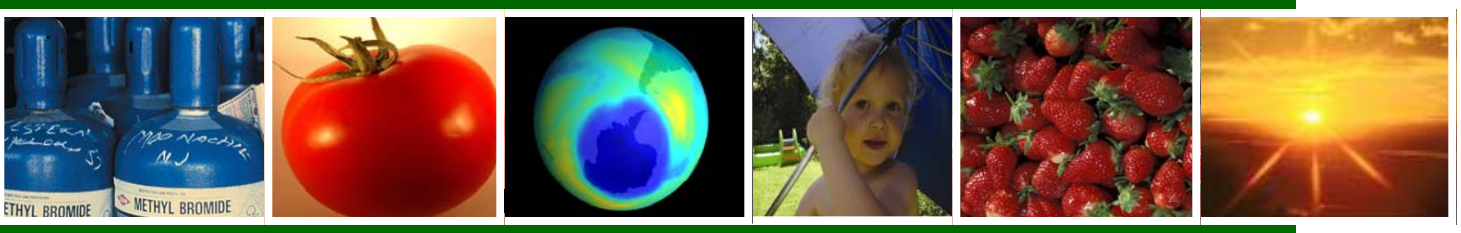
The Continued Destruction of the Ozone Layer



and U.S. Abuse of Methyl Bromide "Critical-Use" Exemptions

environmental investigation agency

INTRODUCTION

In April 2005, the ozone layer over the northern hemisphere thinned to its lowest level in recorded history, stunning the scientific community which had not anticipated such rapid deterioration. Since 1999, "mini ozone holes" have emerged four times in the north, at times stretching as far south as the eastern seaboard of the United States. Unlike the record breaking ozone holes over the southern hemisphere, northern thinning threatens regions densely populated by hundreds of millions of people. In the United States, skin cancer rates are increasing each year and melanoma incidence in children has doubled in the last decade.

Lobbyists for America's largest agricultural industries—such as the California Strawberry Commission and the Florida Fruit and Vegetable Association—along with chemical manufacturers and distributors, methodically obstruct the internationally agreed cessation of the use of methyl bromide. Methyl bromide is a highly toxic ozone layer destroying pesticide that developed countries agreed to stop using by 2005.

Despite 13 years to prepare for the cessation, U.S.-based industries have tenaciously opposed the methyl bromide cessation by making repeated demands for vast commercial exemptions to continue using millions of pounds of this chemical. The demanded exemptions ignored Montreal Protocol Treaty rules requiring methyl bromide stocks to be used up prior to granting exemptions. As a result, a pliable MBTOC and many Parties to the Montreal Protocol acted to protect the methyl bromide industry rather than the ozone layer. The widespread availability of methyl bromide is now undercutting the viability of alternatives in developed and developing countries.

In a reversal of historic American leadership based on transparency and accountability, the U.S. government has refused to divulge information about methyl bromide stockpiles. Instead, U.S. industry has been allowed to secret massive quantities of methyl bromide in order to enable long-term circumvention of the methyl bromide cessation. Past experience with other ozone depleting substances, such as CFCs and halons, shows that stockpiling can lead to significant illegal trade. Other loopholes for quarantine and pre-shipment (QPS) applications of methyl bromide have also resulted in proliferated use of this chemical.

Optimistic predictions that the ozone layer would begin to recover by 2002 have proven unfounded while a disturbing trend of continued record thinning has emerged. Scientists believe that climate change and lack of full compliance with the Protocol's regulations are likely exacerbating ozone thinning. An additional concern is the aggravating effects of ozone thinning on climate change. The uncertainty facing the world's ozone layer underlines the fact that political decision-making within the Montreal Protocol has fallen dangerously out of step with scientific revelations of escalating ozone layer damage.

Disturbingly, children are the most vulnerable to elevated levels of radiation from ozone thinning. Childhood skin cancer incidence in the United States has more than doubled in the last two decades while U.S. skin cancer rates are increasing by 3% a year. One in five Americans will develop skin cancer in their lifetime.

