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Legal Protection of the Ozone Layer - an Enquiry

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I: Introduction

Protection of ozone layer called for legal measures, whereby ozone layer could be protected. It points to those principles or obligations from global conventions, charters, documents and treaties which seek to protect the well-being of posterity.

Since the 1972 Stockholm United Nations (UN) Conference on the Human Environment, most of the countries, irrespective of having different political systems or levels of economic development, have shown a remarkable concern and willingness to adopt new rules and regulations to regulate environmental issues to bequeath to posterity a world worth living in.

While it is critical to credit Governments who show concern for the environment and future generations, one wonders as to what extent they have established or been in the socio-economic and political position to adopt strong binding environmental agreements that secure the interests and rights of future generations. Governments are increasingly dependent upon the interests of world markets that reap short-term benefits from free enterprise, deregulation and weak environmental agreements.

A. The Problem of Depletion of Ozone Layer

Unknown to the common man as to why one should change their use of articles in daily life, raises many questions as to what is ozone and how is it affecting life on earth? The scientists[1] claim that ozone is a trio-atomic form of oxygen having three oxygen atoms instead of the normal two (O_2), which is oxygen. It is formed naturally in the upper levels of the earth's atmosphere by high-energy ultraviolet radiation from the sun. The radiation breaks down oxygen molecules releasing free atoms, some of which bond with other oxygen molecules to form ozone. About 90%

of ozone in the atmosphere is formed in this manner between 15 and 55 kilometers above the Earth's surface-the part of the atmosphere is called the stratosphere. Hence, this is known as the "ozone layer".

Ozone is an unstable molecule. High-energy radiation from the sun not only creates it, but also breaks it down again, recreating molecular oxygen and free oxygen atoms. The concentration of ozone in the atmosphere depends on a dynamic balance between, how fast it is created and how fast it is destroyed. Depletion occurs when the balance is tipped in favour of destruction. The man-made compounds called Chloroflurocarbons (CFCs)[2] are primarily responsible for this phenomenon. The chemical composition of CFC molecule involves one carbon atom, one fluorine atom and three chlorine atoms. When the ultraviolet radiation from the sun strikes a CFC molecule, it causes one of the chlorine atom to break away[3]. This chlorine atom collides with the ozone molecules and steals an oxygen atom to form chlorine monoxide (CLO) leaving a molecule of two oxygen atoms(O_2). When a free atom of oxygen collides with the chlorine monoxide, the two oxygen atoms form a molecule of oxygen (O_2)[4]. The chlorine atom is released from chlorinemonoxide leaving oxygen (O_2) and setting the chlorine atom free to

destroy more ozone[5].

B. Importance of Ozone Layer

The ozone layer is important as it shields the planet from the harmful UV-B radiation of the sun from reaching the earth's surface. This radiation if it reaches the earth has a harmful effect on all life on earth including humanity. It is the miracle chemicals discovered by man called the CFCs (chloroflurocarbons) which are responsible for this fast depletion. Because of the upper ozone depletion and ground pollution, it is now also being found at the ground level, which is harmful too. More UV -B means more melanoma and non-melanoma skin cancers, more eye cataracts, weakened immune systems, reduced plant yields, damage to ocean ecosystems and reduced fishing yields adverse effects on animals and more damage to plastics.

II: International Human Rights

The right to healthy living has been taken to be a basic human right, which in turn has endorsed various principles at the international level. This right also embraces healthy environment as a part of the right

to healthy living. Such is the value assigned to these issues that environment, sustainable development and human rights capture the attention of international lawyers. Human rights in the context of environment and sustainable development recognise that for human communities to survive, they must have an adequate and secure standard of living; they must be protected from harmful substances and unsafe products; they must learn to conserve and equitably share natural resources. Without these environmental and public health policies in place, human rights for respect, dignity, equality, non-discrimination and the ability for the public to participate in decisions that affect their lives can not be achieved[6]. As rightly remarked by an author[7], "the general principles and prescriptions of International law are not without applicability to problems of transnational pollution or environmental degradation". The UN Conference on Human Environment held at Stockholm, 1972 can be stated to be one of the first International agreements to tackle the problem of environment degradation and an effective measure to mobilise and draw attention of the world of its degradation activity which in turn affects the right to healthy living. Prior to this the environmental problems were dealt with by instruments of international law.

