank Sherwood Rowland and Mario Molina, who were then at the University of California, Irvine, began studying the impacts of CFCs in the Earth's atmosphere. They discovered that CFC molecules were stable enough to remain in the atmosphere until they got up into the middle of the stratosphere where they would finally (after an average of 50–100 years for two common CFCs) be broken down by ultraviolet radiation releasing a chlorine atom. Rowland and Molina then proposed that these chlorine atoms might be expected to cause the breakdown of large amounts of ozone (O_3) in the stratosphere.

Their argument was based upon an analogy to contemporary work by Paul J. Crutzen and Harold Johnston, which had shown that nitric oxide (NO) could catalyze the destruction of ozone. (Several other scientists, including Ralph Cicerone, Richard Stolarski, Michael McElroy, and Steven Wofsy had independently proposed that chlorine could catalyze ozone loss, but none had realized that CFCs were a potentially large source of chlorine.) Crutzen, Molina and Rowland were awarded the 1995 Nobel Prize for Chemistry for their work on this problem.

The environmental consequence of this discovery was that, since stratospheric ozone absorbs most of the ultraviolet-B (UV-B) radiation reaching the surface of the planet, depletion of the ozone layer by CFCs would lead to an increase in UV-B radiation at the surface, resulting in an increase in skin cancer and other impacts such as damage to crops and to marine phytoplankton.

But the Rowland-Molina hypothesis was strongly disputed by representatives of the aerosol and halocarbon industries. The chair of the board of DuPont was quoted as saying that ozone depletion theory is "a science fiction tale...a load of rubbish...utter nonsense". Robert Abplanalp, the president of Precision Valve Corporation (and inventor of the first practical aerosol spray can valve), wrote to the Chancellor of UC Irvine to complain about Rowland's public statements (Roan, p. 56.)

After publishing their pivotal paper in June 1974, Rowland and Molina testified at a hearing before the U.S. House of Representatives in December 1974. As a result, significant funding was made available to study various aspects of the problem and to confirm the initial findings. In 1976, the U.S. National Academy of Sciences (NAS) released a report that confirmed the scientific credibility of the ozone depletion hypothesis.[23] NAS continued to publish assessments of related science for the next decade.

Then, in 1985, British Antarctic Survey scientists Joe Farman, Brian Gardiner and Jonathan Shanklin published results of abnormally low ozone concentrations above Halley Baynear the South Pole. They speculated that this was connected to increased levels of CFCs in the atmosphere. It took several other attempts to establish the Antarctic losses as real and significant, especially after NASA had retrieved matching data from its satellite recordings. The impact of these studies, the metaphor 'ozone hole', and the colourful visual representation in a time lapse animation proved shocking enough for negotiators in Montreal to take the issue seriously.[24]

Also in 1985, 20 nations, including most of the major CFC producers, signed the Vienna Convention, which established a framework for negotiating international regulations on ozone-depleting substances. After the discovery of the ozone hole it only took 18 months to reach a binding agreement in Montreal.

But the CFC industry did not give up that easily. As late as 1986, the Alliance for Responsible CFC Policy (an association representing the CFC industry founded by DuPont) was still arguing that the science was too uncertain to justify any action. In 1987, DuPont testified before the US Congress that "We believe there is no imminent crisis that demands unilateral regulation."[25] And even in March 1988, Du Pont Chair Richard E. Heckert would write in a letter to the United States Senate, "we will not produce a product unless it can be made, used, handled and disposed of safely and consistent with appropriate safety, health and environmental quality criteria. At the moment, scientific evidence does not point to the need for dramatic CFC emission reductions. There is no available measure of the contribution of CFCs to any observed ozone change..."[26]

The main objective of the Multilateral Fund for the Implementation of the Montreal Protocol is to assist developing country parties to the Montreal Protocol whose annual per capita consumption and production of ozone depleting substances (ODS) is less than 0.3 kg to comply with the control measures of the Protocol. Currently, 147 of the 196 Parties to the Montreal Protocol meet these criteria (they are referred to as Article 5 countries).

It embodies the principle agreed at the United Nations Conference on Environment and Development in 1992 that countries have a common but differentiated responsibility to protect and manage the global commons.

The Fund is managed by an Executive Committee with an equal representation of seven industrialized and seven Article 5 countries, which are elected annually by a Meeting of the Parties. The Committee reports annually to the Meeting of the Parties on its operations. The work of the Multilateral Fund on the ground in developing countries is carried out by four Implementing Agencies, which have contractual agreements with the Executive Committee:[27]

- United Nations Environment Programme (UNEP), through the UNEP DTIE OzonAction Programme.
- United Nations Development Programme (UNDP).
- United Nations Industrial Development Organization (UNIDO).
- World Bank.

Up to 20 percent of the contributions of contributing parties can also be delivered through their bilateral agencies in the form of eligible projects and activities.

The fund is replenished on a three-year basis by the donors. Pledges amount to US$3.1 billion over the period 1991 to 2005. Funds are used, for example, to finance the conversion of existing manufacturing processes, train personnel, pay royalties and patent rights on new technologies, and establish national ozone offices.

 # Kyoto Protocol

The **Kyoto Protocol** is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits State Parties to reduce greenhouse gas emissions, based on the premise that (a) global warming exists and (b) human-made CO_2 emissions have caused it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There are currently 192 parties (Canada withdrew effective December 2012)[4] to the Protocol.

The Kyoto Protocol implemented the objective of the UNFCCC to fight global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" (Art. 2). The Protocol is based on the principle of common but differentiated responsibilities: it puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.

The Protocol's first commitment period started in 2008 and ended in 2012. A second commitment period was agreed on in 2012, known as the Doha Amendment to the protocol, in which 37 countries have binding targets: Australia, the European Union (and its 28 member states), Belarus, Iceland, Kazakhstan, Liechtenstein, Norway, Switzerland, and Ukraine. Belarus, Kazakhstan and Ukraine have stated that they may withdraw from the Protocol or not put into legal force the Amendment with second round targets.[8] Japan, New Zealand and Russia have

participated in Kyoto's first-round but have not taken on new targets in the second commitment period. Other developed countries without second-round targets are Canada (which withdrew from the Kyoto Protocol in 2012) and the United States (which has not ratified the Protocol). As of July 2016, 66 states have accepted the Doha Amendment, while entry into force requires the acceptances of 144 states. Of the 37 countries with binding commitments, 7 have ratified.

Negotiations were held in the framework of the yearly UNFCCC Climate Change Conferences on measures to be taken after the second commitment period ends in 2020. This resulted in the 2015 adoption of the Paris Agreement, which is a separate instrument under the UNFCCC rather than an amendment of the Kyoto protocol.

References :-

UNEP [United Nations Environment Program] NEWS CENTRE

United Nations Framework Convention on Climate Change (UNFCCC)