The Parties to the Montreal Protocol can decide to take action to curb ozone-destroying bromine in the upper atmosphere. Action can also be taken by U.S. retail consumers of California strawberries, Florida tomatoes and other items produced using methyl bromide, such as peppers, grains, cucurbits, ornamental plants, hams and cheeses.

In light of new evidence of ozone layer thinning, EIA strongly urges the Parties to take rapid action to:

1. Slash critical-use exemptions for 2006 and refuse to approve any exemptions for 2007;
2. Require full disclosure and complete transparency of all existing stocks of methyl bromide held in the U.S. and establish third party independent monitoring of such stocks;
3. Enact immediate controls and a fast track program to eliminate QPS applications of methyl bromide; and
4. Increase support to developing countries to phase out methyl bromide.

Allan Thornton
President, Environmental Investigation Agency
Washington, DC
June 15, 2005

The Fragile Ozone Layer

Life on Earth depends on the protection provided by the ozone layer. This thin layer of ozone molecules screens out nearly 99% of harmful ultraviolet (UV) radiation from the sun.[1] Humans have severely depleted the ozone layer by releasing high quantities of bromine, chlorine and other ozone-depleting substances into the atmosphere.[2] These chemicals react with sunlight in the upper atmosphere to destroy ozone, thus thinning the protective layer and allowing greater amounts of UV radiation to reach the Earth's surface.[2]

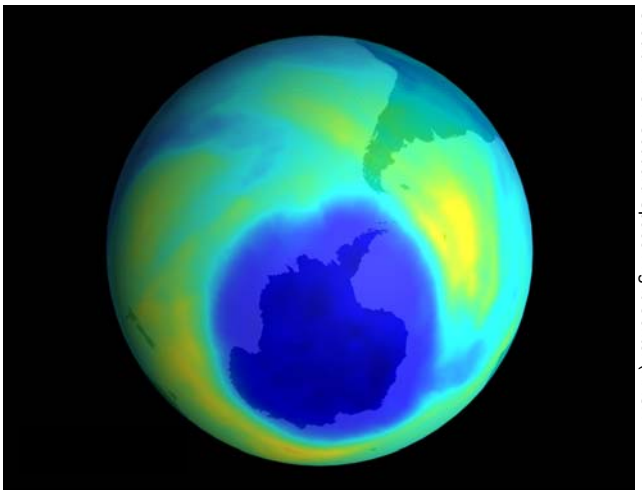
Bromine is a highly destructive ozone-depleting substance. It is almost 60 times more effective at destroying ozone than chlorine — the ozone-depleting substance found in chlorofluorocarbons (CFCs).[3] One of the two main sources of human-introduced bromine in the atmosphere is methyl bromide, a toxic fumigant developed in the 1960s for use in agriculture and shipping to control pests. It also comes from halons, chemicals widely used in the past for fire suppression.[2]

Credit: NOAA/Department of Commerce

NOAA scientists measure ozone.

Credit: NASA

NASA's high-altitude research



Credit: NASA-Goddard Space Flight Center (NASA-

The ozone hole over Antarctica

The Antarctic Ozone Hole

In 1985, scientists discovered severe thinning of the ozone layer over Antarctica due to human emissions of bromine and chlorine.[2] Satellite measurements have confirmed that an Antarctic ozone hole has reappeared each austral spring since its initial discovery. Although there is some variation from year to year, the ozone hole has generally grown larger and lasted longer each year. The 2003 ozone hole measured approximately 11 million square miles (28 million square kilometers) and was larger than the size of North America — nearly equaling the all-time record set in 2000.[4] The 2004 Antarctic ozone hole was slightly smaller than the 2003 hole, as it measured 9.4 million square miles (24 million square kilometers).[5]

In 2000 and 2003, the edge of the Antarctic ozone hole drifted over areas of Argentina, Chile and the Falkland Islands, and reduced ozone levels over the cities of Punta Arenas and Ushaia up to 70%.[6]

> "There's still no clear evidence that the ozone layer, or the ozone hole over the Antarctic, is recovering." [7]
>
> Mario Molina, co-recipient of the Nobel Prize for discovering the link between CFC's and ozone depletion — November 2004.

The Specter of an Arctic Ozone Hole

Scientists recently were shocked to observe severe ozone loss over the Northern Hemisphere and warn of the possible development of an Arctic ozone hole.

