

**MONTREAL PROTOCOL  
ON SUBSTANCES THAT DEplete  
THE OZONE LAYER**



**UNEP**

**REPORT OF THE  
TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL**

**APRIL 2007**

**REPORT OF THE TASK FORCE ON  
CONTINUING TEAP LEGACY**

**Montreal Protocol  
On Substances that Deplete the Ozone Layer**

Report of the  
UNEP Technology and Economic Assessment Panel

April 2007

Report of the Task Force on Continuing TEAP Legacy

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## **Disclaimer**

The views and opinions expressed in the report are those of the Task Force on the Continuing TEAP Legacy and Technology and Economic Assessment Panel (TEAP). The companies and organisations that employ or provide support to the co-chairs and members of TEAP and its Task do not necessarily endorse the views and opinions expressed.

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## 1 Introduction and Foreword

On the occasion of the Twentieth Anniversary of the signing of the Montreal Protocol (agreed in Montreal Canada on 16 September 2007), TEAP formed a Task Force to consolidate records of the Technology and Economic Assessment Panel (TEAP), its Technical Options Committees, and Subsidiary Bodies such as Task Forces. This summary builds on similar work undertaken by all three Assessment Panels in 1997 on the occasion of the Tenth Anniversary. The 2007 Task Force on the Continuing TEAP Legacy summarized the history of assessments building to the signing of the Vienna Convention in 1985 and the Montreal Protocol in 1987; assembled a comprehensive list of its publications; built a database of over 50,000 data entries documenting its membership; and reflected on how the TEAP has responded to requests from Parties. The database of membership (1989 through April 2007) was developed by Task Force Co-Chair Ms. Kristen Taddonio and Task Force Corresponding Member Ms. Liu Liu. The accuracy of the database was confirmed by the Co-Chairs and members of the TOCs.

This report will be a lasting record of the first 18 years of the TEAP and can be updated periodically, as necessary. The database is available to Parties, scholars, and the public from the Ozone Secretariat.

## 2 A Brief History of Assessment Panels of the Vienna Convention and Montreal Protocol<sup>1</sup>

*“Concerns about anthropogenic destruction of stratospheric ozone first appeared in the 1960s, initially based on emissions of nitrogen oxides and hydrogen oxides from aviation, bombs, and rockets. Subsequently, ozone loss caused by chlorofluorocarbons (CFCs) was first proposed by Molina and Rowland.”<sup>2</sup>*

In 1974, when Mario Molina and F. Sherwood Rowland published their thesis of atmospheric science linking chlorofluorocarbons (CFCs) to ozone depletion, there was already a comprehensive assessment--called the Climatic Impact Assessment Project (CIAP)--underway by the US Department of Transportation to calculate the atmospheric, environmental and economic impacts of supersonic flights on climate change and ozone depletion.<sup>3</sup> In 1975, both the United States Environmental Protection Agency (EPA) and the CFC and aerosol products industry published studies of the benefits and costs of the proposed CFC controls. The studies came to opposite conclusions. Later in 1975, the World Meteorological Organization (WMO) issued the first international science statement, ‘Modification of the Ozone Layer Due to Human Activities and Some Possible Geophysical Consequences,’ considering both supersonic transport and CFC emissions.

*“The 1974 CIAP assessment panel used the same integration of scientific, environmental, and economic findings that are in the Montreal Protocol Synthesis Reports; but it did not include findings on technical options that now guide Parties in avoiding and reducing the impacts on stratospheric ozone and climate.”*

Stephen O. Andersen – USA, TEAP Co-Chair, 1989-Continuing

In April 1977, the United Nations Environment Programme (UNEP) organized an international meeting of experts in Washington, DC. This meeting recommended a ‘World Plan of Action on the Ozone Layer’ to coordinate further research on the depletion of the ozone layer, and a Coordinating Committee on the Ozone Layer (CCOL) to undertake annual research reviews to be published as the Ozone Layer Bulletin. The Governing Council of UNEP accepted these recommendations. In 1981, a consortium of international organizations under WMO published a complete update.<sup>4</sup>

*“There is no final answer in science. There is no final action in policy. There is an improved answer and an improved set of Decisions.”<sup>5</sup>*

Dan L. Albritton – USA, Co-Chair SAP 1989 to 2006

In May 1981, the UNEP Governing Council established an *Ad-hoc* Working Group of Legal and Technical Experts to develop a Global Framework Convention for the Protection of the Ozone Layer. This group met many times between 1982 and 1985 to arrive at the Framework Vienna Convention for the Protection of the Ozone Layer. The 1985 WMO/UNEP assessment chaired by Robert Watson was the precursor to the WMO/UNEP science assessments that were done under the auspices of the Montreal Protocol. Attempts to mandate specific controls on ozone-depleting substances (ODSs) did not succeed until 1987, in view of, in the opinion of many countries, scientific uncertainties on the extent of, and reasons for, ozone depletion. The scientific assessment, coordinated by many national and international organizations--such as the U.S. National Aeronautics and Space Administration (NASA), the U.S. National Oceanic and Atmospheric Administration (NOAA), the United Kingdom Department of the Environment (UKDOE) and UNEP and published at the end of 1985, and the 1986 UNEP workshops on ODS demand and technical options (held in Rome, Italy and Leesburg, Virginia USA)--contributed enough certainty for the Montreal Protocol of September 1987.

*“The Existence of the TEAP is a result of the visionary thinking of the original drafters of the Montreal Protocol. In 1987, the Parties to the Protocol recognized that over time, our scientific understanding of ozone layer depletion and its effects would improve. They also realized that technologic innovation would likely make future controls more technically and economically feasible...”<sup>6</sup>*

Suely Carvalho – Brazil, TEAP Co-Chair, 1993-2002

Even at the time the Montreal Protocol was signed in 1987, governments were aware of the likely inadequacy of the control measures. Hence, the 1987 Montreal Protocol included a specific provision for periodic assessment and review:

*“Beginning in 1990, and at least every four years thereafter, the Parties shall assess the control measures provided for in Article 2 on the basis of available scientific, environmental, technical, and economic information. At least one year before each assessment, the Parties shall convene appropriate panels of experts qualified in the fields mentioned and determine the composition and terms of reference of any such panels. Within one year of being convened, the panels will report their conclusions, through the Secretariat, to the Parties.”*

Article 6, Assessment and Review of Control Measures of the Montreal Protocol

### **3 The Four Original Montreal Protocol Assessment Panels**

*“You need to have the experts come together. The experts...create where we are, where we can go and how fast we can get there.”<sup>7</sup>*

Victor Buxton – Canada, TEAP Co-Chair 1989

The four original Montreal Protocol panels – 1) Panel for Scientific Assessment, 2) Panel for Environmental Assessment, 3) Panel for Technology Assessment, and 4) Panel for Economic Assessment – were informally organized in The Hague at the October 1988 ‘UNEP Conference on Science and Development, CFC Data, Legal Matters, and Alternative



Substances and Technologies' and were formalized at the First Meeting of Parties, held in Helsinki in May 1989.<sup>8</sup>

When the panels were first established, UNEP Executive Director Mostafa Tolba, in consultation with Parties, allowed the Technology Panel to be organized in an entirely different framework that would attract a strong membership of respected and capable technical experts from industry.<sup>9</sup> This creative framework made it possible for the newest technology developments to be immediately considered even when not yet documented in peer-reviewed journals. It also meant that the fast-evolving changes in the market caused by the Montreal Protocol could be closely examined by experts with industry and market experience.<sup>10</sup>

*"I established the panels without prior permission of the Parties and then I asked them to endorse my decision eight months later. This initiative was spurred by my desire to get something concrete...a real development, something for them to chew on when they met."*<sup>11</sup>

Mostafa Tolba – Egypt, UNEP Executive Director 1976-1992

The Panel for Scientific Assessment and the Panel for Environmental Assessment organized chapter committees, each with chapter co-chairs, on relevant topics while the TEAP organized Technical Options Committees (TOCs) on industry sectors, each with co-chairs and all members of the Panel for Economic Assessment worked on each of their chapters.<sup>12</sup> The original and subsequent chairs of all the Assessment Panels were nominated by national governments and approved by the Meeting of the Parties.

The Co-Chairs of the SAP and EEAP appointed "Chapter Chairs," who were not typically approved by the Parties. In contrast, the original TEAP TOC Co-Chairs were approved by the Parties as were the original "Senior Expert Members." Subsequently the Parties have nominated and approved new TOC Co-Chairs either as replacements for departing members or when new TOCs are created by the TEAP. The TEAP and its TOC Co-Chairs had full freedom to select experts for these committees.

*Science phenomena "...relate to the well-being of humans on the planet. There are those who have to make decisions associated with those issues; decisions ranging from: 'Is it a big deal or a little deal?' 'How much does it cost if I do something and how much does it cost if I do nothing.' So you see that the assessment process is iterative, where the best opinion is given at the moment and the best decisions are made and revisited some years later."*<sup>13</sup>

Daniel L. Albritton – USA, SAP Co-Chair 1989-2006

The Parties frequently outline terms of reference and timetables for completing assessments of available scientific, environmental, technology and economic information. Requests are clear but unelaborated. The 1990 request to the TEAP was typical:

*"...to assess the earliest technically feasible dates and the costs for reductions and total phaseout of 1,1,1-trichloroethane (methyl chloroform); evaluation of the need for transitional substances (HCFCs) in specific applications; quantity of controlled substances needed by developing countries and availability; and comparison of toxicity, flammability, energy efficiency and safety considerations of chemical substitutes and their availability."*

## 4 Management of the First Montreal Protocol Assessment

The first assessment in 1989 was managed by an ‘Inter-Governmental Panel’ as the political supervisory body. The Inter-Governmental Panel was minimally involved in the drafting of the first Assessment Reports and the first Synthesis Report and reported that the assessment process was satisfactory at the Second Meeting of the Open-Ended Working Group in November 1989. The governments did not appoint a supervisory body for the subsequent assessment reports of the panels. The reports of the panels are published and distributed to Parties without any change or political review.

After 1990, the Panel for Scientific Assessment re-labelled itself “The Scientific Assessment Panel” (SAP); the Panel for Environmental Assessment re-labelled itself “The Environmental Effects Assessment Panel” (EEAP); and The Panel for Economic Assessment was merged with the Panel for Technology Assessment and re-labelled “The Technology and Economic Assessment Panel” (TEAP).

## 5 The Synthesis Report

Synthesis Reports are released to Parties about every three or four years, after each Full Assessment by the SAP, EEAP, and the TEAP (1989, 1991, 1994, 1998, 2002, and 2006). The Co-Chairs of the three assessment panels meet to draft synthesis reports. These reports distil findings into ‘policy-relevant technical information.’ This information includes: policy options for further action; the impact of each option on the ozone layer; and the technical and economic feasibility of the options.

Examples from the 1989 Assessments illustrate the simplicity and clarity of the synthesis:

*“Even if the control measures of the Montreal Protocol were to be implemented by all nations, today’s atmospheric abundance of chlorine (about 3 parts per billion by volume (ppbv)) will at least double to triple during the next century. If the atmospheric abundance of chlorine reaches 9 ppbv by about 2050, ozone depletion of 0–4 percent in the tropics and 4–12 percent at high latitudes would be predicted, even without including the effects of heterogeneous chemical processes known to occur in polar regions, which may further increase the magnitude of the predicted ozone depletion.”*

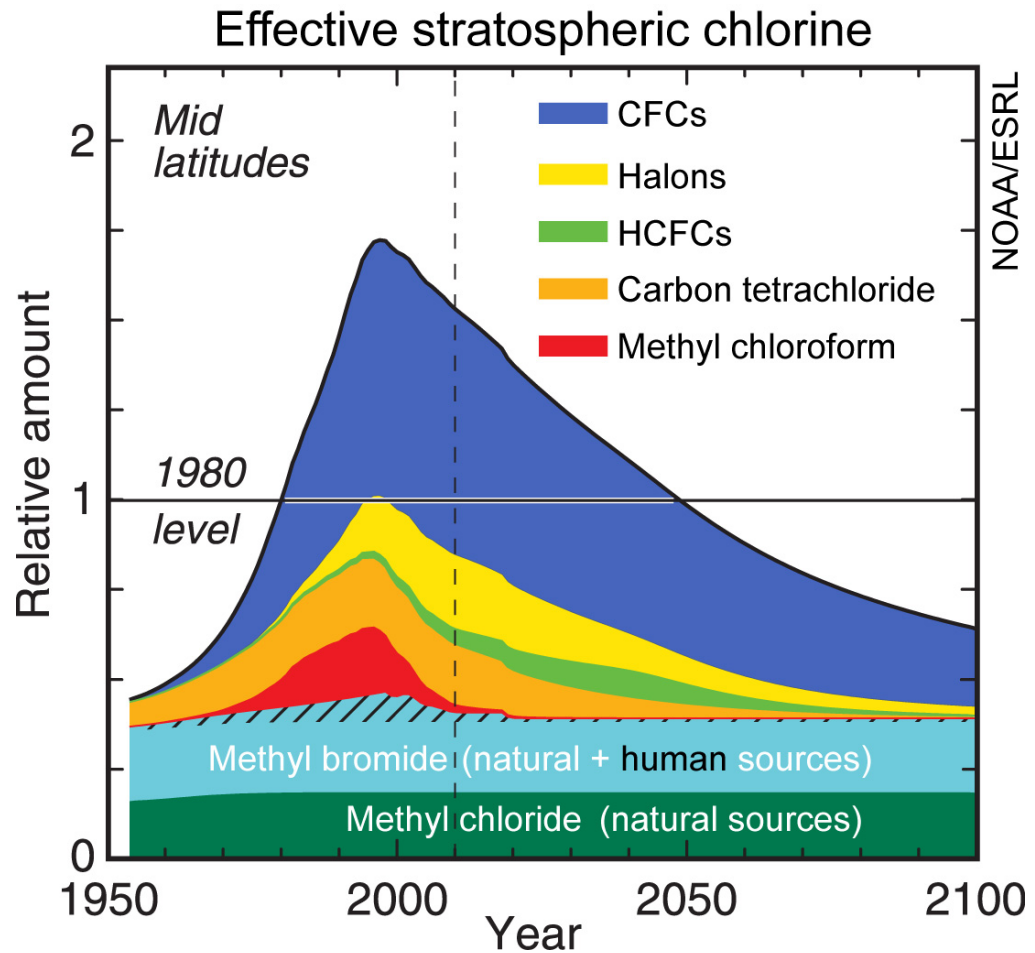
*“Each 1 percent total column ozone depletion is expected to lead to...a worldwide increase of 100,000 blind persons due to UV-B induced cataracts...a 3 percent rise of the incidence of non-melanoma skin cancer, (and)...reduced food yield (and food quality) by up to 1 percent.”*

*“(It) is technically feasible by the year 2000 to phase down by at least 95 percent the production and consumption of the five controlled CFCs, phase out totally the production and consumption of carbon tetrachloride..., (and) phase down by at least 90 percent the production and consumption of methyl chloroform.”*

The synthesis report adopted the graphical policy display captured below in Figure 1. The figure illustrates the past record of observed abundances of atmospheric ‘equivalent’ stratospheric chlorine amounts (which includes bromine, appropriately weighted) and the future abundances that are expected with full compliance under the protocol. The figure also shows that the peak chlorine concentration in the stratosphere occurred in approximately 2000, which can be considered as the turning point in the rate of destruction and the time when concentrations will drop below 2 ppbv (roughly the pre-hole level) representing the

likely closing of the Antarctic ozone hole at a later stage. This presentation dramatically portrays the success of existing and proposed control measures in reducing ozone depletion, and the reality that even the most stringent new controls cannot close the Antarctic hole until 2050 or return the stratosphere to its natural condition until at least several hundred years from the present.

