ECO-COOL™

BULLETIN FOR REFRIGERATION TECHNICIANS

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OLD PRACTICES

ENVIRONMENTALLY FRIENDLY GOOD SERVICING PRACTICES

UNEP Published under contract with UNEP for NCCoPP

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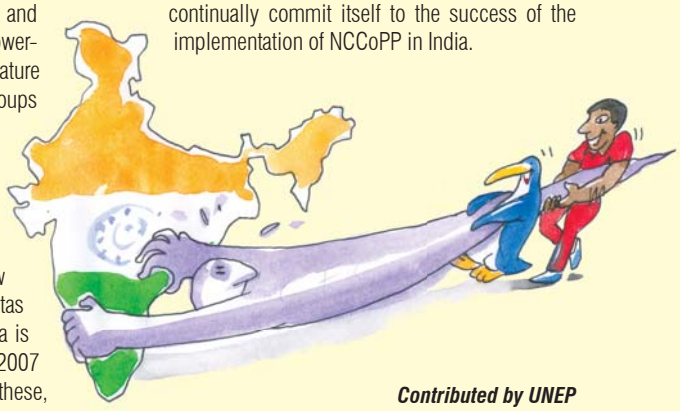
Editorial

From UNEP's perspective and experience in working in servicing sector in various countries, with 50% phaseout having been achieved, the future holds many challenges for the Indian stakeholders, namely the thousands of refrigeration technicians. The phase-out of CFCs in the refrigeration and air-conditioning servicing sector has its own unique characteristics and challenges that national partners need to recognise and address:

- Phase-out will depend on the longevity of use of refrigeration and air conditioning equipment. This is unlike manufacturing industry where ODS phaseout happens soon after the process conversion is complete. Further, a unique feature of this sector is conversion to multiple refrigerant alternatives e.g., HFC-134a, Hydrocarbon, blends etc. for specific applications. This poses special challenges to the servicing technicians.
- Some of the equipment lasts for more than 20 years primarily due to their robust design and use for limited storage applications. This implies that there would be many left over equipment as of 31 December 2009. This may need to be serviced using ODS or technically feasible non-ODS drop-in substitutes. Else, premature retirement or stoppage of use would have socio-economic implications.
- Wide and dispersed presence of service agencies and many of them in the informal sector is compounding the challenges in India. The challenge of the technology change is to create awareness on the alternative technologies for phasing out ODS in servicing sector and also provide training / equipment support to facilitate technology adoption to such dispersed workforce.
- Public at large is still not very aware of ODS phaseout and its implications. As a result, there is a market for "second hand" domestic refrigerators. Typically, these equipment move from urban centres to semi-urban and rural areas predominantly to the lower-income group families. Premature retirement of equipment for these groups of people proves to be more costly than others. This challenge needs to be squarely addressed by the national stakeholders in India.

UNEP also recognises challenge for India in two other major areas: a) how to monitor and verify consumption quotas from 2006-2010; and b) whether India is comfortably poised for achieving the 2007 target of 85% reduction. To address these, specific regulatory initiatives need to be put in place by India to achieve compliance with the specified consumption levels. This could imply monitoring of stockpiles as well as mechanisms to put in place to supply restrictions on CFCs in the local market. India may also consider development and implementation of a mechanism for consumption sector quotas.

These challenges have been recognized by the Government of India and with support from industry, technical experts and implementing agencies, India has defined a roadmap under NCCoPP for facilitating smooth phaseout in this challenging sector. By jointly working with other stakeholders, UNEP would continually commit itself to the success of the implementation of NCCoPP in India.



Contributed by UNEP

NCCoPP contributes to CFC Phase-out

NCCoPP contributes to the phase-out of CFCs in the RAC servicing sector by 2010 through:

- Targeting CFC-Consuming RAC servicing sector firms
- Encouraging good servicing practices for CFC-based appliances
- Training the servicing sector technicians in handling new non-CFC technologies

NCCoPP 2-day practical training programmes scheduled from 2005 to 2009 propose to cover:

- CFC and ODS phase-out processes
- Servicing new HFC-134a and HC-based refrigerators and other commercial appliances, including retrofitting
- "Recovery & Recycling" (R&R) of CFC refrigerants
- Updates on technology and market changes, appropriate tools/equipment
- Best Practices in servicing of Mobile Air-Conditioning (MAC)
- Retrofitting, review of retrofit options and good servicing practices for large commercial appliances using open-type compressors.