III: Archives[8]

It all began in 1830's when Christian Schoenbein identifies ozone in the laboratory. In 1845 Auguste de la Rive and Jean-Charles de Marignac suggested ozone was a form of oxygen and it was confirmed by Thomas Andrews in 1856. In 1858 Andrei Houzeau found ozone present in natural air. In 1865 Jean-Louis Soret proved that ozone was O_3. In 1879 Marie Alfred Cornu measured solar spectrum and found sharp cut off in ultraviolet (UV) light. In 1881 Walter Hartley recognised cut off corresponds to UV absorption by ozone. In 1913 John William Strutt (Lord Rayleigh) showed absorption was not in lower atmosphere. In 1919 Charles Fabry made the first spectrometric measurements of "thickness" of ozone layer. In 1924 G.M.B. Dobson developed ozone spectrophotometer and began regular measurements of ozone abundance

(Arosa, Switzerland). In 1925 Jean Cabannes and Jean Dufay showed ozone was about

10 miles high. In 1928 Thomas Midgley synthesised chlorofluorocarbons (CFCs). In 1929, Umkehr method for Dobson instrument established that ozone maximum was below 15 miles altitude. In 1930, Sydney Chapman described a theory that explains existence of an ozone "layer". In 1934, Ozonesonde (balloon) measurements established the ozone concentration was maximum around 12 miles up. In 1950 David Bates and Marcel Nicolet proposed catalytic (HOx) ozone destruction. In 1957 Global network of Dobson spectrophotometers established during the International Geophysical Year (IGY). In late 1950's CFC market expanded rapidly. In early 1960's Catalytic destruction was necessary in order to explain ozone amounts. In 1960's Boeing proposed supersonic transport (SST) fleet of 800 aircraft. In 1969, Paul Crutzen discovered NOx catalytic cycle. In 1971–1974, the Department of Transportation sponsored intensive program of research, the Climatic Impact Assessment Program (CIAP). In 1971 Congress axes funded for the SST. In 1971, Johnston calculated that NOx from SST's could deplete ozone layer. In 1973, Rick Stolarski and Ralph Cicerone suggested catalytic capability of Cl. In 1973 James Lovelock detected CFC's in atmosphere. In 1974, Sherwood Rowland and Mario Molina warned of ozone depletion due to CFC's. In March, 1977, First international meeting (Washington DC) to address issue of ozone depletion held by the United Nations Environmental Programme (UNEP). In March, 1978, US banned non-essential use of CFC's as aerosol propellant. In 1978, Total Ozone Mapping Spectrometer (TOMS) was launched aboard NIMBUS-7 spacecraft giving global coverage of ozone layer thickness. In 1980's there was renewed expansion of CFC market. In October 1982, Shigeru Chubachi measured low ozone over Syowa, Antarctica (reported at Ozone Commission meeting in Halkidiki, Greece in September 1984). In 1984, British Antarctic Survey scientists discovered recurring springtime Antarctic ozone hole (published in Nature May, 1985). In March, 1985, the Vienna Convention for the protection of the ozone layer took place. In September, 1987, Montreal Protocol on Substances that deplete the ozone layer (Amendments - London 1990; Copenhagen 1992) was entered into in March, 1988, Du Pont agreed to CFC production phase out. In late 1980's, ten years of satellite data began to show measurable ozone depletion globally. In 1991, Du Pont announced phase out of CFC production by the end of 1996. In 1992/1993, an abnormally low ozone was observed globally. In mid 1990's, springtime Arctic ozone dent appeared. In January, 1996, CFC production ended in US and Europe. In 2000, Maximum CFC concentrations in stratosphere was reached and coming to the future plans, the international community decided that by 2010, CFC production would end worldwide. Further by 2030, Hydrochlorofluorocarbon (HCFC)

alternatives would be phased out. In 2040, HCFC production would come to an end world-wide. And, by 2050, the Springtime Antarctic ozone hole would disappear.

IV: The Vienna Convention

With the adoption of the Vienna Convention for the protection of the ozone layer, the foundation was laid for concerted efforts to protect the ozone layer. The Vienna Convention and its Montreal Protocol on substances that deplete the ozone layer were acknowledged and lauded as the outstanding successes and as examples to be followed for the solution of global environmental problems through global cooperation and partnership. Klaus Toeffer, in this connection pointed out:

> Though the steps that the global community took at Vienna were small compared to the challenges facing it, they symbolised a major psychological breakthrough in dealing with the threat of the depletion of the ozone layer[9].