*Figure 1: Abundances of effective equivalent stratospheric chlorine (EESC)*



***TEAP and the IPCC integrated findings***

The graphic presentation of the benefits of policy options (Figure 2 below) was improved in 2006 to present both the ozone and climate benefits of reducing the emissions of ODSs that are also greenhouses gases.

**Figure 2a: GWP-weighted emissions – CFCs, HCFCs and HFCs**

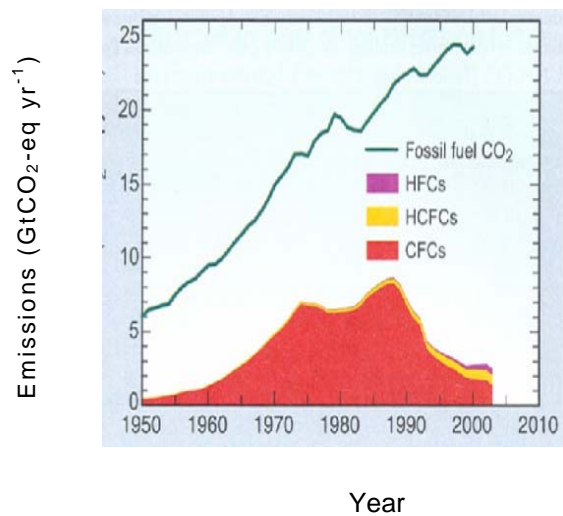


Figure 2a presents direct GWP-weighted emissions (100-yr time horizon) for CFCs, HCFCs and HFCs compared with total CO<sub>2</sub> emissions due to fossil fuel combustion and cement production.

Source: IPCC and TEAP (2005). IPCC/TEAP Special Report on Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons. Cambridge University Press, Cambridge, United Kingdom and New York. Page 29, figure TS-9.

**Figure 2b: Estimates of future EESC**

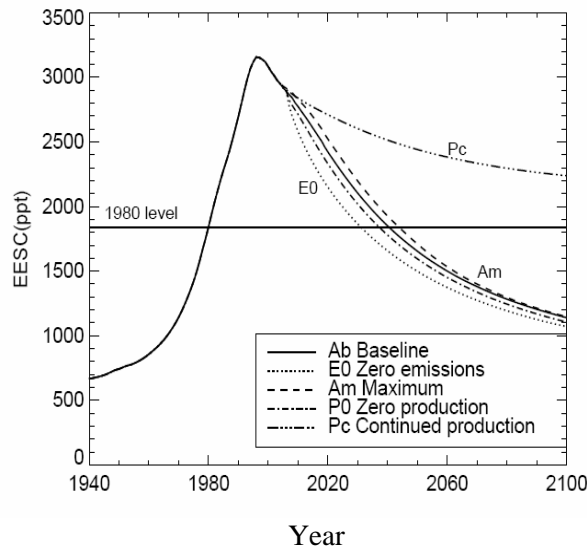


Figure 2b presents estimates of future EESC based on the baseline scenario (Ab; solid line), the maximum scenario (Am; long-dashed line), and the hypothetical cases of zero emissions in 2003 and thereafter (E0), and zero production in 2003 and thereafter of all anthropogenic ODSs (P0). Also shown are results from the scenario with continued ODS production in the future at 1999 rates (Pc), production that is substantially larger than allowed in the fully revised and amended Montreal Protocol.

Source: United Nations Environment Programme (2005, November). *Supplement to the IPCC/TEAP Report. Technology and Economic Assessment Panel of the Montreal Protocol On Substances That Deplete the Ozone Layer*. ISBN: 92-807-2733-8. Page 42, Figure 6-1. UNON, Nairobi and originally published in the Scientific Assessment of Ozone Depletion, 2002.

## 6 TEAP Membership

The permanent membership of the TEAP includes its Co-Chairs, the Co-Chairs of the Technical Options Committees, and Senior Expert Members. In any year, its temporary membership includes the Co-Chairs of any active Task Force.

*“You find people at meetings where you could see whether they are active. You want to have people who...dare to do something. You also want to pick people who can produce results in a specified time-period.”<sup>14</sup>*

Lambert Kuijpers – Netherlands, TEAP & TOC Co-Chair, 1989-Continuing

TEAP members are nominated by national or regional governments and must be confirmed by a Meeting of the Parties. In some cases, TEAP members have been nominated by the national government of a country where they do not reside and in many cases TEAP members have been supported by organizations outside their country of residence. National governments often sponsor the costs of participation of key the TEAP and TOC members and some countries have offered support disproportionate to their population, historic ODS use or other measures of obligation. In 1997 the TEAP presented special awards to Australia, Canada, Netherlands, the United Kingdom, and the United States for exceptional contributions to the operations of the TEAP.

*“I hope that I can be a bridge between China and the international society. For a long time China was not open to the outside world. That meant also that we did not contribute our expertise. I thought I should be a bridge to link the two sides.”<sup>15</sup>*

Zhang Shiqiu – China, TEAP Senior Expert Member, 1997-Continuing

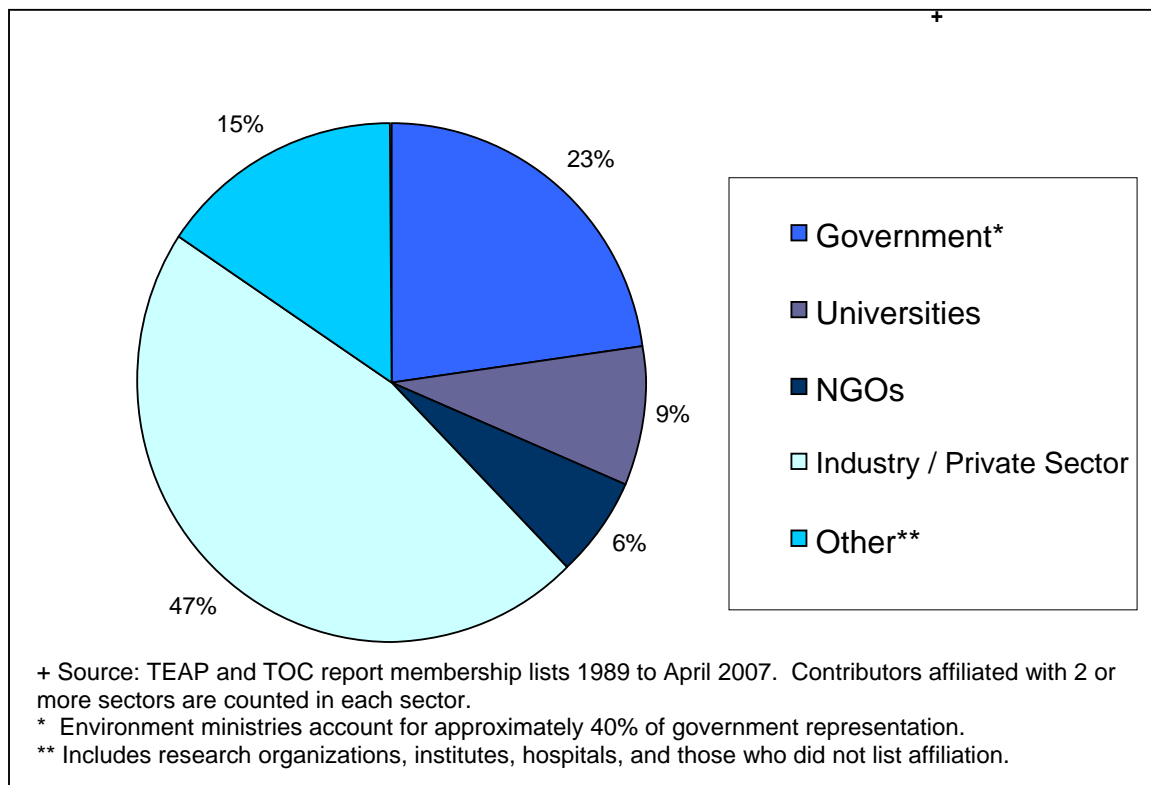
In 1989 and 1990, chlorofluorocarbon producers were not eligible for TEAP or TOC membership, but they were later invited to join when their companies supported further actions to phase out ODSs, and turned their attention to the development and commercialisation of alternatives. The Parties never again excluded experts working for companies that produced newly-controlled substances (such as methyl chloroform or methyl bromide) despite the opposition to the Protocol by some of those companies.

*“The fact people from all over the world can come together, have arguments, come to consensus and write a report is incredible.”<sup>16</sup>*

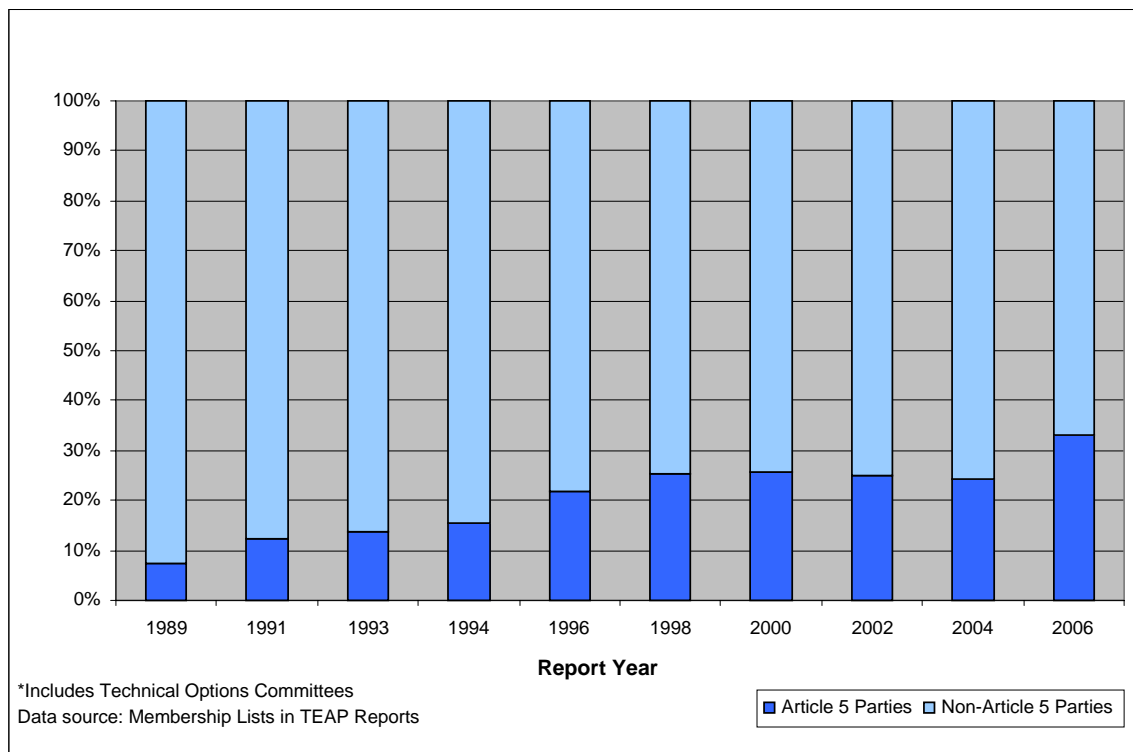
Helen Tope – Australia, ATOC Alternate Co-Chair 1993-1995,  
ATOC/MTOC Co-Chair, 1995-Continuing

Today, over 175 experts serve on the TEAP and its TOCs and subsidiary bodies. Since its creation, over 900 experts from about 65 countries have participated in the assessment process. While members of these bodies have come from government and academia, it is interesting to note that most of the experts have come from the very industries which have been most directly impacted by the controls on ODSs (see figures below). Note that the bar chart for 2007 is equivalent to 2006, with only five new members since 31 December 2006.