All domestic and commercial Refrigeration Servicing Enterprises can apply for training. Specialised 1 day training workshops will be held for MAC service enterprises. All training contacts are on page 7.

Technicians Corner
What you say to us Q and A

Why is there no life period mentioned against HC gas? *

Hydro Carbon (HC) refrigerants are natural substances with a very short lifetime in the atmosphere. This lifetime could be of the order of a few months as compared to the lifetime of 100 years or more for CFCs. In the atmosphere HCs breakdown into water and carbon dioxide. Although carbon dioxide is a global warming gas the amount of HC refrigerant released out of a system is so small that its warming effect is negligible. HC refrigerants have a Global Warming Potential (GWP) of less than 4 as compared to 8500 for CFC12, 1300 for HFC134a and 1700 for HCFC 22. HC refrigerants have an Ozone Depleting Potential (ODP) of Zero like HFC 134a as compared to 1.00 for CFC 12 or CFC 11.

** This question has been asked by a technician during an NCCoPP training programme*

Good Servicing Practices (GSP)

A Review of Some Existing and Good Servicing Practices

Eco Cool has, in the past, brought out in fairly great detail in seven issues, the steps involved in Good Servicing practices. Good Servicing Practices (GSP), apart from delivering a thoroughly well done job, is also key to reduce emissions of refrigerants.

In this issue, we examine the advantages of using GSP not only to reduce emissions, but also as a Win All instrument. Here are some of the advantages of GSP in servicing :

(a) Generates the best possible performance from the appliance/machine being serviced and also ensures reliable working and long life of the appliance.

(b) Ensures minimal returns from customers for rework due to customer dissatisfaction. This enables protection of the profits earned by the servicing entrepreneur.

(c) Enhances customer/user satisfaction and reputation of the servicing firm/technician as being reliable and quality conscious and paves the way for growth in volume of business and profitability.

Surely, no servicing firm/technician would object to any of the above mentioned advantages of GSP. Yet, despite the large number of training workshops that have been conducted under the auspices of HIDECOR earlier and now under NCCoPP, many servicing firms /technicians continue to follow practices that cannot be called GSP, thereby putting the environment, themselves and their customers at needless risk. What are the likely factors that cause them to not adopt GSPs? Some of these factors, based on comments and feedback from servicing firms/ technicians, are listed below:

(1) We have been in the business for ages and though the servicing practices we follow may not be termed as GSP, we have survived and grown through all these years. Surely, there is no need to change these practices for the GSP that is now being touted.

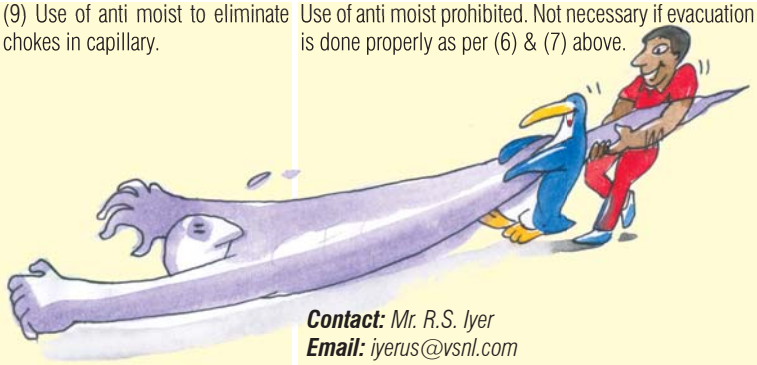
(2) GSP need a certain level of tools and equipment that we cannot afford. Why invest in these tools and equipment when we are able to do our work in our own way with our existing tools and equipment and keep appliances running.

(3) During the busy season, the pressure on us for repairs is so great that there is just no time to follow GSP.

We shall address each of these factors and try and provide convincing answers that should encourage technicians to follow GSP. In this issue, we shall address the first factor, namely the reliance on old practices as opposed to following GSP.