In the winter of 2004-2005, the scientific journal *Nature* reported "the biggest ozone losses ever recorded over the Arctic." [8] Researchers observed a 30% reduction in the ozone layer during the winter/early spring and measured a 50% reduction in ozone at an altitude of 18km.[9] This follows measurements from the 1999-2000 winter, when the Arctic ozone layer lost over half of its ozone.[10]

Interactions with Climate Change

Scientists with the British Antarctic Survey, Cambridge University and other scientific institutions are concerned that recent severe Arctic thinning is a result of the exacerbating effects of climate change.[8] They suspect that climate change may be causing Arctic winters to become colder — thereby causing increases in the formation of polar stratospheric clouds, which intensify ozone destruction by bromine and chlorine.

Credit: NASA

Ozone loss in Earth's upper atmosphere, or stratosphere, is caused primarily by chemical reactions with bromine and chlorine from human-produced compounds. When stratospheric temperatures drop below a threshold temperature, polar stratospheric clouds form (above). Chemical reactions on the surfaces of these clouds activate bromine and chlorine, converting them into forms that destroy ozone.

Dr. Marcus Rex of the Alfred Wegener Institute of Polar and Marine Research and some of his colleagues believe that colder winters due to climate change could create conditions that would allow the formation of an Arctic ozone hole "in the next two decades." [8]

"Mini ozone holes" have occurred over Europe as far south as Italy, parts of the Northeastern United States and Canada. These pockets of severely depleted stratospheric ozone that drift from the Arctic have occurred during four winters in the last decade (1996-97, 1999-00, 2001-02 and 2004-05).

Global Ozone Layer Depletion

Ozone layer thinning is not confined to polar regions; it is a global problem with serious worldwide implications. Current global average ozone levels are approximately 3% below pre-1980 levels.[11] In mid-latitudes, where most of the world's population lives, the ozone layer has thinned between 3% - 6% from pre-1980 levels.[11]

According to a recent report by European scientists, stratospheric ozone amounts over mainland Europe started to decline in the 1970s with larger decreases (between 5% - 10%) occurring during the winter and spring seasons.[12] They also report that biologically active UV radiation has increased at the ground, in line with the reduced ozone amounts.[12]

In addition, measurements from five sites within the continental United States (Bismarck, North Dakota; Caribou, Maine; Boulder, Colorado; Wallops Island, Virginia; and Nashville, Tennessee) show a thinning trend in the ozone layer over the country since the late 1960s.[13]

Ultraviolet Radiation and its Human Effects

The World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) have concluded that thinning of the ozone layer results in increases in the quantities of harmful UV radiation that reach the Earth's surface.[14] Scientists have observed UV increases associated with ozone decline at a number of sites in Europe, North and South America, Antarctica and New Zealand.[15]

One of the most serious health effects of over-exposure to UV radiation is skin cancer. Worldwide, Montreal Protocol controls are expected to prevent about 19 million cases of non-melanoma skin cancer and about 1.5 million cases of melanoma skin cancer by 2050.[16] Currently, an estimated 66 000 deaths occur annually from all forms of skin cancer.[17] Every year, there are more than 130 000 new melanoma skin cancer cases, and between two and three million new cases of non-melanoma skin cancer are diagnosed.[17] In the United States, skin cancer kills one person every hour, and one in five will develop skin cancer in their lifetime.[17]

Children are at particular risk from conditions related to over-exposure to UV radiation, according to the World Health Organization and UNEP.[17] They are physiologically the most vulnerable and can spend a considerable amount of time outside.[18] Statistics from the U.S. National Cancer Institute indicate that skin cancer is on the rise in children. Rates of pediatric melanoma in the United States have more than doubled between 1982 and 2002.

Recent scientific research indicates that UV radiation is much more damaging to the eye and vision than had been previously suspected.[19] For example, one of the only effective preventative measures for cataract is to decrease exposure to biologically damaging UV radiation.[20]

The cataract condition is characterized by opacity of the lens of the eye, which can lead to serious vision impairment and blindness.[19] Globally, in

Credit: NEI/NIH

Montreal Protocol controls are expected to prevent 129 million cases of cataract by 2050.

