Opportunity Wasted

Methyl Bromide: Our best chance to Reduce Ozone Depletion Now

The Earth's ozone layer is currently in its most fragile state in recorded history, leaving people and ecosystems on Earth exposed to unprecedented levels of harmful ultraviolet radiation.

A hole in the ozone layer over the Antarctic has reappeared each year since its initial discovery and has generally grown larger and lasted longer every year. The 2005 ozone hole was one of the deepest and largest ever recorded[1], nearly equaling the all-time record set in 2000.[10] To make matters worse, scientists are now concerned about the linkages between climate change and ozone depletion, as mounting evidence indicates that these two problems exacerbate one another.

Recovery of the ozone layer will depend on the ability of the international community to follow through on commitments to reduce man-made ozone destroying chemicals. Among those, one chemical—methyl bromide—stands out as both the biggest obstacle and greatest opportunity to protect the Earth from human-caused ozone depletion and its effects on human health and the global environment.

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Children are most vulnerable to increased UV radiation. Cases of pediatric melanoma in the United States more than doubled between 1982 and 2002, according to the US National Cancer Institute.[29]

More Fragile Than Ever

Life on Earth depends on the protection provided by the ozone layer. This thin layer of ozone molecules in the upper atmosphere (the stratosphere) screens out nearly 99% of harmful ultraviolet (UV) radiation from the sun.[2]

Humans have severely depleted the ozone layer by releasing large amounts of bromine, chlorine and other ozone-depleting substances into the atmosphere.[3] These chemicals react with sunlight in the stratosphere to destroy ozone, thus thinning the protective layer and allowing more UV radiation to reach the Earth's surface.[3]

Antarctic Thinning

In 1985, scientists discovered severe thinning of the ozone layer over Antarctica due to human emissions of bromine and chlorine.[3] 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.

In 2005, the tip of South America and the Falkland Islands were affected by the edges of the ozone hole between August and September.[4] During these periods, ozone values dropped to over 20% below the normal level for that time of year.[4] By the end of September, ozone levels were down by over 30%.[4] The region was also affected by severe ozone depletion from October 7 to 10, when ozone amounts dropped 50% below normal levels.[4]

Climate Change and Arctic Ozone Depletion

Scientists with the British Antarctic Survey, Cambridge University and other scientific institutions are concerned that recent severe thinning in the Arctic region is a result of the exacerbating effects of climate change.[5]

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 the ozone destruction caused by bromine and chlorine. 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."[5]

According to a joint report by the Intergovernmental Panel on Climate Change and the Technology and Economic Assessment Panel of the Montreal Protocol, climate change and ozone depletion are exacerbating each other in ways that we are only beginning to understand. This report states that: "Both the ODS [ozone depleting substances] and a number of their substitutes are greenhouse gases which contribute to climate change. Options chosen to protect the ozone layer could influence climate change. Climate change may also indirectly influence the ozone layer."[6]

Methyl Bromide and Short-term Ozone Depletion

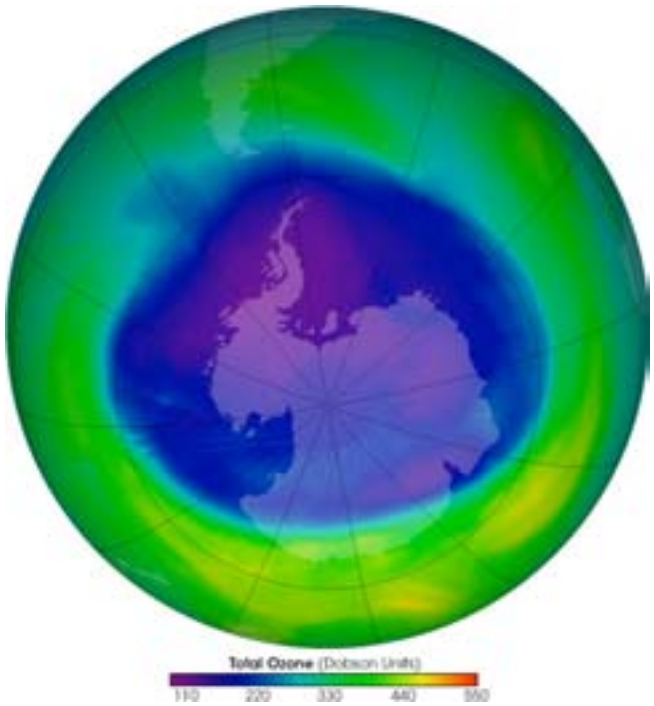
The impact of methyl bromide on the ozone layer is unusually severe and rapid. Bromine, the ozone-depleting element found in methyl bromide, is nearly 60 times more effective at destroying ozone than the chlorine found in CFCs.[9] This means that even though its atmospheric lifetime is quite short (a little over a year)[31], the immediate impact of changes in methyl bromide emissions on the ozone layer is very high compared to other chemicals.