A comparison of existing and GSP has been made in the form of a table and the advantages of GSP has been explained in some detail. It is hoped that this will convince even die hard proponents of existing practices:

OLD PRACTICES	GOOD SERVICING PRACTICES (GSP)	WHY GSP?
(1) Refrigerant not recovered but emitted to the atmosphere.	Refrigerant recovered either by passive or active means in a recovery cylinder for reuse/recycling	Recovery protects environment from ozone depletion and/or global warming. Saves refrigerant cost for the service provider.
(2) Nitrogen not used for flushing/ cleaning. If flushing is done, it is done with refrigerant or air.	Dry nitrogen at less than 5 bar effectively flushes the system and also absorbs the moisture present.	Use of refrigerant for flushing is costly and also harmful for the environment. Use of air is also bad as it brings in atmospheric moisture and oxygen into the system, both of which are damaging for the system. Nitrogen is an inert gas that also absorbs moisture in the system.
(3) Use of blow-lamps for debrazing and brazing.	Use of the following in the order of preference: (a) Oxy- Acetylene (b) Oxy- LPG (c) Use of propane or butane or special gases in small portable torches. (d) Use of special swirl jet torches with LPG. Ideally a continuous sweep of Nitrogen gas inside the tubes during brazing is recommended.	Blow-lamps do not produce the right temperatures for brazing and have to be used for a long time resulting in poor joints and large scale formation of black copper oxide scales inside the tube which later cause capillary chokes. Nitrogen sweep helps in the prevention of black copper oxide scales whilst brazing. Results in better quality brazed joints with less risk of leakage. Helps in reducing rework costs and also emissions in the event of leaks.
(4) No checks done for chokes at capillary – filter drier joints.	Use of nitrogen to check this after brazing helps clearing these joints for chokes	This check is worth doing to prevent rework and extra cost.
(5) Leak testing either not done or done with refrigerant at standing pressure, or often with compressed air.	Leak test done with dry nitrogen at 10 bar	Use of refrigerant at standing pressure (5 bar in case of R12 or 134a) is hardly adequate for leak testing. Secondly, refrigerant when used for leak testing is emitted to the atmosphere, which apart from being expensive is also damaging for the environment. Use of compressed air is bad for the system as it brings in moisture and oxygen. Oxygen at high pressures should not come in contact with compressor oil as it can form an explosive mixture and also lead to oil decomposition. The use of dry nitrogen is therefore the best practice for leak testing.
(6) Evacuation of the system done using the system compressor itself (commonly referred to as self vacuuming) or by using an old refrigeration compressor as a vacuum pump.	Use of a two stage oil sealed rotary vacuum pump for drawing a deep vacuum of about 500 microns that extracts most of the moisture and air existing in the system.	Use of the system compressor not only results in reaching a vacuum level that is not deep enough to extract all the moisture and air but is also not good for the life of the system compressor. Use of an old compressor as a vacuum pump also does not help in pulling a deep vacuum (it can reach only about 60,000 microns or 80 millibars absolute).

(7) Level of vacuum reached during evacuation either not measured using an electronic vacuum gauge (that measures in microns or millibars or pascals) OR Measured using a compound gauge that measures vacuum as 0 to -30" over a small range of the dial. OR Vacuum pump run for a fixed time (say 30 minutes) without measuring the vacuum achieved.	Use an electronic pirani or thermocouple gauge that measures vacuum in microns or millibars or pascals right down to the desired level of 500 microns or lower, check for vacuum holding and retaining the vacuum for about 30 minutes.	It is absolutely necessary to measure the level of vacuum reached so that one is sure that the desired level has been reached that will extract most of the moisture and air. A compound gauge has a resolution of say 1" which is the equivalent of about 25,000 microns and cannot read accurately below this whereas it should be possible to read down to 50 microns. So, one can never be sure as to whether the necessary level of vacuum has been reached using a compound gauge. For effective evacuation it is necessary to reach the vacuum levels targeted and also hold the vacuum for about 30 minutes. Merely depending on time alone is inadequate without knowing that the vacuum pump is functioning properly and is achieving the desired level of vacuum.
(8) Charging refrigerant by feel or pressure.	Charging refrigerant by weight.	Charging by feel or pressure can result in under or over charging of the refrigerant which causes poor performance of the appliance. Charging by weight (i.e. the weight in grams defined by the OEM and indicated on the nameplate) ensures performance closer to what was intended by the OEM.
(9) Use of anti moist to eliminate chokes in capillary.	Use of anti moist prohibited. Not necessary if evacuation is done properly as per (6) & (7) above.  ***Contact:*** *Mr. R.S. Iyer* ***Email:*** *iyerus@vsnl.com*	Anti moist is a chemical which reduces the freezing point of water and prevents formation of ice crystals in the capillary. This is used when evacuation is not done properly leaving behind sufficient moisture that freezes to form ice crystals. This behaviour is more pronounced in R12 systems because of the poor solubility of moisture in R12. As opposed to this, R134a has a large capacity for moisture absorption and capillary choking due to ice crystals may not be observed. So such systems may not be subjected to anti moist treatment but left with large quantities of moisture that will cause oil decomposition and capillary chokes later. Anti moist is also bad for the motor insulation as it causes its breakdown. The key to avoid all this is to evacuate the system properly as defined in (6) & (7) using the right vacuum pump and electronic gauges.