Credit: U.S. Air Force

Melanoma (above) is the most deadly form of skin cancer

2002 more than 161 million people were visually impaired, of whom 124 million had low vision and 37 million were blind — with cataract as the major cause; increased UV radiation is responsible for a portion of this.[20] Montreal Protocol controls are expected to prevent 129 million cases of cataract by 2050.[16]

Environmental Effects

UV radiation also is harmful to plants and animals. The shorter wavelengths, mainly UV-B, are known to harm the biological and chemical processes of myriad living organisms.[21, 22]

Zooplankton and phytoplankton, the foundation of the ocean food chain, lack protection from UV-B radiation and thus are particularly sensitive to the effects of ozone depletion.[25] UV-B radiation can adversely affect the early developmental stages of aquatic organisms, decrease reproductive capacity and impair larval development.[25] Studies of plant species—including trees and agricultural crops — show that some are sensitive to increased UV radiation levels, which can result in reduced plant height, changes in tissue composition and reductions in foliage area.[24] Such changes have serious implications for biodiversity and agricultural productivity.

Environment Canada calculated that full implementation of the Montreal Protocol from 1987 - 2060 would provide a net financial benefit of U.S. $224 billion in terms of reduced damage to fisheries, agriculture and materials.[16] This calculation did not include the huge additional benefits to human health.

Man-Made Methyl Bromide and Ozone Depletion

Man-made methyl bromide emissions from fumigation have resulted in artificially elevated concentrations of this chemical in the stratosphere. Human-caused emissions of methyl bromide contribute between 10% and 40% to the total stratospheric concentration of this compound.[26] Recently, NOAA scientists calculated that "fumigation probably contributes 40% - 45% to the total budget" in the atmosphere.[27]

Methyl bromide is a powerful ozone layer depletor. Current estimates indicate that continued use of methyl bromide as an agricultural pesticide may contribute 5% - 15% to future ozone depletion.[28]

Scientific evidence suggests that methyl bromide's effectiveness in depleting the ozone layer is currently underestimated.[29] Because bromine is so effective at destroying ozone, scientists have calculated a high "ozone depleting potential" (ODP) of about 0.4 for methyl bromide.[30] This calculation assumed that methyl bromide only remained in the stratosphere for about eight months. Recent research, however, reveals that the atmospheric lifetime of methyl bromide may be longer, and as a result, the ODP for methyl bromide is likely to be 0.7 - 0.8[29] — indicating that methyl bromide is about twice as powerful at depleting ozone than previously calculated. This makes the need for Parties to expeditiously phase out this chemical even more urgent.

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Methyl bromide "pigs"

The Global Methyl Bromide Phase-Out

Because of methyl bromide's significant contribution to ozone depletion, the Parties to the Montreal Protocol agreed in 1992 to control this substance. Under the global phase-out schedule for methyl bromide, developed countries were supposed to have completely phased out the chemical's use by January 2005 and developing countries are to do the same by 2015, with only limited exceptions.

Parties' use beyond the phase-out deadline is subject to Montreal Protocol Decision IX/6 criteria,[31] wherein "critical use" of methyl bromide is permitted if the following are determined:

- There are ***no technically and economically feasible alternatives or substitutes available*** to the user that are acceptable from the standpoint of environment and health and are suitable to the crops and circumstances of the nomination.
- The specific use is critical because the lack of availability of methyl bromide for that use would result in a ***significant market disruption***.

Under Decision IX/6, the production and consumption, if any, of methyl bromide for critical uses should be permitted only as follows:

- ***All technically and economically feasible steps have been taken to minimize the critical use*** and any associated emission of methyl bromide.
- Methyl bromide is ***not available in sufficient quantity and quality from existing stocks*** of banked or recycled methyl bromide, also bearing in mind the developing countries' need for methyl bromide.
- It is demonstrated that an ***appropriate effort is being made to evaluate, commercialize and secure national regulatory approval of alternatives and substitutes***, taking into consideration the circumstances of the particular nomination and the special needs of Article 5 Parties, including lack of financial and expert resources, institutional capacity, and information.