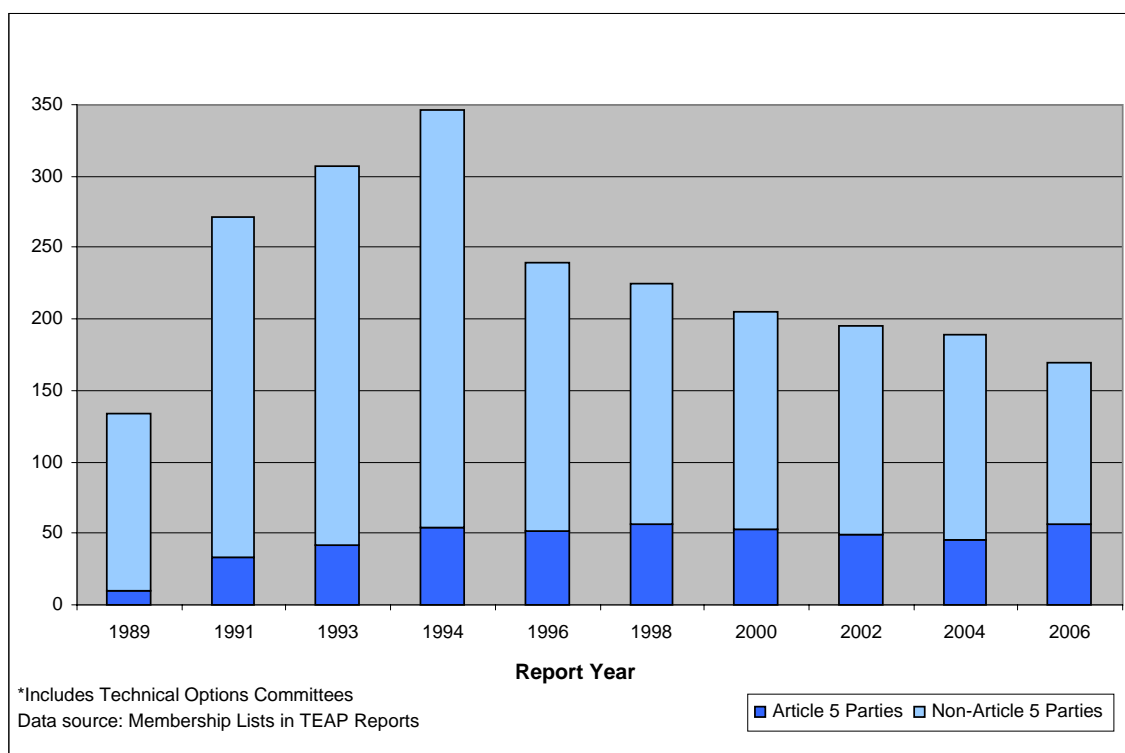
**Figure 3: TEAP and TOC Contributors by Sector, 1989-2006<sup>+</sup>**



**Figure 4: Percentage of TEAP\* Participants by Protocol Party Category**



**Figure 5: Number of TEAP\* Participants by Protocol Party Category**



**Table 1: Countries where Current and Former TEAP Experts Reside(ed)**

Argentina	Hungary	Poland
Australia	India	Russia
Austria	Indonesia	Singapore
Bahamas	Israel	Slovakia
Bahrain	Italy	South Africa
Belize	Japan	Republic of Korea
Belgium	Jordan	Spain
Brazil	Kenya	Sweden
Canada	Kuwait	Switzerland
Chile	Lebanon	Tanzania
China	Liechtenstein	Thailand
Colombia	Malaysia	Trinidad & Tobago
Costa Rica	Mauritius	Tunisia
Croatia	Mexico	Turkey
Cyprus	Morocco	Uganda
Denmark	Netherlands	UK
Ecuador	New Zealand	USA
Egypt	Nigeria	Venezuela
Finland	Norway	Vietnam
France	Pakistan	Yugoslavia
Germany	Philippines	Zimbabwe
Ghana		

**Table 2: 2007 TEAP Members, including its Technical Options Committees and Task Forces Co-Chairs**

<b>TEAP Co-chairs</b>	<b>Affiliation</b>	<b>Country</b>
Stephen O. Andersen	Environmental Protection Agency	USA
Lambert Kuijpers	Technical University Eindhoven	Netherlands
Jose Pons Pons	Spray Quimica	Venezuela
<b>Senior Expert Members</b>	<b>Affiliation</b>	<b>Country</b>
Thomas Morehouse	Institute for Defense Analyses	USA
K. Madhava Sarma	Consultant	India
Shiqiu Zhang	Peking University	China
<b>TOC Chairs</b>	<b>Affiliation</b>	<b>Country</b>
Radhey S. Agarwal	Indian Institute of Technology Delhi	India
Paul Ashford	Caleb Management Services	UK
Mohamed Besri	Institut Agronomique et Vétérinaire Hassan II	Morocco
David Catchpole	Petrotechnical Resources Alaska	UK
Biao Jiang	Shanghai Institute of Organic Chemistry	China
Lambert Kuijpers	Technical University Eindhoven	Netherlands
Michelle Marcotte	Marcotte Consulting	Canada
Marta Pizano	Hortitecna	Colombia
Jose Pons Pons	Spray Quimica	Venezuela
Ian Porter	Institute for Horticultural Development	Australia
Miguel Quintero	Dow Chemical Company	Switzerland
Ian Rae	University of Melbourne	Australia
Kristen Taddonio	Environmental Protection Agency	USA
Helen Tope	EPA, Victoria	Australia
Ashley Woodcock	Wythenshawe Hospital	UK
Daniel Verdonik	Hughes Associates	USA
Masaaki Yamabe	National Institute of Advanced Industrial Science and Technology	Japan
<b>TEAP Legacy Task Force Chairs</b>	<b>Affiliation</b>	<b>Country</b>
Stephen O. Andersen	Environmental Protection Agency	USA
Marta Pizano	Hortitecna	Colombia
Kristen Taddonio	Environmental Protection Agency	USA
<b>QPS Task Force Chairs</b>	<b>Affiliation</b>	<b>Country</b>
Jonathan Banks	Consultant	Australia

### **Task Forces**

- 2007 Task Force on the TEAP Legacy
- 2006 Task Force on Quarantine and Pre-Shipment (QPS)
- Task Force on Emissions Discrepancies
- 2005 Task Force on Replenishment
- Task Force on Foam End-of-Life Issues
- 2004 Process Agents Task Force (PATF)
- Task Force on Basic Domestic Needs
- Chiller Task Force
- 2003 HCFC Task Force
- 2002 Task Force on Replenishment
- Task Force on Collection, Recovery and Storage
- Task Force on Destruction Technologies



- 2001 Task Force on Geographical Market Potential and Emissions of n-Propyl Bromide Process Agents Task Force (PATF)
- 1999 Task Force on Replenishment  
Report of the HFC and PFC Task Force
- 1997 Process Agents Task Force (PATF)
- 1996 Task Force on Replenishment  
Task Force on CEIT Aspects
- 1995 Task Force on CEIT Compliance with the Montreal Protocol  
Chemical Process Agents Working group

## **7 TEAP and TOC Management**

The TEAP membership currently consists of three Co-Chairs, three Senior Expert Members, and the Co-Chairs of each Technical Options Committee and Task Forces. Often, the TEAP Co-Chairs are also Co-Chairs of a Technical Options Committee or Task Force. Currently, for example, Lambert Kuijpers is Co-Chair of the TEAP and Co-Chair of the Refrigeration TOC; Jose Pons Pons is Co-Chair of the TEAP and Co-Chair of the Medical TOC; and Stephen O. Andersen is Co-Chair of the TEAP and Co-Chair of the Task Force on the TEAP Legacy.

Members of the TEAP are active and influential in their respective fields. From the start, TEAP has had significant participation of developed country environmental authorities responsible for ozone layer protection. Members of the TEAP and its TOCs working for government organizations have been pioneers of innovative regulations, incentive programs, and voluntary programs. Members of the TEAP from industry have been inventors and champions of new technology to phaseout ODSs, and academic, consultant and association members have been instrumental in developing new technologies, processes and not-in-kind strategies.

*“...confidential working groups of high-level technical experts from firms facing similar problems...were convened; a rapid, informal, results-oriented process was established;...The inclusion of experts from the firms directly affected by the phaseout of ozone-depleting substances, along with academic and government experts, ensured relevance, credibility, and legitimacy for the process.”<sup>17</sup>*

TEAP members who were Head or Assistant Head of Delegation at one or more Meeting of the Parties:

- Vic Buxton (Canada--1989 TEAP Co-Chair)
- Thomas Batchelor (EC—1998-2000 MBTOC Co-Chair)
- Ingrid Kökeritz (Sweden--1989 ATOC Co-Chair)
- Steve Lee-Bapty (UK--1991-1992 TEAP Co-Chair)
- Sateaved Seebaluck (Mauritius 1996-2002 TEAP Senior Expert Member)

TEAP members, who were Government Officials serving on a Delegation, but not Head of Delegations at one or more Meetings of the Parties:

- Husamuddin Ahmadzai (Sweden—1995 TEAP member)
- Suely Carvalho (Brazil 1993-2002 TEAP Co-Chair)
- Barbara Kucnerowicz-Polak (Poland 1996-2002 HTOC Co-Chair)
- Carmelina Lombardi (Venezuela—1993-1995 TEAP Senior Expert Member)
- Trish MacQuarrie (Canada—1994-1995 TEAP Senior Expert Member)
- David Okioga (Kenya—1996-2001)
- John Reed (Canada—1993 TEAP Senior Expert Member)
- K. Madhava Sarma (India—2001-Continuing TEAP Senior Expert Member)
- Robert van Slooten (UK—1991-2002 Economics Options Committee Co-Chair)

TEAP members who were government authorities (not consultants) with responsibility for implementing national and regional regulations but not serving as Head or Member of their national or regional delegations:

Stephen O. Andersen (United States—1989 and Continuing TEAP Co-Chair)  
Suely Carvalho (Brazil 1993-2002 TEAP Co-Chair)  
Andre P.R. Cvijak (Brazil—1993 TEAP Co-Chair)  
Lászlo Dobó (Hungary—1994-2002 Senior Expert Member)  
Andrea Hinwood (Australia—1990-1995 ATOC Co-Chair)  
Mavis Holmes-Hanek (Bahamas—1991-1992 ETOC Co-Chair)  
Tamas Lotz (Hungary—2002-2006 Senior Expert Member)  
Jean Lupinacci (United States—1989-1992 FTOC Co-Chair)  
Ian Porter (Australia—2005-Continuing MBTOC Co-Chair)  
Sally Rand (United States—1993-1998 FTOC Co-Chair)  
Helen Tope (Australia—ATOC Alternate Co-Chair 1993-1995, ATOC/MTOC Co-Chair 1995-Continuing)

Members of the TEAP from industry and academia make technical contributions which are critical to the process because they have first-hand experience and on-the-ground technical perspectives.

TEAP members who own their own companies or who work or who have previously worked for sophisticated companies and military organizations that were among the first and most successful at phasing out ODS production and consumption include:

Jonathan Banks (Australia 1993-1998 and 2001-2004, MBTOC Co-Chair; 2005-Continuing QPS Task Force Co-Chair)  
David Catchpole (UK—2005-Continuing HTOC Co-Chair)  
Jorge Corona (Mexico—1991-2002 STOC Co-Chair)  
Brian Ellis (Switzerland—2001 TEAP Task Force Co-Chair)  
Yuichi Fujimoto (Japan—1993-2002 TEAP Senior Expert Member)  
Barbara Kucnerowicz-Polak (Poland 1996-2002 HTOC Co-Chair)  
Lambert Kuijpers (Netherlands—1989-Continuing TEAP Co-Chair)  
Mohinder Malik (Germany—1996-2003 STOC Co-Chair)  
Thomas Morehouse (United States—1989 –Continuing TEAP Senior Expert Member)  
Jose Pons Pons (Venezuela—1991-Continuing TEAP Co-Chair)  
Miguel Quintero (Colombia—2002-Continuing FTOC Co-Chair)  
Rodrigo Rodriguez-Kabana (United States 1996-2000 MBTOC Co-Chair)  
Dan Verdonik (USA—2005-Continuing HTOC Co-Chair)  
Masaaki Yamabe (Japan—2002-2005 TEAP Senior Expert Member, 2005-Continuing CTOC Co-Chair)

TEAP members who have been professors or executives of industry NGOs include:

Radhey S. Agarwal (India—1996-Continuing RTOC Co-Chair)  
Stephen O. Andersen (United States—1989 and Continuing TEAP Co-Chair)  
Mohamed Besri (Morocco—2006-Continuing MBTOC Co-Chair)  
Jiang Biao (China 2005-Continuing CTOC Co-Chair)  
Suely Carvalho (Brazil--1993-2002 TEAP Co-Chair),  
Yuichi Fujimoto (Japan—1993-2002 TEAP Senior Expert Member)  
Andrea Hinwood (Australia—1990-1995 ATOC Co-Chair)  
Lambert Kuijpers (Netherlands—1989-Continuing TEAP Co-Chair)  
Nahum Marban Mendoza (Mexico—2002-2005 MBTOC)  
Miguel Quintero (Colombia—2002-Continuing FTOC Co-Chair)

Ian Rae (Australia—2001, 2005-Continuing CTOC Co-Chair)  
Rodrigo Rodriguez-Kabana (United States 1996-2000 MBTOC Co-Chair)  
Lalitha Singh (India—1996-2001 FTOC Co-Chair)  
Ashley Woodcock (UK—1996-Continuing ATOC/MTOC Co-Chair)  
Shiqiu Zhang (China 1997-Continuing TEAP Senior Expert Member)

TEAP members who were consultants to industry and government on ozone layer protection and adoption of alternatives while serving on the TEAP include:

Paul Ashford (UK—1999-Continuing FTOC Co-Chair)  
Jonathan Banks (Australia 1993-1998 and 2001-2004, MBTOC Co-Chair; 2005-Continuing QPS Task Force Co-Chair)  
Brian Ellis (Switzerland—2001 TEAP Expert Member)  
Ahmad Gaber (Egypt—2001-2003 STOC Co-Chair)  
Michelle Marcotte (Canada—2005-Continuing MBTOC Co-Chair)  
Marta Pizano de Marquez (Colombia—2006-Continuing MBTOC Co-Chair)  
Gary Taylor (Canada—1989-2004 HTOC Co-Chair)  
Dan Verdonik (USA—2005-Continuing HTOC Co-Chair)

## **8 TEAP Social Structure and Networks**

The impressive listing of experts on the TEAP who have made implementation of the Montreal Protocol the most successful example of global environmental governance in history can be further understood by appreciating the social structure of innovation, trust and the dynamics of social network creation and maintenance. In 1987 there were no “experts in ozone protection.” Today there are hundreds, positioned in governments, industries, academia, research institutes, and nongovernmental organizations around the world. They are the alumni of the TEAP, which operated as an on-the-ground experiment in risk sharing and knowledge creation.

TEAP members were recruited for their world-class expertise and, more importantly, for their willingness to consider new vocabularies of precautionary action and innovation to apply to stratospheric ozone. They prevailed because of the social connections that they forged, connections that allowed them to move swiftly to successful ventures (or to learn from failed ones) with huge lessons for ozone layer protection as well as for other similarly challenging global crises.