Newsflashes from NCCoPP

a. Update: Equipment Support Scheme (ESS)

The ESS scheme implemented over the last 2 years, continued to be active in the past one year. The scheme has covered 3 phases over this period and is currently at various stages in each of these phases. Here's a brief update on the current status of the scheme in all phases:

ESS Phase 1 (2004-05): Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry

The first phase has been successfully accomplished. Equipment distribution is completed in the three states, with totally 138 equipment packages having reached the short-listed RSEs. The table below provides a summary of equipment distributed in each of these states.

Details of equipment allotted and distributed:

State	Package A	Equipment Distributed	Package B	Equipment Distributed	Total Equipment Allotted	Total Equipment Distributed
Andhra Pradesh	37	37	19	14	56	51
Karnataka	31	31	7	7	38	38
Tamil Nadu & Pondicherry	44	44	5	5	49	49
Total	**112**	**112**	**31**	**26**	**143**	**138**

ESS Phase 2 (2005 – 06): Maharashtra, Gujarat and Kerala

Under Phase 2, the scheme is in full swing, with distribution of Package A having started off and over 65 equipments being distributed. RSEs who have opted for Package B should also be receiving their equipment shortly. The table below provides the current distribution status.

Details of equipment allotted and distributed:

State	Package A	Equipment Distributed	Package B	Total Equipment Allotted	Total Equipment Distributed
Maharashtra	87	9	21	108	9
Gujarat	43	43	11	54	43
Kerala	17	17	4	21	17
Total	**147**	**69**	**36**	**183**	**69**

ESS Phase 3 (2005-06): Chandigarh (Uttaranchal, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir), Uttar Pradesh, Rajasthan and New Delhi

ESS workshops have been held in all these states and Expressions of Interests (EOIs) have been collected. Based on the EOIs collected, the process of short-listing RSEs has been completed. The short-listed RSEs will be intimated soon regarding collecting their equipment. The table below gives the number of EOIs collected in each of the Phase 3 states.

Number of EOIs Received:

State	EOIs
Chandigarh	264
Uttar Pradesh	71
Rajasthan	134
New Delhi	36
Total	**512**

B. Mini Reclamation Centers

Reclamation of Recovered Refrigerant

Reclamation is the processing of the recovered (used) refrigerant by means of various processes including distillation. The resulting quality of reclaimed refrigerant is similar to the virgin (pure) refrigerant. The reclamation process is far better than the recycling of refrigerant in which only some of the contaminants like particulates, moisture and oil are removed from the recovered refrigerant up to a certain extent. The use of recycled refrigerant is usually recommended in the same appliance/equipment from which the refrigerant was recovered to avoid cross contamination. As the reclaimed refrigerant is equivalent to the virgin refrigerant, it can be used in any equipment or appliance. Care has to be taken to avoid mixing of different refrigerants during recovery, storage and the reclamation progress.

Why Reclamation?