Exemptions approved by the Parties fail to comply with Decision IX/6. Excessive critical-use exemptions are being granted despite the availability of technologically and economically feasible alternatives. The Parties also have not deducted stocks as required by Decision IX/6.

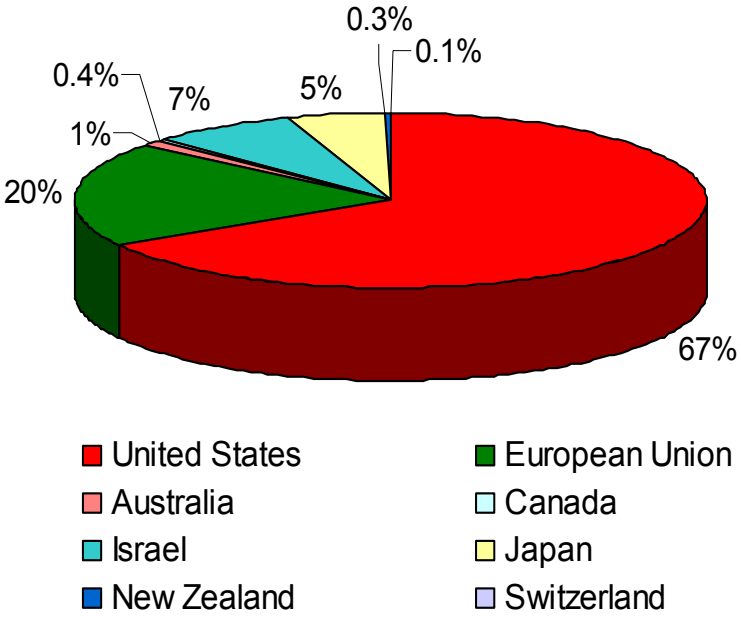
The United States' Excessive Requests for Methyl Bromide Critical Use Exemptions

The deadline for the phase-out of methyl bromide for developed countries has come and gone, and no actual phase-out of consumption or production has taken place. Instead, the United States and several other countries have taken advantage of the "critical-use exemption" loophole and continue massive commercial use of methyl bromide.

Unless the Parties demand complete phase-out, excessive requests for exemptions will result in the emission of thousands of metric tons (mt) of methyl bromide each year for the foreseeable future. Over 14 360 mt of methyl bromide will be consumed by developed countries in 2005 alone. This is only about 1% less than the amount consumed in 2003 — just before the scheduled phase out.

The United States is by far the single largest consumer of methyl bromide. Its exemptions for 2005 are three and one-half times as large as the amount that the 25 countries of the European Union will consume and over two-thirds the amount that the entire developed world will consume that year.

CRITICAL-USE EXEMPTIONS IN 2005



Repeated requests for large exemptions from the phase-out of methyl bromide disregard the spirit and the text of the Montreal Protocol, wherein critical-use exemptions "are intended to be limited, temporary derogations from the phase-out of methyl bromide." [32] U.S. exemptions have proven to be anything but limited or temporary. The United States has continued to request massive exemptions and has utterly failed to demonstrate that it is serious about following through on its obligation for a 100% phase-out.

In fact, the United States appears to be "phasing in" methyl bromide use. According to data supplied under the U.S. Freedom of Information Act (FOIA), total U.S. methyl bromide use in 2003 was 30.1% of baseline (7,674 metric tons). Yet under the 2005 critical-use exemptions, U.S. methyl bromide use will actually increase to 37.4% of baseline. The U.S. nomination for 2006 remains at 37% of baseline and the 2007 nomination, at 29% of baseline, is barely less than the 2003 figure.