He further observed:

The Vienna Convention helped to pave the way for the more comprehensive agreement that was to follow - the Montreal Protocol.

The Vienna Convention committed parties to protecting human health and the environment against the adverse effects of depletion of the ozone layer due to human activities. It set out broad principles of ozone layer protection, rather than establishing the detailed phase out schedule of ozone depleting substances which were later included in the Montreal Protocol in 1987. The Convention committed States to cooperate in researching the causes and effects of ozone depletion as well as alternative technologies; to cooperate on adopting legal and policy measures to counteract activities that are harmful to the atmosphere; and to facilitate the transfer of technology and transmission of information, especially to the developing countries.

Both the Convention and the Protocol allowed the parties thereto, to progress step-by-step in building ownership of the process by all the Governments, industries, non-governmental organisations and academia among others. At its adoption on 22-3-1985, the Convention was signed by 28 countries. There are now more than 173 parties to the Vienna Convention. Such response, it may be pointed out, must continue to ensure recovery of the ozone layer by the year 2050.

V: The Montreal Protocol and the Legal and Financial Mechanism

The Montreal Protocol on substances that deplete the ozone layer (MP) has been the most comprehensive and successful international environmental agreement to date. Since its creation in 1987, the Montreal Protocol has significantly evolved in response to new scientific findings on the extent of the damage of the stratospheric ozone layer. Many more chemicals have been added to the list of controlled substances under the Protocol. Strong commitments of Governments and industries all over the world have resulted in a breakthrough in the development of alternative technologies. These factors have contributed to a more stringent phase out schedule than the one first agreed upon in 1987.

A. Calculation of Control Measures

Under the Montreal Protocol, the task of estimating the control measures was called upon by first calculating the production level by:

Multiplying its annual production of each controlled substance by the ozone depleting potential specified in respect of it in Annexes A, B, C or E; and

Adding together for each group the resulting figures;

Then one has to calculate the imports and exports in accordance with the production of the country. The estimation of production is carried out by adding together the calculated levels of production and imports by subtracting its calculating level of exports as mentioned above. Also any export of controlled substance to non-parties shall not be subtracted in calculating the consumption level of the exporting party.[10]

B. Control of Trade With Non-Parties

Article 4 provides for provisions which state that:

(*a*) Every party to the Montreal Protocol shall ban the import and export of controlled substances with non-party to the protocol.

(*b*) The parties following the procedures contained in Article 10 will elaborate a list

of products containing controlled substances in Annexes A, B, Group II of C. Parties not objecting to these Annexes in accordance with these procedures shall ban within one year of the Annexes being effective, and they will not import these products from any State not a party to the protocol.

(*c*) The parties shall determine the feasibility of banning or restricting from States not party to this protocol, the import of the products produced with, but not containing controlled substances in Annexes A, B, and Group II of C. If feasible the parties following the procedures in Article 10 of the Convention elaborate in an Annex a list of such products. Parties that have not objected to the Annexes in accordance with those procedures shall ban, within one year of the Annex becoming effective. The import of those products from any State not party to this protocol.

(*d*) Every party shall discourage the export to any State not party to this protocol of technology for producing and utilising controlled substances in Annexes A, B, E and Group II of C.

(*e*) Every party shall refraining from providing new subsidies, Aid, Credits, Guarantees or Insurance programmes for export to State not party to this protocol or products, equipment, plants or technology that would facilitate the production of the controlled substances as mentioned above.

(*f*) Under the protocol if a party with respect to even one substance has agreed not to be bound by controlled measures shall be deemed not a party to the protocol.

C. Control of Trade With Parties

If a party is unable to cease production of a controlled substances other than agreed by parties to be essential. Substance for domestic consumption after the phase out date applicable to the controlled substance, it shall ban the export of used recycled and reclaimed quantities of that substance other than for the purpose of destruction.

D. Licensing - (A Control Measure)

As a means to gain control over the uses of controlled substance, it was laid down as imperative for every party to establish and implement a system for licensing the import and export of new, used, recycled and reclaimed controlled substances provided in Annexes, B, C and E of the Protocol.