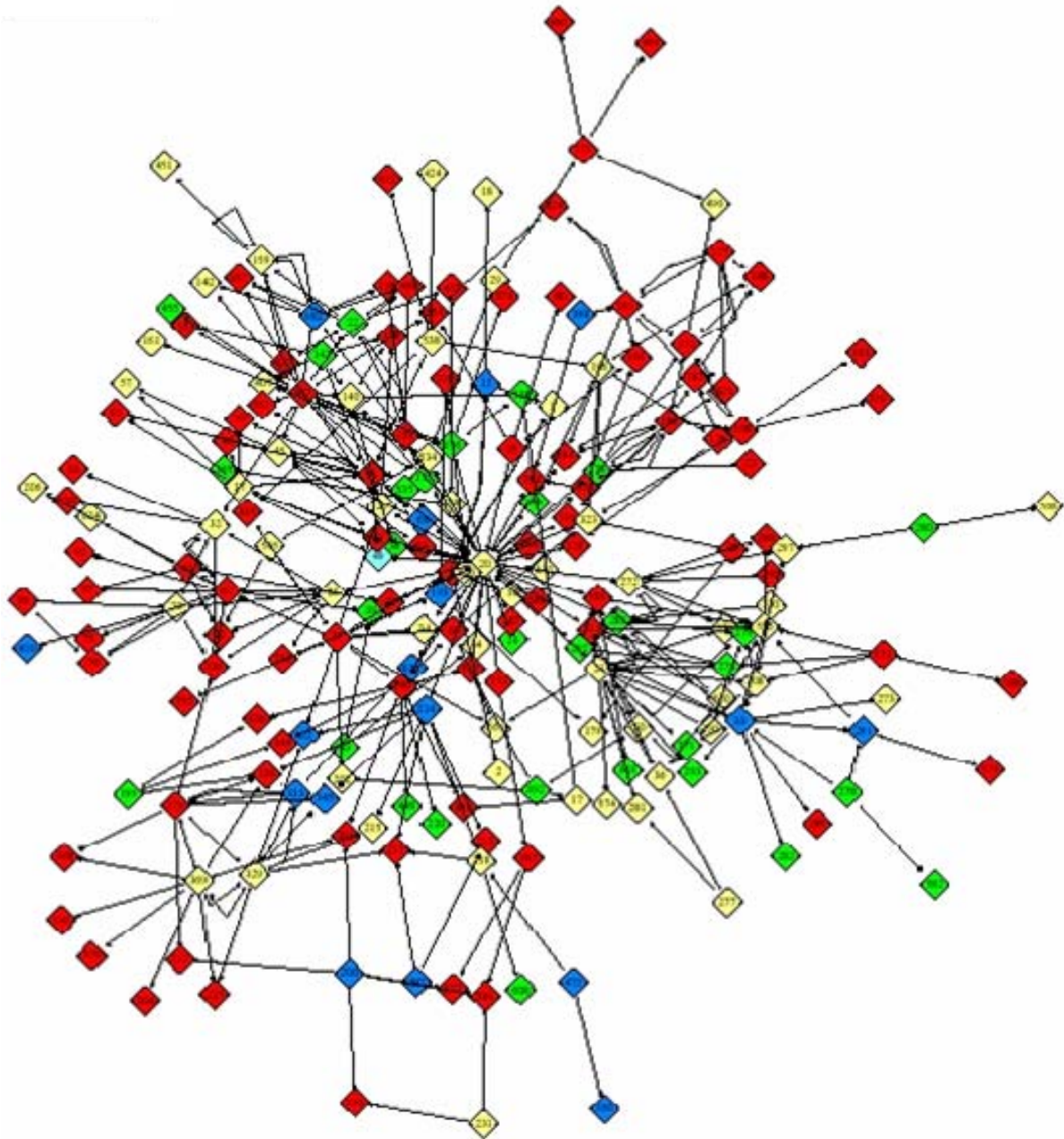
They arrived NOT with a common epistemology, but with a common trait of a “can-do/will find out how/what if” orientation to problem solving. They were supported by an extraordinarily tireless set of collaborative leaders who permitted them to explore the far reaches of creativity and trust. They came to rely on each other as kindred soldiers in a battle for survival. The longevity of their commitment was as soldiers committed not only to winning that battle but also to supporting each other for the cause. They call themselves the Ozone Clan.

Sociological investigation of the structural and relational embeddedness of the Ozone Clan reveals a camaraderie of experts who grew together and together grew the knowledge and experience base for the protection of the stratospheric ozone layer. We can consider the TEAP the vessel of knowledge of turning around a trend of catastrophic portent in less than 20 years. In terms of the structure of trust expertise, Figure 6 below portrays the highly cohesiveness and self-referencing relationships forged by TEAP members as of 1994. This networks view of the TEAP underscores that fostered, nurtured social relationships support innovation, diffusion, and creative responses to uncertainty.

*“The legacy of the Montreal Protocol is one that must recognize the contribution of TEAP co-chairs Stephen Andersen, Lambert Kuijpers, and Jose Pons Pons (and their predecessors)—quintessential collaborative leaders—who appreciated that extremely complex problems require not only identifying and enlisting the appropriate diverse expertise and necessary social capital, but also creating the conditions for social connections of trust and creativity to flourish. Their example was duplicated among the TOC chairs, a formidable ensemble that inspired the entire social network as a community of global best practice.”*

Nancy Reichman<sup>18</sup>

**Figure 6: Structure and Networks of the TEAP membership**



Source: Canan and Reichman (2002). TEAP Membership Key: Red (Industry), Green (NGO), Blue (Academia), Yellow (Government)

## 9 Financing and Integrity of the TEAP

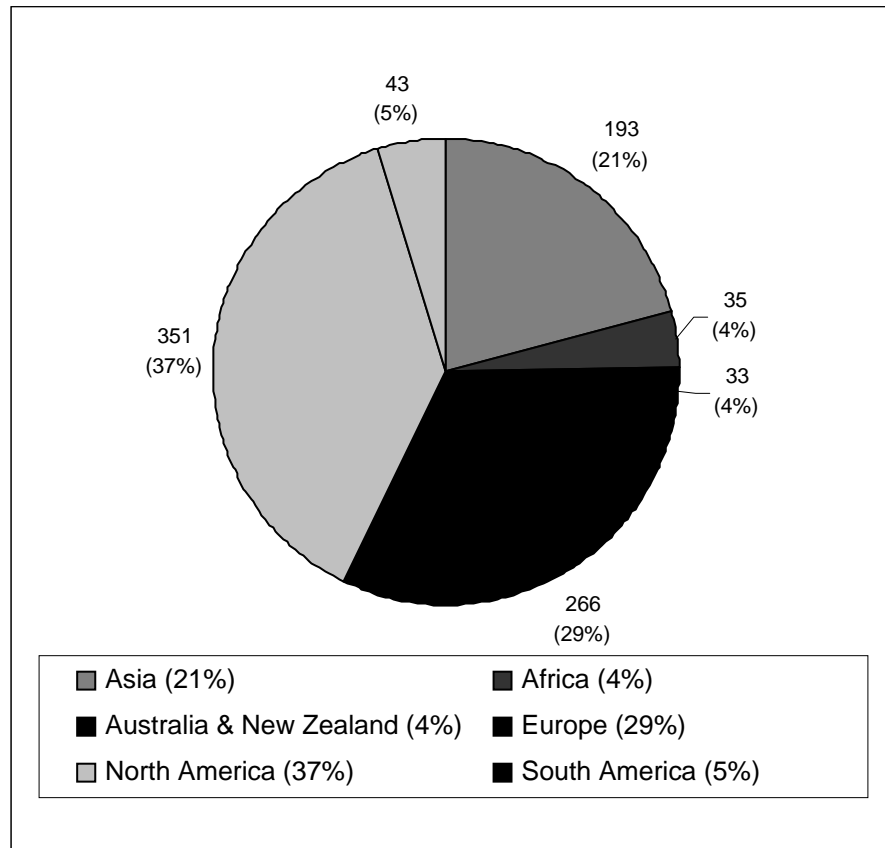
*“At first glance, one may question how affected industries could be objective.”*  
Suely Carvalho – Brazil, TEAP Co-Chair, 1993-2002<sup>19</sup>

The members of the panel and its committees are paid by their employers/sponsors and not by the Protocol. The Trust Fund for the Montreal Protocol, however, meets the travel expenses of experts from developing countries and the countries with their economies in transition.

In a typical year, TEAP requires US\$100,000-150,000 in administrative and management charges, communication, word processing, printing and mailing costs. Each TOC typically spends US\$35,000-100,000 in overhead and management depending on whether the time of the chairs is an in-kind contribution or a sponsored contribution. In a typical year, over 4,000 person-days of effort are necessary to produce TEAP reports, with a calculated value of this voluntary contribution amounting to US\$2,600,000 per year, assuming that the value of expert time is US\$500/person-day and that the average annual per member expense for travel, lodging and other expense of US\$3000.

The TEAP maintains a desirable geographic and geopolitical diversity of members (see Figure 7 below). This is often referred to as “maintaining geographical balance,” which is important because a technology solution appropriate for one region may not be feasible, available or allowed elsewhere. Furthermore, the problems faced in motivating technology change and ODS phaseout may vary by country and region. By maintaining a diverse and balanced membership that can respond to requests from the Parties, TEAP creates a self-monitoring integrity as members strive to demonstrate their fairness and technical proficiency in the ongoing work. This balance enables the TEAP to better assess the extent to which alternatives are technically and economically feasible throughout the world.

**Figure 7: Participants by Continent**



The members agree to notify the TEAP of any potential conflicts of interest, and annually disclose sources of sponsorship. The three TEAP Co-Chairs manage a panel of about twenty members, including senior experts and co-chairs of six Technical Options Committees and occasional Task Forces. The committees each represent an industry sector dependent on ODSs. The TEAP consolidates findings from the committees and writes its own cross-cutting chapters.

*“The Parties rely on the TEAP’s ability for objective and balanced information upon which to base their decisions. Reports are developed through a consensus approach and this leads to the quality technical data on which Parties can rely.”*

The TEAP technical and economic findings have not unduly defended ODS use in a manner that might cause Parties or the public to question the integrity of TEAP. The “interest” of the Montreal Protocol is to protect stratospheric ozone that protects the earth against the harmful effects of ultraviolet radiation. Therefore, the “coincidence of interest” of TEAP members is to phase out ODSs. The “conflict of interest” would be to work against phaseout or to promote individual affiliation interests. So far, technical experts on the TEAP have time and again confirmed through consensus that accelerating the phaseout is technically and economically feasible. With only one exception (2005 nomination by the Russian Federation for MDIs), the TEAP and its TOCs have never recommended an amount greater than nominated for an essential or critical use and have never recommended an amount greater than granted by the Parties.

It may be significant that the TEAP has experienced more problems in enforcing its code of conduct for government employees and their paid consultants than for employees and consultants to industry.

*“The ATOC (now reorganized as MTOC) has been a cohesive group of environmental experts, physicians, and technical experts. The technical experts, although employed by the pharmaceutical companies that manufacture the CFC MDIs, have been remarkably independent in their positions and in the information they have contributed.”<sup>20</sup>*

Helen Tope -- Australia, ATOC Alternate Co-Chair 1993-1995,  
ATOC/MTOC Co-Chair 1993-continuing

Ashley Woodcock – UK, ATOC/MTOC Co-Chair, 1996-continuing

## **10 TEAP as a Catalyst for Change**

In addition to providing scientific and technical information as a basis for policy decisions, the assessment panels have also served as communication tools and catalysts for necessary change. Participation in the TEAP helped industry experts to understand the importance of ozone-layer protection and identify new business opportunities, and helped government participants to appreciate the difficulties of implementing new technology.

*“All panels enjoyed extreme autonomy, with leaders of each panel having unusual authority over the participation, process, and specific mandate covered, while still maintaining close enough relationship with decision makers to ensure the content would be relevant.”<sup>21</sup>*

TEAP members helped to remove barriers to change and inspired technical innovation. Experts from developed and developing countries worked together to identify new technologies applicable worldwide and helped develop a consensus of which technologies offered the best balance of technical efficiency, economy, and environmental acceptability. Perhaps most importantly, the TEAP process helped to build ‘bottom-up’ industry support for new technology in ways that governments, scientists, academics and others would not have been able to do.

*“The fire protection profession is accustomed to operating under the fundamental concept of assessing risks as a means to provide effective solutions. The new challenge was to include “environmental aspects” into its assessment of risk.”<sup>22</sup>*

Walter Brunner – Switzerland, HTOC Co-Chair, 1997-2003

Members of the TEAP are influential in technical standards organizations, industry associations, and private and public regulatory authorities. For example, a previous Co-Chair of the Halons TOC, Gary Taylor, also chaired the international fire-protection organizations with authority to halt testing and training and to approve alternatives and substitutes. A previous Co-Chair of the Solvents TOC, Stephen O. Andersen, also chaired the US Department of Defense committee with authority to approve alternatives and substitutes. Members from environmental ministries use knowledge of emerging technology to time regulatory approval with commercialization. Industry experts are also influential in crafting regulatory incentives necessary to stimulate investment and rapidly achieve economies of scale.

*“When the MBTOC become a target of aggressive business interests intent on dominating the debate, Parties have supported the restructuring in order to return objectivity and integrity to the process.”<sup>23</sup>*

Jonathan Banks, Australia -- MBTOC Co-Chair, 1993-1998 and 2001-2004;  
QPS Task Force Co-Chair, 2005-2007

TEAP experts (both from developed and developing countries) were and are consultants for the GEF and MLF implementing agencies and as such have given an enormous contribution. They have delivered sound technical advice which led to success in technology transfer and technology uptake by developing countries in record time. Their presence in the field to design and implement projects to replace ODS brought awareness of the subject to hundreds of thousands of small, medium and large enterprises, building capacity, and brought back to the TEAP/TOC Reports the “hands on” experience that made the TEAP Assessment more real and credible to the developing countries.

The TEAP provides reliable, unbiased technical information free of charge. Without the TEAP, developing countries would have to pay for technical consultants for the same information on ODS alternatives and technologies. Furthermore, the TEAP has global perspective and provides balanced, unbiased reporting on all technical options available. This unbiased, clear presentation of alternatives is vital to developed and developing countries. By relying on the TEAP, countries can rest assured that they are getting reliable information they can trust.

TEAP experts can influence market transformation. Industry and military members of the TEAP were typically responsible for the phase-out of ODSs from their own organizations. Experts working in world-class teams are more confident in selecting technology than when they work alone. Suppliers are more responsive when markets are primed to accept new technology.