Solar Cycles

In addition to human-induced climate change, the natural cycle of the sun has delayed ozone layer recovery and is expected to trigger increased ozone loss in the short-term as the sun's activity is expected to fall until the "solar minimum" in 2007/2008.[7] Models from researchers at the Institute for Atmospheric Physics in Wessling, Germany, predict that the 11-year solar cycle will delay the onset of ozone recovery and that "the lowest global mean total ozone values [will] occur between 2005 and 2010," when the impact of current methyl bromide emissions will be doing most of their damage.[8]

According to scientist Martin Dameris, who leads sun-cycle research at the Institute for Atmospheric Physics, the role of the sun cycles has been overlooked by the international community.[7] Consequently, his team does not believe that a sustained reversal of ozone depletion started in the late 1990s, stating, "A recovery is only pretended."[7]

With specific new forecasts of increasing ozone layer depletion over the next five years due to exacerbating factors (such as the sun-cycle), reducing methyl bromide emissions is the only available strategy to mitigate short-term ozone layer depletion and the associated human and environmental risks.



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The 2005 Antarctic ozone hole measured over 9.6 million square miles—larger than the size of North America.[1]

The short-term impact on the ozone layer of this year's methyl bromide use in the United States alone is expected to be greater than all the CFCs consumed in the world during the same time period. [11]

Agricultural Methyl Bromide Use

Methyl bromide is a highly toxic fumigant. Its use centers around two broad applications: as an agricultural pesticide, and in quarantine and pre-shipment (QPS) processes to control the spread of pests. Agricultural methyl bromide use is regulated by the Montreal Protocol on Substances that Deplete the Ozone Layer the Ozone Layer. In 1992, Parties to this treaty agreed to phase out the use of this substance in agricultural applications. The use of methyl bromide for quarantine and pre-shipment is exempt from the Montreal Protocol phase out and thus there is currently no regulation of methyl bromide for this use. Instead, methyl bromide is one of two treatment options that, as a result of a 2002 decision by the Parties to the International Plant Protection Convention, are now required to be employed for the elimination of pests in wood packaging materials in international trade.

Under the global phase-out schedule for agricultural methyl bromide, developed countries were supposed to have completely phased out its use by 2005 and developing countries are to do the same by 2015. However, the deadline for the phase-out has come and gone, with no actual end in sight. Instead, the United States and several other countries have taken advantage of a loop-hole in the treaty, called the "critical-use exemption" to continue to use excessive quantities of this harmful substance.

The United States is by far the largest consumer of methyl bromide in the world. In 2006, US methyl bromide emissions for agriculture will comprise 70% of total developed world methyl bromide for this application.[12] US agribusiness, specifically the California strawberry industry and the Florida tomato industry, are the largest users of methyl bromide. These two commodities alone account for more than 52% of all the methyl bromide used in the US for agriculture.[12]