As we all know, commonly used refrigerants like CFCs (R-12, R-502) and HCFCs (R-22) deplete Ozone in the stratosphere and thus their production/ consumption is being phased out under the international agreement, the Montreal Protocol. The use of CFCs in manufacturing of new refrigeration and air-conditioning appliances/equipment has already been banned in India since January 2003. The production of CFCs is also decreasing gradually to meet the total phase out by January 1, 2010. The availability of CFCs even beyond January 2007 will be scarce, as the production will reduce to 15% of the base line production in the country. The price of CFCs in the near future is expected to rise substantially. The recovery, recycling and reclamation processes will provide the most cost effective solution to the question of availability of these refrigerants for servicing, to keep the existing equipment in operation even beyond 2010. The reclamation process, which provides a quality refrigerant as well as the flexibility of use in any equipment/appliance, appears to be the best option.

Mini Reclamation Centers

For the first time in India, NCCoPP has introduced Mini Reclamation Centers, one in North (Chandigarh) and another in South (Bangalore) on a pilot basis, to gain experience and assess the requirement in the country. Each of these centres is equipped with refrigerant reclamation unit (as shown in the image). These units can be used for reclamation of R-12, R-22, R-502, R-134a, R-404A, R-407C and R-410A.

How a Reclamation Machine Works?

Refrigerant can be taken into the system as either vapour or liquid. It is taken to high temperature and high velocity using the heat of compression and the heat from the compressor discharge. It then enters a large, unique separation chamber, where the velocity is reduced to near zero. During this phase, copper chips, carbon, oil, acid, water and all other contaminants drop to the bottom of the chamber, from where they can be removed during the "oil out" operation. The distilled vapour, at high temperature, rises and passes from the separation chamber to the compressor, the tube in tube heat exchanger, then to the air-cooled condenser where it is converted to liquid. The liquid passes into the on-board storage chamber. Within this chamber, an evaporator assembly including thermal expansion valves that correspond to the type of refrigerant, sub-cools the liquid to 20 to 40° F (- 6.7 to 4.4° C) during the CHILL operation. A pair of replaceable Filter/Driers in the circuit removes any remaining moisture while finalizing the cleaning process. This machine is able to purify about 80kg of used refrigerants per hour.

How to Avail Benefits of Reclamation Centres?

The refrigeration technicians/enterprises, who are involved in servicing of refrigeration appliances can recover and store the respective refrigerants in separate cylinders. The recovered refrigerant can be taken to reclamation centres and purified for reuse by paying the processing charges. This will not only protect the environment, but it will also benefit the individual technician/ enterprise, who will be able to save a substantial amount, which otherwise they would have to pay for buying new refrigerant.

Contact: *Prof. R.S. Aragwal*
Email: *rsarwal@mech.iitd.ernet.in*

Invitation for Expression of Interest

NCCoPP is in the process of setting up additional Mini Reclamation Centers all over the country. Expression of Interest is invited from suitable companies and operators. NCCoPP will fund the major part of the procurement cost for the Mini Reclamation Centers. For more details refer to the NCCoPP website at the following link ***(http://www.nccopp.info/reports/itpi%20eoi.doc****).*

Interested parties contact:
GTZ India, *Smita Vichare*
Tel: 011- 26611 021

For Established Mini Reclamation Centres please contact:
Mr. Anshu Kumar, ***Tel:*** 0172-273 5163
Mr. C. J. Mathew, ***Tel:*** 080-2529 9325

Reclamation Unit

Internal view of Reclamation Unit

c. Technicians Trained

The last year (2005-06) was productive for the training component as a total of 2160 technicians received training, a number exceeding the initial target for that year. Different types of training such as MAC ToT, training cum meet for the railways, demo cum retrofitting for the Open Type Compressor (ice candy machines) were introduced this year. Summarized below are the various training programmes held and the number of technicians trained in each of the categories in the past 2 years.