## 11 Measures of TEAP Success

*“I think it is fair to say that science and the consensus among scientists around the world were critical ingredients in the Protocol process, as was the consensus that emerged on what could be accomplished and by when. Even more important was the assessment and reassessment process in the Protocol, since this forced a review and was almost impossible for the Parties to discount. In fact, without the assessment for both science and technology, I doubt that we would have been able to move either to the London or the Copenhagen agreements.”<sup>24</sup>*

Mostafa Tolba -- Egypt, UNEP Executive Director, 1976-1992

*“TEAP reports have been the gold standard, equally credible to industry and environmental NGOs. TEAP shows what can be done, how fast, and at what cost. Their broad credibility provides the technical basis for governments to push for rapid changes from ozone-depleting technologies to cleaner, safer, and more efficient ones. Without the TEAP reports, governments would move much more slowly.”*

David Doniger – USA, Natural Resources Defense Council

Modern management theory uses a number of techniques to measure the success of an organization. An appropriate list of performance measures for an Assessment Panel might include:

- Factual and authoritative findings proven to inform policy decisions
- Parties have never asked that a report be rewritten
- Corrections have been few and literary, not technical
- No scholar has found significant fault with any TEAP or TOC finding
- No reports of errors or omissions by industry or technical bodies
- Considered by industry, scholars, and governments as technical gospel<sup>25</sup>
- TEAP is favourably credited by scholars for its objective findings
- Many technical publications have their origin in the work of the TEAP



Highly prestigious and sought-after membership

TEAP and TOC members work beyond wages and often finance expenses

Resumes of experts spotlight TEAP and TOC participation

*“The TEAP assessments achieved unprecedented success in providing high-quality technical advice to the Montreal Protocol parties regarding the available technical alternatives. In addition, these assessments also served to promote problem solving in deploying alternatives and to disseminate information among relevant industry sectors.”<sup>26</sup>*

## **12 Rewards for TEAP and TOC Participation**

For many technical experts, the TEAP was the first opportunity to team up with experts from competing companies. Motivated by regulatory, consumer and environmental leadership, the companies authorized extraordinary cooperation in identifying technologies and techniques to reduce and eliminate ODS emissions. Soon technical experts from industry were in high demand as national advisers and as speakers at industry conferences. Their experience and market knowledge represented an advantage, hard to be surpassed by government or academic sources. Technical optimism and case studies provided the confidence policy-makers needed to take even more decisive action. Technical reports pulled Montreal Protocol policy, and the increasingly stringent Protocol motivated the industry collaboration to achieve ultimate phase-out goals.

## **13 TEAP cited in Professional and Technical Literature**

### ***Book Search:***

Internet-based book searches on “Technology and Economic Assessment Panel” returns between 50 and 150 results, depending on the search engine. For example, a book search on “Amazon.com” returns about 50 qualified results. Appendix 4 is an indicative list of books with significant content regarding the TEAP and its TOCs.

### ***Patent Search:***

TEAP reports are cited in two US Patents:

US Pat. 5883142 - Filed Nov 25, 1997 - Air Products and Chemicals, Inc., “Silicone surfactants for rigid polyurethane foam made with third generation blowing agents,” and

US Pat. 6624208 - Filed Feb 1, 2002 – Atofina, “Blowing agent based on HFC-134a and cyclopentane for the expansion of polymers.”

### ***Scholarly articles and publications:***

An internet-based search on scholarly articles that reference the “Technology and Economic Assessment Panel” returned over 150 qualified results. Appendix 5 is an indicative list.

### ***Web search:***

Google Search on “Technology and Economic Assessment Panel” returns 27,800 links

Google Search on “Technology and Economics Assessment Panel” returns 1,290 links

## *Guide to the Appendices*

- **Appendix 1: Members of the Task Force on the TEAP Legacy**
- **Appendix 2: Disclosure of TEAP Legacy Task Force Members Not Serving On TEAP**
- **Appendix 3: Cumulative List of TEAP, TOC, Task Force and Other Members 1989-2007**

The employment and national affiliation or place of residence of members sometimes changed during participation on the TEAP and its subsidiary bodies. Task Force members and the TOC Co-Chairs who proofed the list used their best judgment to update the information, but it is likely that errors have been made. Please send any corrections to the Ozone Secretariat.

- **Appendix 4: TEAP, TOC, Task Force and Other Reports, 1989-2006**

Many of these reports are available on the United Nations Environment Programme's TEAP website: <http://ozone.unep.org/teap/Reports/index.asp>

- **Appendix 5: Indicative List from Book Search for the “Technology and Economic Assessment Panel”**
- **Appendix 6: Indicative List of Scholarly Articles referencing the “Technology and Economic Assessment Panel”**

## **Appendix 1: List of Members of the Task Force on the Continuing TEAP Legacy**

### **Co-Chairs**

Stephen O. Andersen, USA, Environmental Protection Agency

Marta Pizano, Colombia, Hortitecnia

Kristen Taddonio, USA, US Environmental Protection Agency

### **Members**

Nick Campbell, France, Arkema

Penelope Canan, USA, University of Central Florida

Suely Carvalho, Brazil, United Nations Development Program

David Doniger, USA, Natural Resources Defense Council

Marco Gonzalez, Costa Rica, Ozone Secretariat

Lambert Kuijpers, Netherlands, Technical University Eindhoven

Melanie Miller, Belgium, Consultant

Jose Pons Pons, Venezuela, Spray Quimica

K. Madhava Sarma, India, Consultant

Megumi Seki, Japan, Ozone Secretariat

Dave Stirpe, USA, Alliance for Responsible Atmospheric Policy

Helen Tope, Australia, Consultant

Masaaki Yamabe, Japan, National Institute of Advanced Industrial Science and Technology

Shiqiu Zhang, China, Peking University

### **Corresponding Member**

Liu Liu, China, University of California—Los Angeles (UCLA)

## **Appendix 2: Disclosure of Task Force Members not Serving on the 2007 TEAP**

**Penelope Canan** is a member of the 2007 Task Force on the TEAP Legacy. She is Professor of Sociology at the University of Central Florida. Penelope Canan is a full time faculty member at the University of Central Florida, main campus in Orlando, Florida. The University of Central Florida has an interest in the topic of the Montreal Protocol because it is academically interesting. Penelope Canan does not have a proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not have an interest in the outcome of EUN or CUNs, and does not consult for organizations seeking to phaseout ODSs. Penelope Canan does not have a spouse. She occasionally works as a consultant to UNEP on matters related to the Montreal Protocol. The Legacy Task Force worked by e-mail and there were no travel or other expenses paid by any organizations to participate in this activity.

**Nick Campbell** is a member of the 2007 Task Force on the TEAP Legacy, has been a member of both the Medical TOC and the Chemicals TOC since they were formed, and has served on other TOCs and Task Forces. Nick Campbell has spent 19 years working primarily on the ozone layer issue and climate change. He works for ARKEMA SA, based in Paris, as the Environment Manager for the Fluorinated Products Division. ARKEMA SA is a producer of CFCs, HCFCs and HFCs. ARKEMA SA supports his participation and travel on the MTOC and CTOC. Nick Campbell has stock options in ARKEMA SA. He is Chairman of the European Fluorocarbon Technical Committee (EFCTC) that represents the producers of fluorocarbons in the European Union and the European Chemical Industry Council (CEFIC) Working Party on Climate Change. He is also the Chairman of the International Chamber of Commerce (ICC) Working Party on Climate Change and the Chairman of the BusinessEurope Climate Change Working group, representing European Union Employers' federations. Nick Campbell has been a member of the World Bank's OORG. He was a Coordinating Lead Author for the IPCC/TEAP joint Report on HFCs and PFCs (April, 2005). He was awarded a 1997 United States EPA Stratospheric Ozone Protection Award for his role in the phase-out of ODS.

**Suely Machado Carvalho** is a member of the 2007 Task Force on the TEAP Legacy. She is the Principal Technical Adviser for Chemicals and Chief of the Montreal Protocol Unit at the United Nations Development Programme, Environment and Energy Group, Bureau for Development Policy, in New York. Before joining UNDP she was a university professor and also worked for the Brazilian government at the federal and state levels. Suely Carvalho was co-chair of the TEAP from 1993-2002 and requested to leave its co-chair position when appointed as Chief of the Montreal Protocol Unit at UNDP. As Chief of the Unit, she is responsible for the portfolio of Montreal Protocol projects implemented by UNDP under the Multilateral Fund and under the Global Environment Facility. She has no proprietary interest on alternatives or substitutes to ODSs and does not own stock in companies producing ODS, alternatives or substitutes to ODSs. Her spouse has no interest in matters before the Protocol. The Task Force worked by e-mail and there was no travel or other expenses paid by any organizations to participate in this activity.

**David Doniger** is a member of the 2007 Task Force on the TEAP Legacy. He is Policy Director of the Climate Center at the Natural Resources Defense Council. David Doniger is employed full time in NRDC's Washington office. The NRDC has a long-term interest in adopting, strengthening and implementing the Montreal Protocol because NRDC is a nongovernmental organization committed to protecting the public health and the environment and, specifically, in protecting the ozone layer. He has no proprietary interest alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not have a financial interest in the outcome of EUN or CUNs, and (other than his employment with NRDC) does not consult for organizations seeking to

phaseout ODSs. David Doniger's spouse has no interest in matters before the Protocol. The Task Force worked by e-mail and there was no travel or other expenses paid by any organizations to participate in this activity.

**Marco Gonzalez** is a member of the 2007 Task Force on the TEAP Legacy. He is the Executive Secretary of the UNEP Montreal Protocol Ozone Secretariat in Nairobi, Kenya. The Ozone Secretariat has an interest in the topics of the Montreal Protocol because it maintains Protocol records, manages Protocol meetings, coordinates with Protocol bodies and with other treaty secretariats, and in many, many other ways assures compliance with the Control Measures of the Vienna Convention and Montreal Protocol. Marco Gonzalez and his immediate family have no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not have an interest in the outcome of EUN or CUNs. The Task Force worked by e-mail and there was no additional travel or other expenses paid by any organizations to participate in this activity.

**Megumi Seki** is a member of the 2007 Task Force on the TEAP Legacy. She is the Senior Scientific Affairs Officer of the UNEP Montreal Protocol Ozone Secretariat in Nairobi, Kenya. The Ozone Secretariat has an interest in the topics of the Montreal Protocol because it maintains Protocol records, manages Protocol meetings, coordinates with Protocol bodies and with other treaty secretariats, and in many, many other ways assures compliance with the Control Measures of the Vienna Convention and Montreal Protocol. Megumi Seki is also Ozone Secretariat liaison to the TEAP. She and her immediate family have no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not have an interest in the outcome of EUN or CUNs. The Task Force worked by e-mail and there was no additional travel or other expenses paid by any organizations to participate in this activity.

**Dave Stirpe** is a member of the 2007 Task Force on the TEAP Legacy. He is the Executive Director at the Alliance for Responsible Atmospheric Policy in Arlington, Virginia. The Alliance has an interest in the topics of the Montreal Protocol because it is composed of enterprises that manufacture and use fluorocarbons, and it advocates responsible use of alternatives to compounds that are phased out under the Protocol in uses such as air conditioning, refrigeration, foam insulation, fire protection, technical aerosols, and MDIs. David Stirpe has no proprietary interest in alternatives or substitutes to ODSs, does not own stock in companies producing ODS or alternatives or substitutes to ODSs, does not have an interest in the outcome of EUN or CUNs. He does consulting for organizations seeking to implement alternatives to ODSs. The Task force worked by e-mail and there was no travel or other expenses paid by any organizations to participate in this activity.

### Appendix 3: Cumulative List of TEAP, TOC, and Task Force Members 1989-2007

Name	Affiliation	Country
A. A. Khan	Indian Institute of Chemical Technology	India
A. Nathan Reed	Stemilt Growers	USA
A. Stera	Lloyd's Register House	UK
A. Wilson	Lloyd's Register of Shipping	UK
A.J. Barnes	Boehringer Ingelheim	Germany
A.V. Rama Rao	Indian Institute of Chemical Technology	India
Abe Finkelstein	Environment Canada	Canada
Abe Rubinfeld	Royal Melbourne Hospital	Australia
Abid Merchant	E.I. Du Pont de Nemours and Company/Consultant	USA
Abraham Gamliel	Agricultural Research Organization	Israel
Adam M. Sebbit	Makerere University	Uganda
Adam Wanner	University of Miami	USA
Adel Kader	University of California	USA
Adrian Carter	Agriculture Canada	Canada
Adrian Steenkamer	Environment Canada	Canada
Ahmad Al-Khatib	Ministry of Environment	Jordan
Ahmad H. Graber	Cairo University / Chemonics Consultancy	Egypt
Ahmed Amin Ibrahim	Egypt Academy of Science Research and Technology	Egypt
Akari Aguri	Daikin Industries	Japan
Akihide Katata	Mitsubishi Electric	Japan
Akio Kanda	Koatsu Gas Kogyo	Japan
Akio Tateya	Japan Fumigation Technology Association / Syngenta Japan	Japan
Al Marulli	Agricultural Trade Services	USA
Alan Fine	U.S. Environmental Protection Agency	USA
Alan Miller	University of Maryland	USA
Alan Robinson	Boeing Commercial Airplane Group (retired)	USA
Alan Tang	Sanden	Malaysia
Alan Teramura	University of Maryland	USA
Albert Able	Commodore Environmental	USA
Albert L. Sheffer	Brigham and Women's Hospital	USA
Albert Paulus	University of California	USA
Alberto Carrizo	QTC-Qualltas	USA
Alberto Zarantonello	Cannon	Italy
Albin Czernichowski	Universite D'Orleans	France
Alec Bouchitte	B.D.P.A.	UK
Alejandro Valeiro	INTA / Department of Agriculture	Argentina
Alessandro Amadio	UNIDO	Italy
Alfred P. Dougherty	E.I. DuPont de Nemours and Company	USA
Alfredo (Didi) Gonzales	Private Consultant	Philippines
Allen Zhang	Owens Corning	China
Amber Moreen	U.S. Environmental Protection Agency	USA
Anders Hansson	Astra Draco	Sweden
Anders Lindborg	Frigoscandia	Sweden
Andre Orban	European Chlorinated Solvents Association	European Union
Andre P. Rd Cyjak	Ministry of Trade, Industry and Tourism	Brazil
Andrea Hinwood	Victoria Environment Protection Authority / Monash University	Australia