The California Strawberry Commission and the Florida Fruit and Vegetable Association have lobbied strenuously to ensure a steady stream of methyl bromide, claiming that they are dependent on it to maintain their production capacity. However, effective alternatives to methyl bromide are being consistently used in other countries, as well as in the US. In 2006, the Technology and Economic Assessment Panel (TEAP) of the Montreal Protocol performed a comprehensive meta-analyses study which considered the available global library of peer-reviewed reports of field studies on methyl bromide alternatives. The study, which examined the yields of methyl bromide alternatives for both strawberries and tomatoes (as well as for peppers, melons/cucurbits, and eggplants) concluded that, "there are one or more alternatives for these products that have similar cost and efficacy to the methyl bromide treatments currently used."[6] The May 2006 TEAP report also noted that the tomato industry in Australia has completely switched to chemical alternatives and crop rotation techniques, with estimated yields within 5% of yields produced with methyl bromide treatments.[6]

Despite the effectiveness of many alternatives to methyl bromide and its significant contribution to ozone depletion, the US continues to seek large, unjustified exemptions. For 2007, the US is planning to use 6,750 metric tons of methyl bromide and it has requested a further 6,415 metric tons for 2008.[12] However, TEAP reports that it is currently unable to assess the US 2008 nominations, noting that, "Some parties previously applying for CUNs [critical-use exemptions] particularly in strawberry fruit, tomatoes and vegetable crops, have adopted these alternatives on a wide scale."[6]

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Tomatoes and strawberries alone account for more than 52% of all the methyl bromide used in the US agriculture.[12]

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A new international standard, ISPM No. 15, mandates the use of methyl bromide or heat treatment for quarantine of wood packaging material in international trade. EIA is concerned that this will result in a dramatic increase in global use of methyl bromide.

Quarantine and Pre-Shipment Uses

The other major category of methyl bromide use, quarantine and pre-shipment, has gone completely unchecked by the international community, and is likely to become the greatest threat to the short-term health of the ozone layer. In 1992 when the Parties agreed to phase out agricultural methyl bromide, QPS uses were thought to be quite small. By 2002, best estimates indicated QPS use of methyl bromide to be about 28% of total global use.[6] Today, without any regulation of QPS methyl bromide and with increasing world trade and quarantine requirements, this use threatens to overtake and ultimately dwarf other applications. Thus, depending on how quarantine uses are applied, QPS use of methyl bromide could become the greatest obstacle to a complete phase out of ozone depleting substances and the recovery of the ozone layer.

ISPM No. 15 and Methyl Bromide

In 2002, the Parties to the International Plant Protection Convention implemented a new International Standard for Phytosanitary Measures named *ISPM No. 15: Guidelines for Regulating Wood Packaging Material in International Trade*. The measure requires that either methyl bromide fumigation or heat treatment be used to treat solid wood packaging materials in international trade.[13]

This measure is expected to greatly increase the global use of methyl bromide. In fact, many delegates of the Commission on Phytosanitary Measures confirmed to EIA that their use of methyl bromide has increased with implementation of ISPM No. 15. One representative stated that they have observed a “4 to 5 fold increase” in the use of methyl bromide since implementation of ISPM No. 15 and several others reported “great increases” and the “doubling” of methyl bromide use.[14]

While treatment of wood packaging materials is just one subset of uses that can be categorized as QPS, its potential impact on total QPS use of methyl bromide should not be underestimated. For example, it is estimated that well over one-half of the $1.7 trillion worth of the goods that enter or leave the United States use some form of solid wood packing material.[15]

Stockpiling and Illegal Trade

The Montreal Protocol stipulates that existing stocks of methyl bromide must be used before allowing new production of the chemical, and that these stocks be deducted from production and consumption allowed under the critical use exemptions. However, the Montreal Protocol does not take stockpiles into account when it makes its recommendations for critical-use exemptions. This is primarily because the largest user of methyl bromide, the US, has offered no clear information to date on existing US stockpiles of methyl bromide, despite having collected this information.

The US Environmental Protection Agency suggested that "stockpiling had indeed taken place", in testimony given in 2003, and that those stocks were over 9,000 metric tons. Any further information is being withheld pending the outcome of related court cases. In June 2005, the Environmental Investigation Agency documented over 50 methyl bromide railcars—each with a storage capacity of over 250,000 pounds (114 metric tons)—in just three locations on the outskirts of a city in Florida, suggesting that stockpiling is taking place. Indeed, there is no indication, from the little data available, that stockpiles that existed before the phase-out have been depleted.

