International agreements on ozone layer protection: effectiveness and current policy issues

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Abstract. This paper looks at the (generally successful) measures taken to protect the ozone layer, and at the outstanding policy and enforcement issues.

Pre-history: towards the Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer was one of a number of international environmental agreements reached in the late 20th Century. Its agreement in 1987 reflected growing realisation that some environmental problems cross national borders that global environmental problems require global solutions. It also reflected a growing body of scientific knowledge that manufactured substances, including chlorofluororcarbons (CFCs), were responsible for depletion of stratospheric ozone. The chain of events leading to the Protocol are well-documented elsewhere. A brief summary is presented in Table 1.

Table 1. Brief summary of events leading up to signature of the Montreal Protocol.

1972	The Stockholm Declaration was the first comprehensive international statement to link human activity with the Environment. The declaration was "soft-law" in that it set out non-legally binding principles that parties were to consider in relation to particular environmental issues (Palmer, 2001).
1974	Molina and Rowland suggested for the first time that CFCs may be responsible for ozone layer destruction (Molina and Rowland, 1974).
1975	The United Nations Environmental Programme (UNEP), which was born out of Stockholm, formed the Ozone Research Programme.
1981 - 1985	As scientific work into the impacts of -manufactured substances on the ozone layer continued, the international community negotiated the 1985 Vienna Convention for the Protection of the Ozone Layer. Like the Stockholm Convention, the Vienna Convention was "soft law". It did, however, acknowledge the need for action, and it provided a framework within which information could be synthesized, and decisions on ozone issues made.
1985	British researchers in the Antarctic confirmed for the first time the existence of an Ozone "hole", and the research crystallized international opinion about the need for action. Negotiation of a firm protocol, under the umbrella of the Vienna Convention, began.

Impact of the 1987 Montreal Protocol

By the end of 1985, countries were ready to take firm action on ozone-depleting substances (ODS), and the *Montreal Protocol on Substances that Deplete the Ozone Layer* was negotiated by 1987. The Protocol is "hard law", in that countries made legally binding agreements to reduce the use of CFCs and freeze the use of halons. Just as importantly:

- The Protocol was to be flexible enough to allow for tighter controls as scientific understanding about the potency of ODS grew, and as technically and economically feasible alternatives became available.
- The Protocol acknowledges the different abilities of 'developing' and 'developed' countries (known respectively as "Article 5" and "non-Article 5" countries[1]). Developing countries were given a 10-year grace period for phase-out schedules, and a multilateral fund was set up to assist with technology transfer.

An interesting and practical feature of the Protocol is its focus on reducing "consumption" (production and imports) of ozone-depleting substances, rather than on emissions. There were few options for safe disposal, and allowing ongoing use of existing substances encouraged industries to keep them contained. In addition, it gave industry some time to plan for alternatives, and it avoided any incentives for illegal discharge.

As expected, the Montreal Protocol was amended several times as understanding about the role of ozone-depleting substances grew. New substances were added to the Protocol, and phase-out schedules were agreed for all listed substances (albeit with some exemptions for products needed for human health and safety). The estimated impact of the Montreal Protocol and its subsequent adjustments on levels of stratospheric chlorine and bromine are shown in Figure 1 (UNEP, 1999).

[1] Article 5 specifies that developing countries with a limited per-capita consumption of ODS are entitled to delay their compliance with the specified control measures by 10 years.

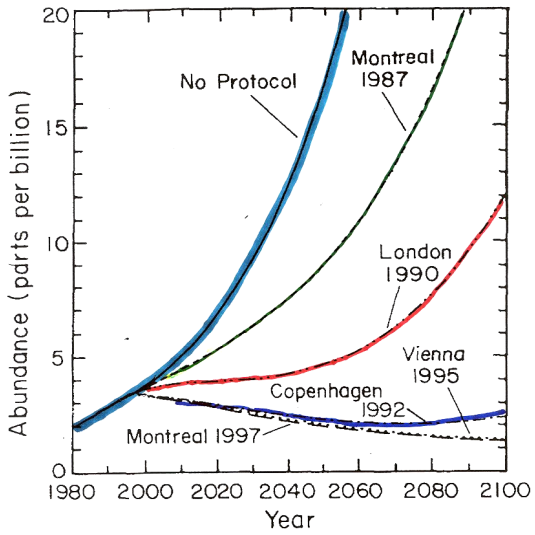

Figure 1. Projected abundance of stratospheric chlorine and bromine under various amendments to the Montreal Protocol, and compared with no regulation (UNEP, 1999).