<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
Andrea Minuto	Agroinnova Universita di Torino	Italy
Andrew Cleland	Massey University	New Zealand
Andrew Greig	Protection Projects	South Africa
Andy Pearson	Star Refrigeration	UK
Angelo Bertu	Whirlpool	Italy
Anhar Karimjee	U.S. Environmental Protection Agency	USA
Anil Markandya	University College of London / Harvard Institute for International Development	UK
Ann Godfrey	U.K. Department of Environment	UK
Annie Boutland	Environment Australia	Australia
Annie Illett	Environment Australia	Australia
Annie Maurel-Groleau	Telemecanique	France
Anthony B. Murphy	Australia Commonwealth Scientific and Industrial Research Organization	Australia
Antonio Bello	Centro de Ciencias Medioambientales	Spain
Antonio Cristodero	Consultant	Argentina
Antonio Sabater	Consultant	Spain
Aocheng Cao	Chinese Academy for Agricultural Sciences	China
Ariane Saade	Totken Lebanon	Lebanon
Arne Kverheim	SINTEF Industrial Chemistry	Norway
Arnon Simakulthorn	Thai Compressor Manufacturing	Thailand
Art FitzGerald	Nortel / Northern Telecom	Canada
Arthur Lim	Institution of Fire Engineers	Singapore
Arvind Kapoor	Indian Chemical Manufacturers' Association	India
Aryadi Suwono	Bandung Institute of Technology	Indonesia
Ashley Woodcock	University of Manchester	UK
Atsuo Takei	Bridgestone	Japan
Attila Zoltan	Refrigeration Association	Hungary
Avi Grinstein	Israel Laboratory for Pesticide Application	Israel
Ayub Hira	E.A. Mueller Consulting Engineers	USA
B.S. Kataria	India Defence Institute of Fire Research	India
Bai Xianhong	China International Science Centre	China
Barbara Kucnerowicz-Polak	Poland State Fire Services Headquarters	Poland
Barry Blair	Zimbabwe Tobacco Research Board	Zimbabwe
Barry Lee	Wormald	Australia
Bella Maranion	U.S. Environmental Protection Agency	USA
Bente Sleire	Norway State Pollution Control Authority	Norway
Bernard Valentin	Frigiking	France
Bernard Madé	Environment Canada	Canada
Bert Veenendaal	RAPPA	USA
Biao Jiang	Shanghai Institute of Organic Chemistry	China
Bill Baumgartner	W.Z. Baumgartner and Associates	USA
Bill Brox	IFV	Sweden
Bill Gutheim	Carrier	USA
Bill Kopko	U.S. Environmental Protection Agency	USA
Bill Thomas	U.S. Environmental Protection Agency	USA
Birgitta Schmekel	University Hospital	Sweden
Bishu Chakrabarti	U.K. Central Science Laboratory	UK
Bjorn Lindstrom	Ericsson Radar Electronics	Sweden
Bob Taylor	Consultant	UK

<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
Brent Davey	Australia Centre for Environmental Management	Australia
Brian Ellis	Protonique	Switzerland
Brian Hobsbawn	Environment Australia	Australia
Brian Ward	Kidde Graviner	UK
Brian Yamashita	Royal Canadian Mounted Police	Canada
Bruno Costes	Aerospatiale / Airbus	France
Bryan Baxter	British Aerospace	UK
Bud Levine	Deft Chemical Coatings	USA
C. W. Lee	U.S. Environmental Protection Agency	USA
Caio Cezar Borges Sedeno	Dow Latin America / Dow Chemical Brazil	Brazil
Candido Lomba	Instituto Nacional do Plastico / ABRIPUR	Brazil
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Mohamed Besri	Institut Agronomique et Vétérinaire Hassan II	Morocco
Mohamed Zahoor Dean	Remco	Kenya
Mohammed Ridzuan Ismail	Malaysian Department of Agriculture	Malaysia
Mohammed Azmi Rahim	Malaysia Department of Agriculture	Malaysia
Mohinder P. Malik	Lufthansa German Airlines	Germany
Montfort Johnsen	Montfort A. Johnsen & Associates	USA
Morkel Steyn	South African Department of National Health and Population Development	South Africa
Muneharu Sanoh	Japanese Electrical Manufacturers' Association	Japan
Murray Hannah	Primary Industries Research Victoria	None listed
Myles Morse	U.S. Environmental Protection Agency	USA
Nahum Marban Mendoza	Universidad Autonoma de Chapingo	Mexico
Nancy Sherman	Foodservice & Packaging Institute	USA
Naoyuki Matsumoto	National Institute for Agro-Environmental Sciences	Japan
Natalie Karavarsamis	Department of Primary Industries, Victoria	Australia
Nee Sun Choong Kwet Yive	University of Mauritius	Mauritius
Nick Campbell	ICI / Atofina / Arkema Group	UK/France
Nick Highton	Overseas Development Administration	UK
Nick Vink	University of Stellenbosch	South Africa
Nicolai P. Kopylov	All-Russian Research Institute for Fire Protection	USSR
Nigel Lo	Boeing	USA
Nimirsada Lazarevic	Federal Secretariat for Foreign Economic Relations	Yugoslavia

<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
Nobuhiko Yokota	Japan Refrigeration & Air Conditioning Industries Association	Japan
Nobuo Ishikawa	Tokyo Institute of Technology	Japan
Norio Sawada	Sanyo	Japan
Noriyuki Mizuno	Nakano Refrigerators	Japan
Norman Leppla	U.S. Department of Agriculture	USA
Ole Reinholdt Nielsen	Re-a-ct Consultancy	Denmark
Olga Blišnova	Russian Scientific Center of Applied Chemistry	Russia
Olle Mattsson	Getinge	Sweden
Olufunke Egunjobi	Ondo State University	Nigeria
Omar El-Arini	Montreal Protocol Fund Secretariat	Egypt
Ong Ewe Hock	Malaysia ODS Working Group	Malaysia
Osama A. El-Kholy	Egyptian Environment Directorate	Egypt
P. Burk	Sudd Kuehlerfabr Behr	Germany
P. Johansing, Jr.	Transformation Technologies	None listed
P. Kumarasamy	Kontrak Manufacturing Services	Malaysia
Pakasit Chanvinij	Thai Airways	Thailand
Pamela Foster	Friends of the Earth	None listed
Pascal Deschamps	Consultant	France
Pat Rynd	Owens Corning	None listed
Patrice Rollet	Promosol / Avantec, Dehon Group	France
Patricia Clary	Californians for Alternatives to Toxics/SAFE Alliance	USA
Patricia Drill	U.S. Department of Agriculture-Agricultural Research Service	USA
Patrick Ducom	Ministère de l'Agriculture et de la Pêche	France
Patrick Vail	U.S. Department of Agriculture-Agricultural Research Service	USA
Paul Ashford	BP Chemicals / Caleb Management Services	UK
Paul Atkins	Oriel Therapeutics	USA
Paul Brauch	Vilter Manufacturing	None listed
Paul Cammer	Cammer & Associates	USA
Paul Horwitz	U.S. Environmental Protection Agency	USA
Pauline Midgley	University of Stuttgart	Germany
Paulo E.S. Vieira	Du Pont do Brasil	Brazil
Paulo Vodianitskaia	Consul SA / Multibras	Brazil
Pei Wang	Texas Instruments	USA
Penelope Canan	University of Denver	USA
Per Danig	Danish Technical University	Denmark
Per Henrick Pedersen	Danish Technological Institute	Denmark
Per S. Dovle	Statens Forurensningstilsyn	Norway
Per Samuelson	Finsam	Norway
Per-Erling Frivik	SINTEF	Norway
Peter Caulkins	U.S. Environmental Protection Agency	USA
Peter Cooper	Sainsburys / Adtec Services	UK
Peter Fowlie	Wastewater Technology Centre	None listed
Peter Johnson	ICI / European Chlorinated Solvents Association	UK
Peter Kjeldsen	Technical University of Denmark	Denmark
Peter Landymore	U.K. Overseas Development Administration	USA
Peter Likes	Hussman	USA
Peter Miasek	Exxon Chemical Canada	Canada
Peter Moser	Sulzer Friotherm	Switzerland

<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
Peter Tomlein	Slovak Refrigeration Assoc	Slovakia
Peter Uhlenbrock	Hoechst	Germany
Peter Verge	Boeing	USA
Petter Neksa	SINTEF	Norway
Pham van Tho	Vietnam Ministry of Fisheries	Vietnam
Phil Fairchild	Oak Ridge National Laboratory	USA
Phil J. DiNenno	Hughes Associates	USA
Philip Morton	Cleanaway Technical Waste	UK
Phillip Pierce	Armed Forces Pest Management	None listed
Pierre Barthélemy	Solvay Fluor and Derivate	None listed
Pierre Weiss	Elf-Atochem	None listed
Pieter Koelet	NV Schatten	Belgium
Poul-Erik Hansen	Danfoss	Denmark
Pranot Kotchabhakdi	Thai Nam Plastic / Sunprene	Thailand
Preston Hartsell	U.S.Department of Agriculture	USA
Quiang Xu	Shanghai Haohai Chemical Corporation	China
R. C. Knollys	CMB Aerosols / FEA Environment Committee	UK
R. Garcia-Espinosa	Centro de Fitopatologia	None listed
Radhey S. Agarwal	Indian Institute of Technology	India
Raj Singh	Apollo Hospital	India
Rajendra Shende	United Nations Environment Programme IE/PAC	France
Ralph Ross	U.S. Department of Agriculture	USA
Raymond Watkins	Boeing	USA
Reg Hurd	British Rubber Manufacturers' Association	UK
Reiner Tillner-Roth	University of Hannover	Germany
Ren Jinlu	GMRI	China
Renata Tenente	Embrapa/Cenargen	Brazil
Rene Weber	Great Lakes Chemical Corporation	USA
Reva Rubenstein	U.S. Environmental Protection Agency / Consultant	USA
Ricardo T. Deang	Consultant	Philippines
Rich Sweetser	Gas Cooling Center	USA
Richard Bromberg	Brazil Halon Services	Brazil
Richard Bruno	Sun Diamond Growers of California	USA
Richard Ertinger	Carrier	None listed
Richard Kramer	National Pest Control Association	None listed
Richard Lockey	University of South Florida	USA
Richard Marcus	FRC International	USA
Richard Minday	3M Industrial Chemical Products	USA
Richard Oas	Safeway	USA
Richard Olson	Dolco Packaging	USA
Richard Radecki	Harrison Radiator Division of General Motors	USA
Richard Turle	Environment Canada	Canada
Richard Wright	American Society of Heating, Refrigeration, and Air-Conditioning Engineers	USA
Rick Freeman	Boeing	USA
Rick Keigwin	U.S. Environmental Protection Agency	USA
Rick Mulhaupt	National Fire Protection Association	USA
Risto Ojala	Consultant	Finland
Rob Layet	Ensign Laboratories	Australia
Rob Van Den Bor	Akzo-Nobel	Netherlands
Robert Begbie	Exxon Chemical	None listed

<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
Robert Chin-Hsing Huang	Environment Alberta	Canada
Robert Darwin	U.S. Department of the Navy	USA
Robert Dunn	Australian Environment Protection Agency	Australia
Robert E. Tapscott	New Mexico Energy Research Institute	USA
Robert Eplee	U.S. Department of Agriculture	USA
Robert Hall	U.S. Environmental Protection Agency	USA
Robert Hawkes	SRL Plasma	Australia
Robert Heap	SCRCA / Cambridge Refrigeration Technology	UK
Robert Hornung	Friends of the Earth	Canada
Robert Johnson	Whirlpool	USA
Robert Kisch	Boeing Commercial Airplane Group	USA
Robert Krieger	Technical Assessment Systems	None listed
Robert Meyer	U.S. Food and Drug Administration	USA
Robert Morrissey	Johnson & Johnson	USA
Robert Norris	3M Industrial Specialties	USA
Robert Orfeo	AlliedSignal	USA
Robert Russell	independent consultant, down plastics	USA
Robert Suber	RJR-Nabisco	USA
Robert T. Wickham	Wickham Associates	USA
Robert Taylor	Consultant	UK
Robert Tóth	Hungary Ministry for Environment and Regional Policy	Hungary
Robert van Slooten	UK Dept. of Trade & Industry / Economic Consultant	UK
Robert Watson	U.S National Aeronautics and Space Administration	USA
Robert Webb	Driscoll Strawberry Associates	USA
Roberto de A. Peixoto	Maua Institute of Technology	Brazil
Robin Round	Friends of the Earth Canada	Canada
Rodrigo Rodriguez-Kabana	Auburn University	USA
Roger Daly	Ontario Hydro	Canada
Roland Ares	Hussman	USA
Roland Mottal	International Institute of Refrigeration	France
Roland Stechert	Boehringer Ingelheim Pharma	Switzerland
Rolf Segerstrom	Electrolux	Sweden
Rolf Wallner	Behr	Germany
Rolf Wemer Eckermann	Bayer AG	Germany
Ron Cole	RAC, RA Cole and Associates	USA
Ronald Fredriksz	Ministry of Environment	Netherlands
Ronald Kuse	Boeing Commercial Airplane Group	USA
Ronald S. Sheinson	U. S. Naval Research Laboratory	USA
Ronald Vallort	A. Epstein & Sons	USA
Ronald W. Sibley	U.S. Defense Logistics Agency	USA
Rosemary Townsend	Australia Environment Protection Agency	Australia
Roy Young	U.K. Loss Prevention Council	UK
Rune Aarlien	Norwegian Inst. Of Tech / SINTEF Energy Research	Norway
Russell Benstead	Elec. Council RC / EA Technology	UK
Ruth Anderson	AT&T Bell Laboratories	USA
Ruth Covill / Kolb	San Diego Port Authority / San Diego Unified Port District	USA
Ryoichi Fujimoto	Hitachi	Japan
S. Forbes Pearson	Star Refrigeration	UK
S. K. Mukerjee	India Ministry of Environment and Forests	India
S. Purushothama	Loss Prevention Association of India	India
S. W. Clarke	The Royal Free Hospital	None listed