Upcoming RSE Training Programmes

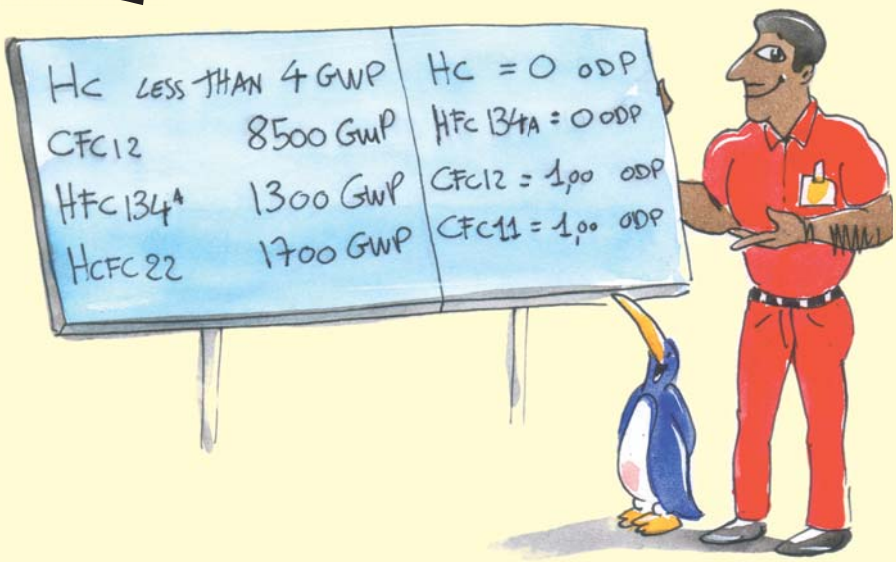
City	Training Date	Training Partner
Srinagar	16-17 Sep.06	Ananth Enterprises
Sonepat	28-29 Oct.06	Ananth Enterprises
Kanpur	16-17 Sep.06	Isha Enterprises
Lukhnow	28-29 Oct.06	Isha Enterprises
Hanumangarh	14-15 Oct.06	Bohra Services
Pune	30 Sep.06-1 Oct.06	Max Cooling Systems

* Please refer to page no. 7 for contact details of training partners

Training Programme

- ITI Instructors
- ITP / SGTB
- MAC
- MAC-Pilot
- Mini MAC ToT
- NCCoPP-ToT
- OTC
- OTC-Pilot
- Railway Technicians
- RSE
- TOT
- Independent

FAQs



From this issue of Eco Cool, we are starting a new section, Frequently Asked Questions (FAQs). This section will focus on a variety of FAQs and will look at it topic-wise. In this issue we focus on technical issues under RAC and those specifically related to "Servicing Practices".

Q1. Using nitrogen at 10bar makes the oil in the condenser and evaporator to come out?

Flushing should be done at 5 bar only.

Q2. Trichloroethylene also contains chlorine and is recommended for cleaning. Will it also contribute to damaging the ozone layer damage?

The chlorine in trichloroethylene does not rise to the stratosphere and contribute to ozone damage. It is not as stable as CFCs and the chlorine in it gets separated and lost in the lower atmosphere. It is therefore not listed amongst the ODS in the Montreal Protocol that need to be phased out.

Q3. What is the correct measure of vacuum? Is it the level of vacuum or the time the vacuum pump is kept running?

The level of vacuum, as measured in microns of Hg in a vacuum gauge (that is of the pirani or thermocouple type) is the right measure of Vacuum. The recommended measure is at least 200 microns (100 microns desirable) Hg for 134a and 500 microns Hg at least for R12. After achieving this level of vacuum, the vacuum pump should be isolated with the valve and stopped and the vacuum holding capacity of the system should be checked. If the pressure rises slowly and then stabilises at a higher level of microns, it means that there is some moisture still remaining. The vacuum pump should then be restarted and reconnected and run again for about 10 minutes and the rise in pressure checked again. This process should be repeated till the rise in pressure is as low as possible, suggesting that almost all the water vapour has been removed. After this has been achieved, the vacuum pump should be run for another 5 to 10 minutes before proceeding to the next step of charging refrigerant.

Q4. Evacuation needed for HFC is to be as low as 100 microns. Is such low levels needed for HCs also?

HCs can be evacuated to the same levels as CFCs i.e. at least 500 microns. Moisture can be as detrimental in an HC system as in a R12 system. Further, the solubility of HCs in oil as well as the solubility of moisture in HCs is higher than in the case of CFCs. Therefore it is better to evacuate HC systems to at least 500 microns and for HFC system is at least 200 microns.

Newsflashes from Ozone Layer

Earth's Ozone Shield is Poised for Recovery

Earth's sunscreen appears poised for recovery after decades of assault from man-made chemicals.

Scientists noted initial signs of this trend three years ago and specifically attribute the changes to the Montreal Protocol. The main targets so far have been chlorine-carrying compounds used as coolants in refrigerators and for fighting fires.