The impact on human health outcomes has been just as positive. Studies done in Northwestern Europe and the US suggest that, without the Protocol and under its early provisions, there would have been large increases in cataracts and skin cancer. Under scenarios that take its later amendments into account, increases in levels of skin cancer and cataracts attributable to increased UV drop almost to zero by the end of the century (UNEP, 1998).

The Montreal Protocol; remaining policy and enforcement issues

Although the Montreal Protocol has been very successful, there are some lingering international and New Zealand-specific issues. These issues include:

Illegal trading in ozone depleting substances. Illegal trade is not a significant problem for New Zealand but it is an issue internationally. While the extent of the problem is difficult to quantify, there have been several prosecutions for illegal trade between companies in developing or "Article 5" countries which are still able to manufacture ODS, and parties in non-Article 5 countries with machinery that still runs on ODS. Open borders between some Article 5 and non-Article 5 countries (see footnote 1) are likely to exacerbate the situation. Parties to the Montreal Protocol are presently grappling with ways of addressing illegal trade through, for example, unified customs codes for ODS. The challenge is to find practical and effective ways of addressing illegal trade that are within the means of member countries.

New Zealand-specific issues. Issues of more moment for New Zealand are management of stockpiles of remaining ODS, and addressing the growing demand for methyl bromide for quarantine and pre-shipment.

Dealing with stockpiles of halons and CFCs. Halons are the most destructive of ozone-depleting substances. Significant stocks are believed to be still in existence. Good substitutes are available for most uses of halon so New Zealand and other 'developed' countries that are party to the Protocol have been asked to recover and safely destroy as much halon as possible. On advice from the Protocol's expert advisors, New Zealand opted for a voluntary approach to decommissioning, with financial subsidies (presently covering about 25% of the cost of transporting halons to Australia for destruction; MfE, 2002a). The fire protection industry is actively in implementing the halon management strategy.

While less destructive than halons, CFCs were used in much greater quantities. An unknown quantity is still in use in air conditioning and refrigeration systems internationally and in New Zealand. Ways of managing CFCs vary within developed countries. New Zealand has again taken a non-regulatory approach (MfE, 2002b). The refrigeration industry runs a voluntary levy scheme to fund the destruction of CFCs, and the Government has supported the development of training programmes to encourage best practice among refrigeration technicians and engineers (since well maintained systems are less likely to leak).

Use of methyl bromide for quarantine and pre-shipment. The use of methyl bromide for soil fumigation is being phased out of 'developed' countries by 2005. At present there are no limits on the use of methyl bromide for quarantine and pre-shipment. The amounts of methyl bromide used for quarantine and pre-shipment have grown in many countries, including New Zealand, and further calls for controls are likely in international fora.

In the meantime, countries have been asked to monitor their use, and to encourage alternatives where economically and technically feasible. Methyl bromide is critical to New Zealand's biosecurity, and is heavily used on some key exports such as timber. The challenge is therefore to develop a management regime in New Zealand that adequately addresses environmental, trade and biosecurity needs (MfE, 2002b). Supporting and encouraging research into alternatives is likely to be a key part of the strategy.

Conclusions

Despite the issues listed above, the Montreal Protocol has undoubtedly been successful. The strength of the science, the clarity about solutions, and public support for phase-outs have contributed to its success. In addition, the flexibility of the Protocol, and allowing for the differing needs of developed and developing countries also helped. We will be living with ozone depletion for many decades, so the "slip, slop, slap," approach to sun protection will remain a part of the New Zealand summer for some time to come.

We should, however, draw strength from the success of the Montreal Protocol – it is a good news story, and lessons from it should be applied to other global environmental problems.

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