<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
S.C. Bhaduri	Indian Institute of Technology / Tehcumseh	India
Saad Hafez	University of Idaho	USA
Sachio Hotani	Japan Association of Refrigeration	Japan
Salah El Serafy	The World Bank	USA
Sally Rand	U. S. Environmental Protection Agency	USA
Sally Schneider	U.S. Department of Agriculture	USA
Sandip Bhatia	Navin Fluorine Industries	India
Santiago Pocino	FMC Forét	Spain
Sateaved Seebaluck	Mauritius Ministry of the Environment & Quality of Life	Mauritius
Scott Wood	U.S. Department of Agriculture	USA
Sean McDonald	Battelle Pacific NW Laboratory	USA
Seiji Ishii	Japan Urethane Foam Association	Japan
Seiji Sumikawa	Diesel Kiki	Japan
Seizo Horiuchi	Japan National Research Institute of Vegetables	Japan
Seok Woo Lee	Korea National Institute of Technology and Quality	Korea
Serge Langdau	Commercial Chemical Branch	Canada
Sergey Kopylov	All Russian Research Institute for Fire Protection	Russia
Sergio Minerbi	Shanti Consultants	Israel
Sergio Oxman	Ministry of Land & Environment Chile / The World Bank	Chile
Seunghwan (Charles) Choi	Hanju Chemical Company	South Korea
Sheila Daar	Bio-Integral Resource Center	USA
Shelton Taylor	Refrigerant Recovery Systems	USA
Sherman Forbes	U.S. Department of Defense	USA
Shi Jia Fan	Qindao Haier Group	China
Shigeo Kojima	Japan National Institute of Hygienic Sciences	Japan
Shigeo Matsui	Toshiba / Japan Audit and Certification Organization	Japan
Shigeru Dejima	All Japan Laundry & Drycleaning Association	Japan
Shigeru Wakana	Dow Chemical Japan	Japan
Shigeru Tomita	Kurabo Industries	Japan
Shinji Hibi	Mitsubishi Electric	Japan
Shiqiu Zhang	Peking University	China
Shreekant Gupta	University of Delhi	India
Shun-ichi Yamashita	Kanto Denka Kogyo	Japan
Shunichi Samejima	Asahi Glass/The Asahi Glass Foundation	Japan
Shunya Hisashima	Japan Refrigeration and Air-conditioning Industry Association	Japan
Sidney Braman	Rhode Island Hospital	USA
Simon Lee		None listed
Sodarlo Souto	Multibras	Brazil
Sonny Sundaresan	Copeland	USA
Srinivas K. Bagepalli	General Electric Research & Development	USA
Staffan Olsson	Scanraff	Sweden
Stefan Smith	Department of Primary Industries, Victoria	None listed
Stephan Sicars	Siccon Consulting	Germany
Stéphane Grenon	Environment Canada	Canada
Stephen A. Montzka	National Oceanographic and Atmospheric Administration	USA
Stephen DeCanio	University of California at Santa Barbara	USA
Stephen Evanoff	General Dynamics / Lockheed Martin	USA
Stephen Lai	Singapore Institute of Standards and Industrial Research	Singapore
Stephen O. Andersen	U.S. Environmental Protection Agency	USA
Stephen Seidel	U. S. Environmental Protection Agency	USA

<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
Steve Anderson	Australian Fluorocarbon Council	Australia
Steve Bernhardt	Honeywell	USA
Steve Lee-Bapty	U.K. Department of the Environment	UK
Steve McCormick	U.S. Army	USA
Stig Christensen	COWiconsult	Denmark
Stig Grundén	Hydro Plast	Sweden
Sture Astrom	Elsi-Tech	Sweden
Sudhakar Kesavan	ICF	USA
Sue Stendebach	U.S. Environmental Protection Agency	USA
Suely Machado Carvalho	United Nations Development Programme	Brazil
Sukumar Devotta	India National Chemical Laboratory	India
Suresh Rastogi	Denmark Ministry of Environment & Energy	Denmark
Susan Colgan	National Fire Protection Association	USA
Susanne Clarke	Australian Halon Bank	Australia
Suzie Kocchi	U.S. Environmental Protection Agency	USA
Swee Hee Ko	Jumaya Industries	
Sylvain Rault	Universit de Caen	France
Takao Kadota	Dow Chemical Japan	Japan
Tadatoshi Banse	Toshiba	Japan
Takaaki Konno	Fenwal Controls of Japan	Japan
Takamitsu Muraoka	Sanko Chemical	None listed
Takao Yamamoto	Japan Urethane Foam Industrial Association	Japan
Takashi Kawabata	Japan Ministry of Economy, Trade and Industry	Japan
Takashi Misumi	Ministry of Agriculture, Forestry and Fisheries Japan	Japan
Takeshi Yano	Zexel Corporation	Japan
Takesho Yoshii	Japan Heat Pump & Test Center	Japan
Tamás Lotz	Consultant to the Ministry of Environment and Water	Hungary
Ted Biermann	BASF Corporation	None listed
Ted Moore	New Mexico Energy Research Institute	USA
Terry Chadderton	Meat Industry Research Institute	New Zealand
Terry Ritter	Calor Gas	UK
Terry Statt	Department of Energy /Electric Power Research Institute	USA
Teruo Fukada	Japan Electrical Manufacturers' Association	Japan
Tetsuo Nishide	Japan Ministry of Economy, Trade and Industry	Japan
Thomas A Cortia	Halon Alternatives Research Corporation	
Thomas Batchelor	European Commission	Belgium
Thomas Bush	U.S. Department of the Army	USA
Thomas Jones	Boeing	USA
Thomas Land	U.S. Environmental Protection Agency	USA
Thore Berntsson	Chalmers Institute / Institute for Heat Technology	Sweden
Thorkil Hallas	Danish Technological Institute	Denmark
Timothy Leah	Environment Canada	Canada
Tom Bell	Simon Fraser University	Canada
Tom Duafala	TriCal	USA
Tom Waltz	The World Bank	USA
Tomishige Oizumi	Toshiba	Japan
Tony Griffiths	Gellsoft Ltd	Cyprus
Tony Hetherington	Australia Environmental Protection Agency	Australia
Tony Thornhill	Canadian Department of National Defence	Canada
Tony Vogelsberg	E.I. Du Pont de Nemours and Company	USA
Toshihide Kita	Japan Assoc. for Hygiene of Chlorinated Solvents	Japan

<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
Toshihiro Kajiwara	Japan Plant Protection Association	Japan
Trish MacQuarrie	Environment Canada	Canada
Trude Tokle	SINTEF Energy	Norway
Tsugio Iigusa	Nohmi Bosai	Japan
Tsuneo Sakurai	Teijin Chemicals	Japan
Tunde Otulana	Aradigm Corporation	USA
Udo Wenning	Bosch-Siemens Hausgeraete	Germany
Ulku As	Turkish Ministry of Agriculture	Turkey
Ulrich Hesse	University of Hannover / Robert Bosch	Germany
Ulrich Schmidt	Dow/Haltermann	Germany
V. N. Kudryavtsev	Mendeleyev University of Chemical Technology	Russia
V.P. Kukhar	Russian Federation Ozone Committee	USSR
Valerie Allegre	Arkema Group	France
Valery G. Barabanov	Russian Scientific Center of Applied Chemistry	Russia
Vasily Pivovarov	All Russian Research Institute for Fire Protectoin	Russia
Vassily N. Tselikov	ICP "Ozone"	Russia
Vern Walter	Abash Insect Control	None listed
Vicent Cebolla	Instituto Valenciano de Investigaciones Agrarias	Spain
Vicky Simpson	U.K. Department of Environment	UK
Vincente E. Velarde	VM Desin Associates	Philippines
Vinci Felix	E.I. Du Pont de Nemours and Company	USA
Vitaly Pulikov	USSR Ministry of the Chemical Industry	USSR
Vivian McIntire	Eastman Chemical Company	USA
Volker Brünighaus	Hennecke	Germany
Volkmar Hasse	GTZ	Germany
W. J. Samuel	SRF Limited	India
Walter Brunner	Envico	Switzerland
Wang Wenliang	Zhejiang Chemical Industry Research Institute	China
Wang Yuejin	China Ministry of Agriculture	China
Ward Atkinson	Sun Test Engineering	USA
Wayne Bishop	Boeing	USA
Wei Zhao	United Nations Environment Programme ActionOzone Programme	
Werner Jensen	Integral Technologie	Germany
Werner Viloehr	Bosch Siemens Hausgeraete	Germany
Werner Wagner	Valorec Services	Switzerland
Wiel Klerken	Netherlands Ministry of Economic Affairs	Netherlands
Wilfred Burr	U.S. Environmental Protection Agency	USA
Wilhelm Ritter	Upper-Austrian Electric Power Company	Austria
William Allen	CILS	None listed
William Currie	U.S. Environmental Protection Agency	USA
William Dennis	Duke University Medical Center	USA
William Eckholm	Fike Corporation	USA
William Feng	Anachemia Solvents	Canada
William Kenyon	DuPont / Global Centre for Process Change	USA
William Olkowski	Bio-Integral Resource Center	USA
William Telliard	U.S. Environmental Protection Agency	USA
Wim Sprong	The Netherlands Ministry of Housing, Spatial Planning and Environment	Netherlands
Wiraphon Rajanuraks	Thailand Department of Industrial Works	Thailand
Wolf-Eberhard Schiegl	Siemens	Germany



<b>Name</b>	<b>Affiliation</b>	<b>Country</b>
Wolfgang Scholten	Hoechst	Germany
X' Avier HK Yoong	Malaysian National Semiconductor	Malaysia
Xaba Mohoena	Ministry of Health Welfare and Pensions	South Africa
Xiao Xu Pei	Shanghai Institute of Organo Fluorine Materials	China
Y. Igarashi	Heat Pump Technology Center	Japan
Yasuhiro Kawanishi	Sanyo	Japan
Yasuo Omi	Masashi Institute of Technology	Japan
Yehia Lotfi	Technocom	Egypt
Ying-yun Cai	Zhongshan Hospital	China
Yoshiyuki Chunama	Achilles	Japan
Yoshiyuki Ishii	Hitachi/Japan Industrial Conference for Ozone Layer Protection	Japan
Yoshiyuki Morikawa	Matsushita Electric	Japan
Yoshiyuki Ohnuma	Achilles	Japan
You Yizhong	China Aerosol Information Center / Journal of Aerosol Communication	China
Youn Yong Lee	Korea Institute of Science & Technology	Korea
Yu Bing Feng	Xi'an Jiatong University	China
Yuanhui Xei	Zhejuang Chemical Industry Research Institute	China
Yuichi Fujimoto	Hitachi/Japan Industrial Conference for Ozone Layer Protection/Consultant	Japan
Yukinobu Ikemoto	Mitsubishi Heavy Industries	Japan
Yungong Feng	China Chemical Ministry	China
Yusof Bin Sidek	Malaysia Fire Services Department	Malaysia
Yusuf Ahmad	Consultant	Kenya
Yvon Marty	CTFHE	France
Zeev Gollop	Dead Sea Bromine	Israel
Zhang Zhiqun	Beijing University of Chemical Technology	China
Zhou Kaixuan	CAAC-AAD	China
Zhu Hailin	Tianjin Fire Research Institute / Ansul	China
Zhu Mingshan	Tsinghua Universtiy	China

## Appendix 4: Cumulative List of TEAP, TOC, Task Force & Other Reports

### *TEAP Reports:*

- TEAP Progress Report (2007)
- TEAP Assessment Report (2006)
- TEAP: Task Force on emissions discrepancies report (October 2006)
- TEAP Final Report: Evaluations Of 2006 Critical Use Nominations For Methyl Bromide And Related Matters (September 2006)
- Report of the Ozone Secretariat Workshop on the IPCC/TEAP Special Report (September 2006)
- TEAP Special Report: Validating the Yield Performance of Alternatives to Methyl Bromide for Pre-plant Fumigation (May 2006)
- TEAP Progress Report (May 2006)
- Corrigendum to the TEAP Progress Report (May 2006)
- Handbook on Essential Use Nominations
- Addendum to the October 2005 Supplement Report
- TEAP Supplemental Report to the IPCC/TEAP Special Report: Safeguarding the ozone layer and the global climate system (November 2005)
- Supplement to the May 2005 TEAP Task Force Replenishment Report (October 2005)
- TEAP Progress Report (May 2005)
- TEAP Report Vol 2: Funding Requirement for the Period 2006-2008 (May 2005)
- TEAP Report Vol 3: Task Force on Foam End-of-Life Issues (May 2005)
- TEAP Progress Report (May 2004)
- Clarification and Revision of TEAP CUN Supplementary Report (March 2004)
- TEAP CUN 2004 Supplementary Report (February 2004)
- TEAP Progress Report (October 2003)
- TEAP Progress Report (May 2003)
- TEAP Assessment Report (2002)
- TEAP Progress Report April (2002)
- Report of the Technology and Economic Assessment Panel (2002)
- TEAP Progress Report Vol 2: Funding Requirement for the Period 2003-2005 (April 2002)
- Supplement to the April 2002 TEAP Replenishment Report (September 2002)
- TEAP Progress Report (April 2001)
- TEAP Progress Report (April 2000)
- TEAP Progress Report (April 1999)
- Joint IPCC/TEAP Expert Meeting on Options for the Limitation of Emissions of HFCs and PFCs, proceedings, 1999, Kuijpers and Ybema (editors)
- Assessment of the Funding Requirements for the Period 2000-2002 (April 1999)
- Supplementary to the April 1999 TEAP Replenishment Report (August 1999)
- TEAP Assessment Report (1998)
- TEAP Progress Report April (1998)
- TEAP Report (Volume 1) (April 1997)
- TEAP Report (Volume 2) (April 1997)
- Corrigendum to the 1997 TEAP Report
- Assessment Of The Funding Requirement For The Replenishment Of The Multilateral Fund For The Period 1997-99 (June 1996)
- TEAP Report to the Parties(1996)
- ODS Disposal Technology Update by the TEAP subcommittee on ODS Disposal (June 1995)
- TEAP Report to the Parties (1995)

- Report of the Economics Options Committee and 1995 Assessment (1994)
- TEAP Report to the Parties (1994)
- Handbook on Essential Use Nominations (1994)
- Report of the TEAP Including Recommendations on 1993 Nominations for 1994 Essential Use Production/Consumption Exemptions for Halons (1993)
- Report of the Economics Options Committee (December 1991)
- Assessment Report of the Technology and Economic Assessment Panel (December 1991)
- Report of the Technology Review Panel (June 1989)
- Economic Panel Report (July 1989)