After circulating this system as a law into their economies, each party shall report to the Secretariat on the establishment and reporting of the system which in its part as the invigilator of these systems. The Secretariat shall periodically prepare and circulate to all parties a list of all parties which have reported on their licensing system. The Secretariat shall then forward the information to the Implementation Committee for consideration and appropriate recommendation to the parties.

E. Developing Countries (Article 5 Countries)

The developing countries, leaving behind a certain steps than the developed

countries, are in a state of transit where they are using certain substances but a little lesser than those of the big brother i.e. the developed countries. A few provisions were made essential for the developing countries:

(1) The developing countries have been given certain grace periods and a little delay for phasing out the use of those controlled substances which are not ozone friendly and it has been further said that all adjustments and amendments shall apply to them as well after the second meeting of the parties in London in 1990.

(2) Under Article 5, the developing countries shall not exceed the level of consumption beyond that of the annual calculated level of controlled substances of certain kilograms per capita in accordance with the Annexes.

(3) When implementing the control measures set out in Articles 2-A to 2×E and Article 5, any country shall be entitled to use either the average of its annual calculated level of consumption or production inclusive or a set amount of calculated level of consumption of products of certain kilograms per capita (in accordance with Annexes A and B For A, by Year 1995–97, For B, by Year 1998-2000) whichever is lower, as the basis for determining its compliance with the control measures relating to consumption or production as the case may be.

(4) Article 5 provides that if any country is either unable to obtain an adequate supply of controlled substances or unable to effectively implement provisions of the Financial Mechanism[11], it shall notify the Secretariat who in turn shall transmit a copy of such notification to the parties which shall consider the matter in the next meeting and decide upon for an appropriate action.

(5) A meeting of the parties shall review before 1995 the effective implementation of the financial cooperation and transfer of technology to them and adopt such revisions as may be deemed necessary.

F. Assessment and Review of Control Measures

Beginning from 1990, and every four years thereafter, the Parties shall assess the control measures provided for in Article 2 and Articles 2-A to 2-H on the basis of available scientific, environmental, technical and

economic information which in one year's time before assessment shall through a panel of experts qualified in their fields shall report their conclusion through the Secretariat to the parties.

G. Reporting of Data

Each party shall provide to the Secretariat the statistical data on its production, imports and exports of each of controlled substances. In case the possible estimates of such data or actual data are not available and for the calculation of production, it shall take into account the amounts used in various fields as well as amounts destroyed by different technologies.

H. Non-Compliance

The parties at their first meeting shall consider and approve procedures and institutional mechanisms for determining noncompliance with the provisions of the protocol and for treatment of parties found to be non-compliant.

I. Research Development, Public Awareness and Exchange of Information

The parties shall cooperate, consistent with their national laws regulations and practices and taking into account in particular the needs of developing countries, in promoting directly or through competent international bodies, research, development

and exchange of information on technologies for reducing emissions. They shall explore the possible alternatives and costs and benefits of relevant control strategies as well as bring public awareness and every two years submit a summary of action to the Secretariat.

J. Financial Mechanism

The parties have established a mechanism for providing financial and technical cooperation for assistance. Under Article 5 all countries are required to meet all agreed incremental costs of such parties to enable their compliance with the control measures of the Protocol.

(*a*) Multilateral Fund

This mechanism has established a multilateral fund which shall finance all operations regarding the ODS phase out. The incremental costs include cost of transfer of technology and purchase of capital equipment. It is financed by contributions from parties who are not countries under Article 5 in convertible currency on the basis of United Nations scale of assessments and operational costs for switching over to non-ODS technologies enabling the developing countries to phase out controlled substances. This also means a multilateral, regional

and bilateral cooperation. The Fund's allocation was $240 million for 1991–93, $455 million for 1994–96, and $465 million for 1996–99. The replenishment for the three-year period of 2000-2002 was fixed at $440 million by the parties at their Beijing meeting in December, 1999. This includes $150 million for China and $82 million for India to close down their production facilities for CFCs. The Multilateral Fund has thus far disbursed over a billion dollars for capacity building and projects to phase out CFCs.

(*b*) Executive Committee

Under the Multilateral Fund the parties shall establish an Executive Committee to develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements including disbursement of resources. The parties shall decide:

(*a*) The program budget for each fiscal period.

(*b*) Percentage of contributions of individual parties.

(*c*) Disbursement of resources with the concurrence of the beneficiary party.