"It's clear that the Montreal Protocol has reduced the total amount of chlorine entering the atmosphere," notes Derek Cunnold, an atmospheric scientist at Georgia Institute of Technology in Atlanta.

Those reductions, he continues, should first arrest the decline, then allow the ozone layer to rebuild.

Ozone concentrations are still quite low and are allowing historically high levels of damaging ultraviolet light to reach Earth's surface, researchers caution. Moreover, once the upswing begins, a recovery is likely to come only in fits and starts over 50 to 60 years. And scientists say it's highly uncertain whether the effort will overshoot or undershoot the protocol's target of returning stratospheric ozone concentrations to pre-1980 levels.

Global warming is expected to present ozone with a far different environment than the one that existed before 1980. changing circulation patterns, temperatures, and the rise or fall of methane, nitrous oxides, and water vapor reaching the stratosphere - will affect the outcome.

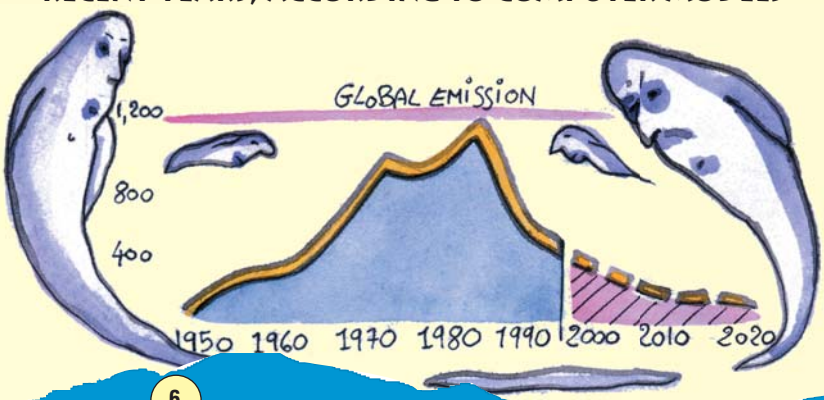
The strongest evidence for the protocol's effect comes at altitudes ranging from 11 to 16 miles. There, chlorine has leveled off, and so has ozone decline, Cunnold's team reports.

Even as they continue to monitor the protocol's impact on ozone levels, researchers are now struggling to factor the impact of climate change and natural variations of stratospheric ozone into estimates of how long recovery will take and how close to the mark it will reach. For David Doniger, the climate-policy director for the Natural Resources Defense Council in Washington, these results indicate that when it comes to the environment, "global treaties work." But he holds that the battle to curb ozone-depleting chemicals isn't over.

Source: *http://www.csmonitor.com/*

For more information: *http://www.csmonitor.com/2006/0601/p02s01-sten.html*

OZONE-EATING CHEMICALS LEVEL OFF
THE DECLINE IN THE GLOBAL EMISSIONS OF FIVE OF THE MAJOR OZONE-DEPLETING CHEMICALS HAS SLOWED IN RECENT YEARS, ACCORDING TO COMPUTER MODELS



Book Post

Training Partners And Contacts

The following organisations manage all training in India through the appointed training partners:

Regional Management Organization: **Quest Consulting and Training,** V. Subramaniam, Plot No 86, Road No 3, Threemurthy Colony, Mahendra Hills, East Marredpally, Secunderabad - 500026 Tel: 040-27732851 & 27732891 Mobile: 99497 36363 Email:questvs@gmail.com

Godrej & Boyce Mfg Co. Ltd. (Appliance Division) S A Juvekar, L.B.S. Marg, HO Service, Plant 11, Pirojsha Nagar, Mumbai - 400 079 Tel: 022-6796 6603 / 6623 Fax: 022-6796 6066 Email: saj@godrej.com www.godrejsmartcare.com

Training Partners:

Andhra Pradesh: Veerender Nath, Maega Services, 3-3-780/B, Kuthbiguda, Esamia Bazaar, Hyderabad - 500 027 Tel: 040-246 53 602 Mobile: 98492 03750 Email: tvnath@rediffmail.com