#### ***Aerosols & Miscellaneous Uses Options Committee***

- ATOC Assessment Report (2002)
- ATOC Assessment Report (1998)
- Report of the Aerosols, Sterilants, Miscellaneous Uses and Carbon Tetrachloride Technical Options Committee (1994)
- Report of the Aerosol Products, Sterilants Miscellaneous Uses and Carbon Tetrachloride Technical Options Committee (1991)

#### ***Rigid and Flexible Foams Technical Options Committee (FTOC) Reports***

- Assessment Report (2002)
- Assessment Report (1995)
- Assessment Report (1991)
- Flexible and Rigid Foams Technical Options Report (June 1989)

#### ***Halons Technical Options Committee (HTOC) Reports***

- HTOC Assessment Report (2002)
- HTOC Assessment Report (1998)
- HTOC Assessment Report (1994)
- HTOC Assessment Report (1993)
- Recommendations on Nominations for Essential Use (1993)
- HTOC Assessment Report (1991)
- HTOC Assessment Report (1989)
- Technical Note #1: New Technology Halon Alternatives (March 1999)
- Technical Note #2 : Halon Emission Reduction Strategies (December 1997)
- Technical Note #3 : Explosion Protection - Halon Use and Alternatives (December 1997)

#### ***Methyl bromide Technical Options Committee (MBTOC) Reports***

- MBTOC Assessment Report (2006)
- Final report of the evaluations of the 2006 critical use nominations for methyl bromide and related matters (September 2006)
- Handbook on Critical Use Nominations for Methyl Bromide (2005)
- Final report of the evaluations of the 2005 critical use nominations for methyl bromide and related matters (October 2005)
- Final report of critical use nominations- Section III of Annex to Decision XVI/2 and former 'Unable to assess (May 2005)
- Handbook on Critical Use Nominations for Methyl Bromide (2004)
- Final report of the 2004 critical use nominations for methyl bromide (October 2004)
- Critical Use Evaluations - Interim evaluation of 2004 Nominations (June 2004)

- Critical Use Nominations Supplementary Report (February 2004)
- Critical Use Nominations Supplementary Report (Final report) (October 2003)
- MBTOC Assessment Report (2002)
- Essential Use Nominations Handbook (June 2001)
- MBTOC Assessment Report (1998)
- 1994 Report of the Methyl Bromide TOC, 1995 Assessment (1995)
- Synthesis Report of the Methyl Bromide Interim Scientific Assessment and Methyl Bromide Economic Assessment (June 1992)

***Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee (RTOC) Reports***

- RTOC Assessment Report (2002)
- RTOC Assessment Report (1998)
- Subcommittee Report on Flammable Refrigerants under the TOC Refrigeration, AC and Heat Pumps (1997)
- 1994 Report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee and 1995 Assessment (1995)
- Report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee (December 1991)

***Solvents, Coatings & Adhesives Technical Options Committee (STOC) Reports***

- STOC Assessment Report (2002)
- STOC Assessment Report (1998)
- Solvents, Coatings and Adhesives Technical Options Committee Assessment Report (1991)
- Electronics, Degreasing and Dry Cleaning Solvents Technical Options Report (June 1989)
- Technical Note (October 1994)

***Process Agents Task Force (PATF) Reports***

- PATF Report (October 2004)
- PATF Report (April 2001)
- PATF Report (April 1997)
- Report of the Chemical Process Agents Working group of the TEAP (1995)

***Other Task Force Reports***

- Report of the Task Force on the Continuing TEAP Legacy (2007)
- Report of the Task Force on Foam End-of-Life Issues (May 2005)
- TEAP Basic Domestic Needs Task Force (October 2004)
- TEAP Chiller Task Force Report (May 2004)
- HCFC Task Force Report (May 2003)
- Report of the Task Force on Collection, Recovery and Storage (April 2002)
- Report of the Task Force on Destruction Technologies (April 2002)
- Report on the Geographical Market Potential and Estimated Emissions of n-Propyl Bromide (April 2001)
- Report of the HFC and PFC Task Force (October 1999)
- Final report of the TEAP Task Force on CEIT Aspects (1996)
- Assessment of Basic Problems Confronting Countries with Economies in Transition in Complying with the Montreal Protocol (1995)

## **Appendix 5: Indicative List of Books**

### **Book search for “Technology and Economic Assessment Panel” (Excluding TEAP and UNEP publications)**

**Source: Google Books**

- Agrometeorology: Principles and Applications of Climate Studies in Agriculture, by Mavi S. Harpal and Graeme J. Tupper, 2004.
- Air Pollution Control Law: Compliance and Enforcement, by Arnold W. Reitze, 2001.
- Assessments of Regional and Global Environmental Risks: Designing Processes for Effective Use, by Alexander E. Farrell and Jill Jäger, 2006.
- Blowing Agents for Polyurethane Foams, by S. N. Singh, 2002.
- Blueprint 4: Sustaining Earth, by UNEP, 1995.
- C.h.a.o.s.s.: An Essay and Glossary for Students and Practitioners of Global Environmental, by Richard Albert Meganck and Richard E. Saunier, 2004.
- The Clean Air Act Handbook, by Robert J. Martineau, David P. Novello, and P. David Martineau, Jr., 2005.
- Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment, by John Theodore Houghton, B. A. Callander, and S. K. Varney, 1992.
- Climate Change and Africa, by Pak Sum. Low, 2005.
- Climate Change and Carbon Markets: A Handbook of Emissions Reduction Mechanisms, by Farhana Yamin, 2005.
- Climate Change Policy, by Michael Bothe and Eckard Rehbinder, 2005.
- Environment and Statecraft: The Strategy of Environmental Treaty-making, by Scott Barrett, 2003.
- Code of Life-Cycle Inventory Practice by SETAC and Angeline S. H. De Beaufort-Langeveld, 2003.
- The Earthscan Reader in Business and Sustainable Development, by Richard Welford and Richard Starkey, 2001.
- The Effectiveness of International Environmental Agreements: A Survey of Existing Legal Instruments, by Peter H. Sand, 1992.
- Environment and Statecraft: The Strategy of Environmental Treaty-Making, by Scott Barrett, 2005.
- Environmental Regime Effectiveness: confronting theory with evidence, by Edward L. Miles, 2001.
- Environmental Requirements and Market Access, edited by Organisation for Economic Cooperation, 2005.
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## Appendix 6: Indicative List of Scholarly Articles

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Source: Google Scholar

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- The US Search for Methyl Bromide Alternatives, N. Ragsdale and K. Vick, in Pesticide Outlook, 2001.

## ENDNOTES

<sup>1</sup> The Task Force edited and expanded text from Appendix 7, “Assessment Panels of the Montreal Protocol,” in Stephen O. Andersen and K. Madhava Sarma (2002) *PROTECTING THE OZONE LAYER: THE UNITED NATIONS HISTORY*, Earthscan London. Appendix 7 was authored by Stephen O. Andersen, Suely Carvalho, and Helen Tope and by E. Thomas Morehouse and Sally Rand.

<sup>2</sup> National Academy of Science Committee on Analysis of Global Change Assessments, “Analysis of Global Change Assessments: Lessons Learned,” The National Academies Press, Washington, DC forthcoming, p. 4.3.

<sup>3</sup> US Department of Transportation (1975) ‘Climate Impact Assessment Program: Environmental Impacts of Supersonic Flight: Biological and Climate Effects of Aircraft Emissions in the Stratosphere’, US Department of Transportation, Washington, DC.

<sup>4</sup> Consortium members include the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), United Kingdom Department of the Environment, United Nations Environment Programme (UNEP) and World Meteorological Organization (WMO).

<sup>5</sup> Daniel Albritton, “What Should be Done in a Science Assessment,” in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) *PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS* Kluwer Academic Publishers, Boston, MA, p. 70.

<sup>6</sup> Suely Machado Carvalho, “Technology Assessment for the Montreal Protocol,” in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) *PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS*, Kluwer Academic Publishers, Boston, MA, p. 143.

<sup>7</sup> Quoted in Penelope Canan and Nancy Reichman (2002) *OZONE CONNECTIONS: EXPERT NETWORKS IN GLOBAL ENVIRONMENTAL GOVERNANCE*, Greenleaf Publishing, Sheffield UK, p. 101.

<sup>8</sup> Daniel Albritton (USA) and Robert Watson (USA) co-chaired the first Panel for Scientific Assessment; Jan C. van der Leun (Netherlands) and Manfred Tevini (Germany) co-chaired the first Panel for Environmental Assessment; Victor Buxton (Canada) chaired and Stephen O. Andersen (USA) vice-chaired the Panel for Technical Assessment, and George Strongylis (EC Commission) chaired and Stephen O Andersen (USA) and John S. Hoffman (USA) vice-chaired the Panel for Economic Assessment. In 1990, Stephen Lee-Bapty (UK) replaced G. Victor Buxton as Co-Chair of the TEAP. In 1992 Lambert Kuijpers (The Netherlands) replaced Stephen Lee-Bapty as Co-Chair of the TEAP and Pieter Aucamp (South Africa) was added to the SAP, Andre P. R. Cvijak (Brazil) to the TEAP, and Xiaoyan Tang (China) to the EAP. In 1993, Suely Carvalho (Brazil) replaced Andre P R Cvijak as Co-Chair of the TEAP. In 1997, Parties appointed Gerard Megie (France) as the fourth Co-Chair of the SAP. In 2000, Ayite-Lo Nohende Ajavon (Togo) replaced Pieter Aucamp on the SAP. In about 2002, Janet Bornman replaced Manfred Tevini as Co-Chair of the EAP. In 2003, Jose Pons replaced Suely Carvalho as Co-Chair of the TEAP. In 2006 A.R. Ravishankara was appointed as Temporary Co-Chair of the SAP in anticipation of the retirement of Dan Albritton from the SAP.

<sup>9</sup> For elaboration, see S. M. Carvalho ‘Technology Assessment for the Montreal Protocol’; S Rand and L. Singh, ‘Importance of the TEAP in Technology Cooperation’; L. Kuijpers, H.

Tope, J. Banks, W. Brunner and A. Woodcock, 'Scientific Objectivity, Industrial Integrity and the TEAP Process'; and R. Van Slooten, 'TEAP Terms of Reference' in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS, Kluwer Academic Publishers, Boston, MA.

<sup>10</sup> Of all TEAP, TOC, and Working Group members, roughly 47 per cent are from industry, 23 per cent from government (of government members, approximately 40 percent are associated with environment ministries), 9 per cent from universities, and 21 per cent from technical institutes, research organizations, and non-governmental organizations, and hospitals. The 1989 Assessment explicitly excluded participation of experts from companies producing CFCs.

<sup>11</sup> Quoted in Penelope Canan and Nancy Reichman (2002) OZONE CONNECTIONS: EXPERT NETWORKS IN GLOBAL ENVIRONMENTAL GOVERNANCE, Greenleaf Publishing, Sheffield UK, p. 85.

<sup>12</sup> The TEAP currently has six Technical Options Committees: Chemicals (CTOC) Flexible and Rigid Foams (FTOC); Halons (HTOC); Methyl Bromide (MBTOC); Medical (MTOC), and Refrigeration, Air Conditioning and Heat Pumps (RTOC). There are also occasional Working Groups and Task Forces that consider special technical topics.

<sup>13</sup> Daniel Albritton, "What Should be Done in a Science Assessment," in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS Kluwer Academic Publishers, Boston, MA, pp. 67-68.

<sup>14</sup> Quoted in Penelope Canan and Nancy Reichman (2002) OZONE CONNECTIONS: EXPERT NETWORKS IN GLOBAL ENVIRONMENTAL GOVERNANCE, Greenleaf Publishing, Sheffield UK, p. 171.

<sup>15</sup> Quoted in Penelope Canan and Nancy Reichman (2002) OZONE CONNECTIONS: EXPERT NETWORKS IN GLOBAL ENVIRONMENTAL GOVERNANCE, Greenleaf Publishing, Sheffield UK, p. 112.

<sup>16</sup> Quoted in Penelope Canan and Nancy Reichman (2002) OZONE CONNECTIONS: EXPERT NETWORKS IN GLOBAL ENVIRONMENTAL GOVERNANCE, Greenleaf Publishing, Sheffield UK p. 157.

<sup>17</sup> National Academy of Science Committee on Analysis of Global Change Assessments, "Analysis of Global Change Assessments: Lessons Learned," The National Academies Press, Washington, DC forthcoming, p. 4.5.

<sup>18</sup> Nancy Reichman, Memorandum to P. Canan, March 2007.

<sup>19</sup> Suely Machado Carvalho, "Technology Assessment for the Montreal Protocol," in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS Kluwer Academic Publishers, Boston, MA, p. 144.

<sup>20</sup> Helen Tope and Ashley Woodcock, "Aerosols Technical Options Committee: Scientific Objectivity, Industrial Integrity and the TEAP Process," in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS Kluwer Academic Publishers, Boston, MA p. 143.

<sup>21</sup> National Academy of Science Committee on Analysis of Global Change Assessments, "Analysis of Global Change Assessments: Lessons Learned," The National Academies Press, Washington, DC forthcoming, p. 4.7.

<sup>22</sup> Walter Brunner, “Halons Technical Options Committee: Scientific Objectivity, Industrial Integrity and the TEAP Process,” in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS Kluwer Academic Publishers, Boston, MA, p. 143.

<sup>23</sup> Jonathan Banks, “Methyl Bromide Technical Options Committee: Scientific Objectivity, Industrial Integrity and the TEAP Process,” in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS Kluwer Academic Publishers, Boston, MA, p. 170.

<sup>24</sup> Mostafa K. Tolba, “The Story of the Ozone Layer: Lessons Learned and Impacts on the Future,” in Le Prestre, Philippe G., Reid, John D. and Morehouse, E. Thomas (eds.) (1998) PROTECTING THE OZONE LAYER: LESSONS, MODELS AND PROSPECTS Kluwer Academic Publishers, Boston, MA, p. 21.

<sup>25</sup> Defined as in the Oxford Dictionary as “the gospel truth—something absolutely true” from the Old English “good news.”

<sup>26</sup> National Academy of Science Committee on Analysis of Global Change Assessments, “Analysis of Global Change Assessments: Lessons Learned,” The National Academies Press, Washington, DC forthcoming, p. 4.6.