Exemptions Undermine Phase-Out in the Developing World

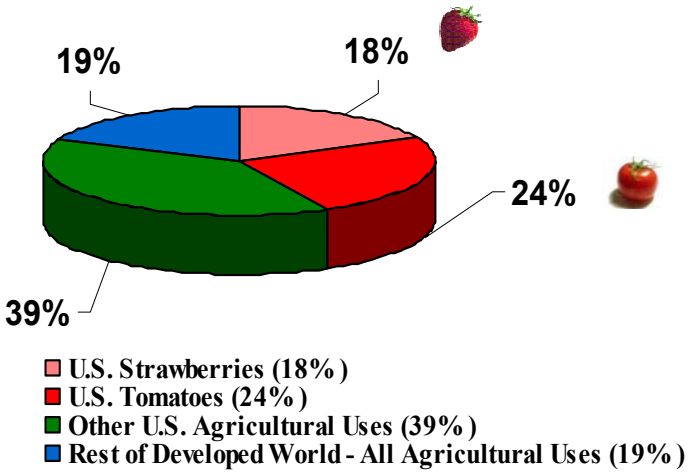
The Montreal Protocol's technical body, the Technology and Economic Assessment Panel (TEAP), recently documented developing countries' concern that their substantial progress in phasing out methyl bromide (MB) is threatened by:

- "the large critical-use exemptions requested by some MB users in [industrialized world] countries creating a competitive disadvantage for the alternatives;
- the continued promotion of MB products (as noted in previous reports of TEAP); and
- the global over-supply of MB, leading to falling prices of MB in some [developing] countries." [32]

Special-Interest Politics: The U.S. Strawberry and Tomato Industries

Special-interest lobbyists for American agribusiness are largely responsible for the continued use of methyl bromide in the United States. Among these groups, the California Strawberry Commission and the Florida Fruit and Vegetable Association are two of the most vocal advocates for the sustained use of methyl bromide. These groups consistently lobby the U.S. government to renege on its international treaty commitment to eliminate the use of methyl bromide.[33, 34]

Intended Methyl Bromide Use 2005



© D. Sims/EIA

Large quantities of toxic methyl bromide are used on crops such as tomatoes and strawberries.

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Ozone-Safe Alternatives to Methyl Bromide

The repeated requests for large exemptions from phase-out do not reflect the availability of alternatives for many uses of methyl bromide. Alternatives already are being successfully used in nearly all sectors where exemptions are requested. Application techniques of alternatives are improving, costs have decreased significantly and some have turned out to be more effective than methyl bromide.

Dow Agrosciences (Dow), a leading producer of methyl bromide alternatives, has argued that available alternatives are being effectively ignored by the U.S. government. Dow has invested over $150 million in an intensive development effort to commercialize new products that will meet anticipated U.S. needs for methyl bromide replacements.[35] In testimony to the U.S. House of Representatives, Dow stated its belief that: "[there is a] great deal of misinformation and distortion pertaining to alternatives that has been represented in the U.S. critical-use exemption process. The result of this misinformation is that the U.S. critical use nominations for 2005, 2006 and 2007 do not take into account the considerable progress that has been made in the substitution of methyl bromide by alternatives and the additional potential that these products have to replace a considerable portion of the remaining methyl bromide critical-use exemptions." [35]

Methyl Bromide is Jeopardizing the Montreal Protocol Treaty

The U.S. position on methyl bromide threatens to collapse the most successful international environmental agreement in history. The Parties to the Montreal Protocol have been forced to hold two "extraordinary" meetings, outside of their normal course of business, just to deal with controversial requests for massive critical-use exemptions for methyl bromide. Members of the U.S. Congress have gone so far as to propose legislation that would effectively require the U.S. to violate its Montreal Protocol commitments.[36]

Methyl Bromide Stockpiling in the United States

The U.S. government has to date offered no clear information on existing stockpiles of methyl bromide, despite already having collected this information. In testimony in 2003, the U.S. Environmental Protection Agency suggested that "stockpiling had indeed taken place" and that those stocks were over 9000 mt. Any further information is being withheld pending the outcome of court cases that the U.S. government does not appear eager to bring to a swift close.

The United States is ignoring a requirement that existing stocks must be used before allowing new production of methyl bromide. The Montreal Protocol (Decision IX/6) requires existing stocks to be deducted from production and consumption allowed under critical-use exemptions, but there does not appear to be any attempt to accomplish this. Existing stockpiles need to be drawn down before additional production for critical-use exemptions is permitted.

Avoiding the Problems of the Past

The continuation of high levels of methyl bromide production after scheduled phase-out comes at a time when signs of illicit stockpiling, oversupply and "dumping" in developing countries, as well as unreported trade of methyl bromide, are increasing and remain unaddressed.