Assam: D.Talukdar, Kuwality Coolers, Das Complex, R.G.Barua Road, Guwahati - 781 024 Tel: 0361-220 22 29 Mobile: 98640 17889 Email: kuwalitycoolers@rediffmail.com

Bihar: S.G Sebastian Joseph, Principal Loyola Industrial School, Kurji, Patna - 800 010 Tel: 0612 - 226 27 46 Mobile: 94310 21743 Email: brseby@yahoo.co.in

Chandigarh: A. Kumar, Ananth Enterprises, 5397/1, Modern Residential Complex, Manimajra, Chandigarh -160 101 Tel: 0172-273 51 63 Mobile: 98143 01541, Email: chandigarhozone@yahoo.co.in

Gujarat: Naranbhai M. Patel, Kirti Freeze, Kirti House, Ashirwad Complex (Opp. Bata Showroom), Ashram Road, Ahmedabad - 380 009 Tel: 079-265 80 466 Mobile: 94263 01242 Email: zeelpower@satyam.net.in

Karnataka: C. J. Mathew, Dewpoint Services, 808 10th A main, 1st stage, Indira Nagar, Bangalore - 560 038. Tel: 080-252 99 325 Mobile: 98450 70594 Email: cjmathew@vsnl.com

Kerala: V.Vijayakumar, V.R. Enterprises, Building No. 39/3463, (East Part), Thekkumcheril Building, Ravipuram Road, Kochi - 682 016 Tel: 0484-235 60 93 Mobile: 94474 64821 Email: vijayakumar@kircop.com

Madhya Pradesh: Arun Mishra, Divyansh Services, B-15, MIG Colony, Opp. KID'S Kingdom Play School, Indore-452011 Tel: 0731-4069881 / 82 Mobile: 09826620890 Email: arunmishra71@rediffmail.com

Maharashtra: Abraham Mathew, Max Cooling Systems, 2, Butte Patil Residency, 363/5, Shivaji Nagar, Pune - 411 005 Tel: 020-255 34 737 Mobile: 94220 11095 Email: maxcoolengg@yahoo.com

New Delhi: Jaspal Singh, Hindustan Refrigeration Stores, 2,4 & 5 Nethaji Subhash Marg, Darya Ganj, New Delhi -110 002 Tel: 011-232 71 898/59 650 Mobile: 98100 19794 Email: higrop@ndb.vsnl.net.in

Orissa: L. N. Dash, B-12, BJB Nagar, Bhubaneswar - 751 014 Tel: 0674-243 52 80 Mobile: 94370 82401 Email: lndash@rediffmail.com

Rajasthan: Surendra Bohra, Bohra Services, 60 Gem Enclave, Pradhan Marg, Malviya Nagar, Jaipur - 302 017. Tel: 0141-252 24 00 Mobile: 94140 66848 Email: bohra@bohraappliances.com

Tamil Nadu: Mr.R.Kamala Kannan M/s.Sakthi Refrigeration & Air-conditioning Enterprises, 0/1-Kanakkar Street, Near Venkateswara Theatre, Thiruvottiyur, Chennai-600 019 Tel: 044-2573 3833 Mobile: 94443 88495 Email : id_skssaba@yahoo.co.in

Uttar Pradesh: Rajesh M. Misra, Isha Enterprises, B-1/56, Sector - B, Aliganj, Lucknow - 226 024 Tel: 0522-233 05 78 Mobile: 94150 24423, Email: rajeshm@kircop.com

West Bengal: Navin Lamba, Crystal Refrigeration Company, 7, A.J.C Bose Road, Kolkata - 700 017 Tel: 033-224 76 48 8 Mobile: 98308 20848 Email: nl@vsnl.net

Industry Training Partners:

Kirloskar Copeland Ltd., V.G. Sardesai, 1202/1, Ghole Road, Pune - 411 005 Tel: 020-255 20 80 2 / 255 21 86 0 Email: sardesai@kircop.com

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National Partner for Awareness Raising:

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Editorial Board:
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Editorial Direction & Materials Compilation:
Manisha Dolia

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For all correspondence write to: ECO-COOL ™, IT Power India Pvt. Ltd., No.6 & 8, Romain Rolland Street, Pondicherry - 605 001. Tel: 0413-222 78 11 or 234 24 88 Fax: 234 07 23 Email: md@itpi.co.in