In 2005, according to US accounting submitted to the Ozone Secretariat, the US produced or imported more methyl bromide than it consumed – by 443 metric tons.[12] For 2006, the Parties approved 8,081 metric tons of methyl bromide exemptions for the US and the US produced or imported 7,658 metric tons.[12] The US requires that CUEs left over from one year be deducted from the allowable new production/import in the following year. The deficit in methyl bromide in 2006 was likely to have been entirely made up through the use of left over methyl bromide from 2005. This means that either stockpiles have not been drawn down or they are being drawn down by agricultural use that has not been approved by the Parties.

The continuation of high levels of methyl bromide production after scheduled phase-out comes at a time when signs of illicit stockpiling, oversupply, "dumping' in developing countries, and unreported trade of methyl bromide are increasing and remain unaddressed. Experience shows that continued large scale production of controlled ozone depleting chemicals, and the accumulation of stockpiles leads to illegal trade.

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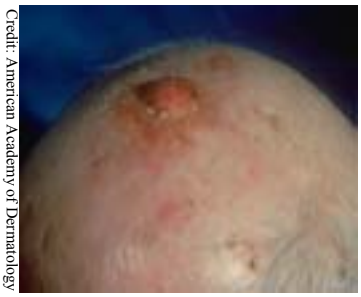
At the 17th Meeting of the Parties to the Montreal Protocol, the Parties requested TEAP options that the Parties may wish to consider for preventing harmful illegal trade in methyl bromide. In its May 2006 report, TEAP outlined the following possible sources of illegally traded methyl bromide:[6]

- Stockpiles in developed countries (which have already phased out the consumption of methyl bromide except for critical uses and QPS);
- Production allowed for developed countries in order to meet the basic domestic needs of developing countries;
- Production and stockpiles of developed countries.
- They also note that many developing countries have phased out much of their methyl bromide use, but that the Protocol allows, until 2015, production by developed countries up to 80% of the average developed country production for meeting the basic domestic need of developing countries for 1995-1998 and cautioned that "it is this quantity that needs to be regulated carefully to prevent harmful trade."



Credit: American Academy of Dermatology

Human Health Effects

The World Meteorological Organization 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.[16]

One of the most serious health effects of over-exposure to UV radiation is skin cancer. Worldwide, Montreal Protocol controls (which seek to reduce emissions of ozone depleting substances) 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.[17] Currently, an estimated 66,000 deaths occur annually from all forms of skin cancer.[27] 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.[30] In the United States, skin cancer kills one person every hour, and one in five will develop skin cancer in their lifetime.[18]

There has been a dramatic increase in two types of non-melanoma skin cancer in people under 40, according to researchers at the Mayo Clinic.[19] The most likely causes: the fact that young people seek tans and the depletion of the earth's ozone layer.[19] The results of the study were published in the most recent edition of the *Journal of the American Medical Association*.

Children are at particular risk from conditions related to over-exposure to UV radiation, according to the World Health Organization and UNEP.[28] They are physiologically the most vulnerable and can spend a considerable amount of time outside.[28] Statistics from the U.S. National Cancer Institute indicate that skin cancer is on the rise in children: cases of pediatric melanoma in the United States more than doubled between 1982 and 2002.[29]

Recent scientific research also indicates that UV radiation is much more damaging to the eye and vision than had been previously suspected.[20] For example, one of the only effective preventative measures for cataract is to decrease exposure to biologically damaging UV radiation.[21] The cataract condition is characterized by opacity of the lens of the eye, which can lead to serious vision impairment and blindness.[20]

In December 2005, scientists from the Wilmer Eye Institute at the Johns Hopkins School of Medicine, the Joint Global Change Research Institute and the Institute for Global Risk Research estimated that with 5–20% ozone depletion, there will be 167,000–830,000 additional cases of cortical cataract by 2050.[22]

Globally, in 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.[21] Montreal Protocol controls are expected to prevent 129 million cases of cataract by 2050.[17]

Environmental Consequences

Excess UV radiation is also harmful to plants and animals. The shorter wavelengths, mainly UV-B, are known to harm the biological and chemical processes of myriad living organisms.[23/24]

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.[26] 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 US$224 billion in terms of reduced damage to fisheries, agriculture and materials.[17] This calculation did not include the huge additional benefits to human health.