The Environmental Investigation Agency (EIA) has witnessed the long-term implications associated with the continuation of CFC production and the accumulation of stockpiles. Many developing countries are struggling to reach their compliance targets due to the continued availability of CFCs from new production, stockpiles and unreported trade.

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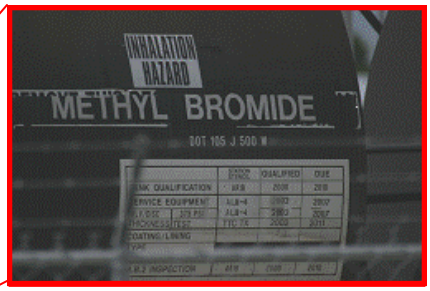

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Methyl bromide stored in railcars.

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Methyl bromide cylinders.

Quarantine and Pre-Shipment Uses of Methyl Bromide

While Parties struggle to phase out much of the use of methyl bromide, one category of use appears to be growing unchecked — quarantine and pre-shipment (QPS). QPS refers to the use of methyl bromide for fumigation of goods and packaging materials before shipping. Production for QPS may have accounted for nearly a quarter of total methyl bromide use in 2002. Given that it is exempt from the Montreal Protocol phase-out, production for QPS is expected to grow. To date, the Parties essentially have ignored QPS, but it is now time to phase out this growing threat to health and the global environment.

QPS use appears to be growing worldwide as an increasing number of countries adopt stringent import regulations that rely almost exclusively on methyl bromide. The International Standards for Phytosanitary Measures #15 (ISPM 15)[36] outlines guidelines for regulating wood packaging material in international trade. It requires methyl bromide fumigation or heat treatment only, ignoring other possibilities for phytosanitary control and prolonging the widespread use of this significant ozone-depleting substance.

Various alternatives to fumigation with methyl bromide exist for controlling the spread of invasive pests from international trade. Preliminary results of a UNEP survey on QPS consumption indicate that 65% of the methyl bromide currently used for QPS can be replaced by alternative technologies. Fifteen Parties that responded indicated that they had no use of methyl bromide for QPS in 2002.

Parties must work together to include other alternatives in their quarantine regulations and adopt feasible heat treatment systems. Some Parties have made positive efforts: the European Union imposed its own restrictions on QPS use by freezing current use in 2001 at the average rate from 1995 - 1998. Japan, Israel and Mexico have drastically reduced their methyl bromide use through adoption of alternatives.

Developing countries account for the majority of methyl bromide use for QPS, mostly in response to importers' strict regulations. In fact, according to the UNEP survey, 76% of total methyl bromide use in developing countries was for QPS. Many developing countries are making significant efforts to decrease their QPS use, but the combination of the adoption of ISPM 15, low cost, widespread availability of methyl bromide and the high cost of heat treatments will make this task extremely challenging. It will be difficult for many of these countries to make the transition to alternatives when, as the QPS exemption stands, they are unable to receive financial or technical assistance through the Montreal Protocol's funding mechanisms.

Conclusion

In 1992, Parties to the Montreal Protocol agreed to freeze production of methyl bromide after an international group of nearly 300 scientific experts concluded that eliminating methyl bromide is the most significant remaining action governments can take to prevent future ozone loss.[42]

Unfortunately, now that the time has come to complete the phase-out of methyl bromide, some Parties, led by the United States, are requesting large exemptions despite the availability of feasible alternatives. In addition, no action has been taken to address the growing use of methyl bromide for quarantine and pre-shipment purposes or to enforce the use of existing stockpiles under the Montreal Protocol.

This refusal to complete the phase out of methyl bromide could not come at a worse time. The Antarctic ozone hole continues to develop and has reached record size in recent years, ozone thinning over the Arctic is unprecedented, childhood skin cancer is on the rise, and the ozone layer shows no sure signs of recovery. The added uncertainty of global climate change potentially exacerbating ozone depletion makes it imperative that Parties rapidly complete the phase-out of methyl bromide.

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Anonymous Donors
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environmental investigation agency

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