(*d*) Take decisions by consensus and if no consensus is reached then by a two-third majority vote of the parties present and voting, representing the majority.

The Executive Committee in discharging the responsibilities is helped by

- The World Bank.
- The United Nations Environment Programme (UNEP).
- The United Nations Development Programme (UNDP).
- The United Nations Industrial Development Programme (UNIDO).
- The Global environment facility (GEF).

These agencies work for information exchange, institutional strengthening, networking, preparation of country programmes, providing technical assistance, and investment projects with the GEF specially set for implementing projects in the developing countries.

K. Meetings of the Parties

The parties shall hold meetings at regular intervals and extraordinary meetings may

be held at times as is deemed necessary on the written request by any party. The parties in their first meeting established various panels and mechanisms as well as rules of procedure

and financial rules for the working of the matter of the Protocol. Further, in these meetings the parties shall preview the implementation of the Protocol, adjust and amend the Protocol according to the new situations and consider the future course of action. Any specialised or international agencies not party to the Protocol may be represented at meetings of the parties as observers[12].

L. Secretariat

Under the Protocol, a Secretariat is to be established for the proper functioning of its objectives and to provide and disseminate information or any other data either asked for information of all the parties. It also performs all other functions necessary for the achievements of the purposes of the Protocol as may be assigned to it by the parties.

IV. The Chemicals and Their Phase Out Schedules

The various chemicals that have been identified and brought into the fold by the panels assessing and identifying them are:

- Halo-carbons, notably Chlorofluorocarbons (CFCs) and Halons. CFC-11 remains in the atmosphere for 50 years, CFC-12 for 102 years, and CFC-115 for 1700. Halon -1301 is used primarily in fire extinguishers and has an atmospheric lifetime of 65 years.
- Carbon tetrachloride is used as a solvent and takes 42 years to break down in the atmosphere.
- Methyl chloroform (1, 1, 1-trichloroethane) is also used as a solvent and takes 5.4 years to break down.
- Hydrobromofluorocarbons (HBFCs) are not widely used, but they have been included under the Protocol to prevent any new uses.
- Hydrochlorofluorocarbons (HCFCs) were developed as the first major replacement for CFCs. It is much less destructive than CFCs, HCFCs but they contribute to ozone depletion. They have an atmospheric lifetime of 1.4 to 19.5 years.
- Methyl bromide (CH3Br) is used as a fumigant for high-value crops, pest control, and quarantine treatment of agricultural commodities awaiting export. Total world annual consumption is about 70,000 tonnes, most of it in the industrialised countries. It takes 0.7 years to break down.

- Bromochloromethane (BCM), a new ozone ozone depleting substance, that some companies sought to be introduced into the market by some companies in 1998, has been targeted in the 1999 Amendment for immediate phase out, to prevent its use.
- The parties are considering measures to prevent the marketing of new ozone depleting substances not so far covered by the Protocol.

A. Phase Out Schedule For Developed Countries

The phase out schedule for the developed countries are as follows:

- Phase out Halons by 1994;
- Phase out CFCs, carbon tetrachloride, methyl chloroform, and HBFCs by 1996;
- Reduce methyl bromide by 25% by 1999, 50% by 2001, 70% by 2003, and phase out by 2005; and
- Reduce HCFCs by 35% by 2004, 65% by 2010, 90% by 2015, and 99.5% by 2020, with and 0.5% is permitted for maintenance purposes only until 2030.
- Phase out HBFCs by 1996 and immediate phase-out of BCM immediately.

B. Developing Countries Have A Grace Period

The developing countries have a grace period before they must start their phase out schedules. This reflects the recognition that developed countries are responsible for the bulk of total emissions into the atmosphere and that they have more financial and technological resources for adopting replacements. The schedule for developing country are as follows:

- Phase out HBFCs by 1996 and immediate phase out of BCM.;
- Freeze CFCs, Halons and carbon tetrachloride at average 1995–97 levels by 1-7-1999, reduce by 50% by 2005, 85% by 2007 and phase out completely by 2010;
- Freeze methyl chloroform by 2003 at average 1998–2000 levels, reduce by 30% by 2005, 70% by 2010, and phase out by 2015;
- Freeze methyl bromide by 2002 at average 1995–98 levels, reduce by 20% by 2005, and phase out by 2015; and
- Freeze HCFCs by 2016 at 2015 levels and phase out by 2040[13].

VI: India's Commitment

A-Institutional Framework

The Government of India has entrusted the work relating to ozone layer protection and implementation of the Montreal Protocol to the Ministry of Environment and Forests (MOEF). The MOEF has set up an Ozone Cell as a national unit to look after and to render necessary services to implement the Protocol and its ODS phase out programme in India.

The MOEF has also established an Empowered Steering Committee, which is supported by four Standing Committees, namely, the Technology and Finance Standing Committee, Standing Committee for Small Scale, Tiny and Unorganised industries, Standing Committee on Implementation of ODS phase out projects and Monitoring and Evaluation Committee. The Empowered Steering Committee is responsible for the implementation of the Montreal Protocol provisions, review of various policies and implementation options, project approvals and project monitoring.

B-Regulatory Framework

India has provided for protection and improvement of the environment in its Constitution. Article 21 provides the basic right to live the right to a healthy living by keeping our environment healthy and clean. Article 51(*g*) of the Constitution says that it is the duty of every citizen of India to protect and improve the natural environment including forest, lakes, river and wildlife and to have compassion for living creatures. The constitutional provisions are implemented through environment protection laws of

the country. In the recent past, the Honorable Supreme Court of India has ordered initiatives for protection of environment and prevention of pollution. This order can be passed based on public interest litigation. The Environment Protection Act, 1986 empowers the Central Government to protect and improve the environment and prevent, control and abate environmental pollution.

The Regulations and Controls relating to ozone layer protection namely, Ozone Depleting Substances (Regulations and Control) Rules, 2000 have also been issued by the Central Government under the Environment Protection Act, 1986.

C- India's Commitment

(i) India's Country Programme

The Executive Committee, at its 32nd meeting, adopted a strategic framework for the MLF in view of the compliance period

started with effect from 2001. Accordingly under Article 5 countries were advised to revise the country programme and to prepare the national strategies for complying with provisions of the Montreal Protocol obligations.

The UNDP is the implementing agency and assisted in preparing an up-to-date country programme.

A draft country programme update has been prepared based on the following information on the informations provided by the States:

- Country Programme - 1993.
- Article 7 data and sectoral data under Country Programme Progress Report.
- Implementation of individual and group projects approved by the Executive Committee during 1993–2000.
- Terminal project in foam, aerosol, commercial refrigeration.
- National CFC Consumption Phase out Plan (NCCoPP).
- National CFC Production Phase out Plan.
- National CTC Production and Consumption Phase out Plan
- Ozone Depleting Substances (Regulation and Control) Rules, 2000 and its amendments

Over the past twelve years since the approval of India's original country programme for Phase out of ozone depleting substances in 1993, India made significant progress in controlling the production and consumption of ODS. From a consumption level of 10,370 MT of ODS in 1991, the unconstrained demand was forecasted at about 96,000 MT by 2005. The consumption of these substances by end-2004 was only about 9000 MT annually. These reductions were achieved with technical and financial assistance from the Multilateral Fund and implementing agencies and due to proactive policy actions by Government of India.

(*ii*) Status of ODS Phase out in India

Sector-wise Approved Projects as on 31-8-2007

No.	Sector	No. of Projects	Grant Amount (US$)	Chase out of ODP (in Tonnes)
1.	Aerosol	27	3,227,739	689
2.	Foam	159	34,785,641	4373
3.	Halon	18	2,458,701	2162
4.	RAC	49	32,254,823	3203

5.	Solvent	41	66,178,980	12,966
6.	Production Sector	2	90,750,000	22,988
	Total	296	229,655,884	46,381

It is interesting to note that Halon Production Sector Phase out in India. The Executive Committee of the MLF approved US $2.6 million for phasing out halon production and remaining consumption of halons. The enterprises producing halons have dismantled their production plants and rendered them incapable of producing halons.

Industry Structure

There was a wide variety of firefighting technologies in India, identified at the time of preparation of the original Country Programme, such as ABC powder, aqueous systems, CO_2-based and foam-based systems, etc. There were about 200 manufacturers of firefighting equipment, of which over 85% were manufacturers of portable fire extinguishers. Halons, which are potent ODS, were used in about 5% of the firefighting applications.

As of 1991, there were two manufacturers of Halon-1211 and Halon-1301, although their manufacturing facilities were very recently installed. The total installed production capacity was 500 MT. A few manufacturers of Halon-based fire extinguishers were identified.

ODS Consumption

In 1991, the total consumption of Halons in India was 750 MT equivalent to 3650 ODP MT. This constituted 7.2% of India's total ODS consumption and almost 28% of the total ODP consumption. Imports accounted for 550 MT of the total, while 200 MT was indigenously produced. The growth rate in this sector was forecast at 15% annually.

Technology

As noted earlier, the use of halons in firefighting constituted about 5% of the firefighting applications in India. There were no drop-in replacement technologies identified. The alternative technologies identified were ABC powder, inert gases, aqueous systems, CO_2-based systems, fast-response sprinklers, etc. Among the priority actions identified to address the ODS phase out in this sector were:

- Revision of national fire extinguisher codes and standards to promote halon alternatives.
- Halon conservation programme to limit emissions.
- Feasibility of a Halon management programme including halon banking.
- Evaluation of essential uses of halons particularly in the defence sector.

Foam Sector Phase out Project

The Executive Committee of the Montreal Protocol at its 37th meeting held in July,

2002 approved the foam sector phase out plan at a total funding level of US $5,424,577 to phase out 612 ODP tons of CFC-11 by 31-12-2006. UNDP is responsible for implementation of this project. A total of 6 foam manufacturing enterprises under this sector plan have been endorsed for implementation of ODS phase out activities.

Commercial Refrigeration Sector Phase out in India

The Executive Committee of the Montreal Protocol at its 38th meeting held in November, 2002 approved the Commercial Refrigeration Sector (manufacturing) phase out plan at a total funding level of US$3,609,186 to phase out 535 ODP tons of CFC-11 by 31-12-2006. UNDP is responsible for implementation of the commercial refrigeration component and UNIDO is responsible for implementation of the transport refrigeration sub-sector under this sector plan. A total of 144 enterprises engaged in activities for commercial and transport refrigeration have been endorsed for phase out of CFC-11 and CFC-12 by 2006.

National CFC Consumption Phase out Plan

The project's main scope is on training of refrigeration servicing technicians in servicing refrigeration and air-conditioning equipment based on ODSs and non-ODs alternatives. It also covers training for Mobile Air-Conditioning (MAC), Open Type Compressor (OTC) and specifically targets the Railways as a key institutional user of CFC refrigerants. The project adopts a multi-prolonged approach to achieve its targets. In addition to training, it includes equipment support, awareness building and information dissemination, and capacity building of customs officers on illegal ODS trade.

The Executive Committee of the Montreal Protocol at its 42nd meeting held in March 2004 approved the commercial refrigeration sector (manufacturing) phase out plan at a total funding level of US $6.388 million to phase out 1502 ODP tons of CFCs by 31-12-2009. The Government of Germany is responsible for implementation of this project as the lead implementing agency. The Government of Switzerland is responsible for training activities and UNDP is responsible for procurement of equipment. UNEP is responsible for creation of awareness. Besides, UNEP is organising customs and policy training activities in collaboration with National Academy for Customs, Excise and Narcotics (NACEN). A total of 144 enterprises engaged in activities for commercial and transport refrigeration have been endorsed

for phase out of CFC-11 and CFC-12 by 2006. This project is scheduled to end by 31-12-2009.

National CTC Phase out Plan

The Executive Committee of the Montreal Protocol at its 40th meeting held in November/December 2003 approved the CTC National Phase out Plan at a total funding level of US $52 million to phaseout 11535 ODP tons of CTC production and 11525 ODP tons of CTC consumption by 31-12-2009. This Includes US $10 million under the bilateral assistance programme with the Governments of Germany, France and Japan are contribution US $2 million, US $3 million and US $5 million respectively.

Out of the total funds, US $28.5 million will be utilised for CTC production phase out, US $21.5 million will be utilised for CTC consumption phase out and US$ 2 million will be made available for technical support of project management. The World Bank is the lead Implementing Agency. The Governments of Germany, France and Japan and UNIDO are cooperating agencies for implementation of the National CTC consumption

phase out activities. Besides, UNDP on behalf of Government of Japan is responsible for executing conversion activities in large and medium metal cleaning sub-sector.

Aerosol Sector

Aerosols are widely used in several applications involving propellants including perfumes, shaving foams, insecticides, pharmaceuticals, paints and inhalers. Twenty-three projects have been supported covering 44 enterprises to phase out CFC-11 and CFC-12 in this sector. India is preparing the transition strategy for metered dose inhalers, with assistance from UNDP. One of the best examples of successful change over to alternatives has been the case of a pharmaceutical firm which has entered into an agreement to supply CFC free inhalers overseas. The non-ODS alternatives proposed for this sector include destenched liquid petroleum gas particularly for the industrial aerosol sector. Hydrocarbon Aerosol propellants (HAPs) are proposed for other applications. This complicates issues related to consistent availability of non-ODS alternatives and associated costs.

Year	CFC agreed production target
1999	22,588 MT
2000	20,706 MT
2001	18,824 MT
2002	16,941 MT

2003	15,058 MT
2004	13,176 MT
2005	11,294 MT
2006	7,342 MT
2007	3,389 MT
2008	2,259 MT
2009	1,130 MT
2010	0 MT

CFC Production Sector Phase out in India

CFC-11, CFC-12 and CFC-113a. are to be phased out. Production is controlled through a production quota allocated to each producer every year. The Ozone Cell conducts audits twice a year to monitor the production. CFC has been completely phased out as on 1-8-2008.

VII. Conclusion:

The Montreal Protocol on the depletion of the ozone layer was action oriented. Although analyses of and reflection on the technology transfer and providing financial assistance was a part of the Protocol, the goal was to change and optimise the existing situation by which depletion of ozone could be stopped. The Vienna Convention provided the framework on the basis of which action was brought and paved way for taking measures for healing the ozone layer. To increase its effectiveness, development of regional innovation strategy was undertaken in partnership with the main regional actors concerned. The success of the Montreal Protocol depended, therefore, heavily on the project promoters and the various agencies and their ability to motivate people, to acquire political support and to build consensus on a common regional innovation strategy.

The Government intervention of all countries in the world helped to succeed in taking up implementation of the provisions with particular requirements being dealt with having special measures taken up for such concerns. This has helped the Protocol being made a success story over other agreements at the international level. The evidence being given and sustained by scientists along with the scientific findings led to important issues being dealt by all countries at the regional as well as the international level, who played an important role as a facilitator to promote the regional innovation system. This has demonstrated furthermore the conditions under which this role was be shaped.

The signing of the Montreal Protocol meant that significant cutbacks in ozone depleting substances had become a strategic business necessity. Industrial leaders' recognition of this fact may in part have

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been simply an acknowledgement of the legal reality of the Protocol but there is ample reasons to believe that their support of the Protocol was based on an understanding of the science as well. Given the existence of this sort of consensus, undertaking the kind of organisational changes needed to eliminate ODSs followed. Participation in the ozone protection effort became a basis for career advancement and a source of personal pride for individuals within companies. Firms found that by redesigning processes to reduce their need for ODSs, they could realise previously unforeseen productivity gains, as was discovered that printed circuit boards could be manufactured without having to clean off soldering residues with a CFC solvent[14]. Thus the above discussion shows that India is making important contribution in phasing out the use of ozone depletion substances. It is a lesson for the developed world.

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1. Glossary of ozone Protection Terms: UNEP, DTIE Ozone Action Programme.

2. Commonly called chlorofluorocarbons.

3. CFCL3+UV−B=CFCL2+CL.

4. CL+O3=CLO+02.

5. CLO=CL+O (Leaving chlorine atom to destroy more ozone).

6. A. Karim Ahmed, *Environment Protection, Public Health and Human Rights*. A Report prepared for Science and Human Rights Programme of the American Association for the advancement of Science (Global Children's Health and Environment Fund, National Council for the Science and the Environment, Washington, 2003).

7. Cecil, J. Olmstead, "Prospects for Regulation of Environmental Conservation under International law" in *The Present State of International Law and other Essay's*, (1973), p. 245 at p. 246.

8. www.albany.edu/faculty/rgk/atm101/o3histor.htm.

9. Executive Director of the United Nations Environment Programme (UNEP).

10. Montreal Protocol Document.

11. Article 10, Montreal Protocol.

12. In accordance with rules of procedure of the Protocol.

13. May 1999, Press backgrounder.

14. Iman and Lichtenberg, 1993; Wexler 1996a.