Conclusions and Recommendations

The Earth's ozone layer is currently in its most fragile state in recorded history, leaving parts of the Earth exposed to unprecedented levels of harmful radiation with wide-ranging impacts on ecosystems and human health. Methyl bromide stands out as both the biggest obstacle and greatest opportunity remaining to protect the ozone layer.

While progress has been made to reduce agricultural applications of methyl bromide, some Parties are still seeking unjustified exemptions to continue using excessive quantities of this chemical well beyond the agreed phase out date. There are now signs that the reluctance to fully phase out methyl bromide in developed countries is affecting the viability of methyl bromide alternatives in developing countries. There has also been insufficient enforcement of the stockpile draw down requirement in the US. All indications are that the methyl bromide stockpile in the US still exists, and is likely growing. Past experience with other ozone destroying chemicals, such as CFCs and halons, shows that stockpiling can lead to illegal trade and over-production.

Credit: NOAA

In addition, no action has been taken to address the growing use of methyl bromide for QPS purposes. Complete data on QPS production and consumption is seriously lacking. QPS uses of methyl bromide, which are currently unregulated, could threaten to overtake and ultimately dwarf other applications; thereby becoming the greatest obstacle to mitigating the impacts of ozone depletion.

It is of urgent importance that the Parties to the Montreal Protocol take action to significantly reduce all uses of methyl bromide. Reducing the use of methyl bromide is the only option that Parties have to mitigate the short-term impacts of ozone depletion during this time of peak ozone thinning.

The Environmental Investigation Agency urges Parties to the Montreal Protocol to:

- Slash critical-use exemptions for 2007 and refuse to approve exemptions for 2008;
- Refuse to consider multi-year exemptions which would serve to extend the use of methyl bromide even further beyond the phase-out date;
- Require full disclosure and complete transparency of all existing stockpiles of methyl bromide as a condition for consideration of any critical-use exemption requests;
- Require full and transparent reporting of production and consumption for QPS and BDN (basic domestic need) uses of methyl bromide; and
- Actively engage the Parties to the International Plant Protection Convention to significantly reduce, with the view to phasing out, the use of methyl bromide for QPS purposes.

REFERENCES

1. British Antarctic Survey Ozone Bulletin. December 2005. URL: http://www.antarctica.ac.uk/met/jds/ozone/index.html
2. Rai, L.C. & Mallick, N. 1998. Algal Responses to enhanced ultraviolet-B radiation. PINSA B64(2). Pg. 126.
3. Twenty Questions and Answers About the Ozone Layer. Scientific Assessment of Ozone Depletion: 2002. United Nations Environment Programme. Q.11 and Q.20. URL: http://www.epa.gov/ozone/science/unepSciQandA.pdf
4. British Antartic Ozone Survey. Natural Environment Research Council: 2006. http://www.antarctica.ac.uk/met/jds/ozone/index.html
5. Arctic Trends Scrutinized. Nature, Volume 435. May 5, 2005.
6. Report of the Technology and Economic Assessment Panel. Montreal Protocol on Substances that Deplete the Ozone Layer. UNEP: 2006
7. Hole in ozone layer expected to increase. Feb. 16 2006. Guardian News Service. URL: http://www.guardian.co.uk/science/story/0,,1710757,00.html
8. Dameris, et al. *Solar cycle effect delays onset of ozone recovery*. Geophysical Research Letters, Vol. 22, L03806. 2006.
9. Kurylo, M. J. et al. Scientific Assessment of Ozone Depletion: 1998. World Meteorological Organization, Geneva, 1999.
10. NASA Science News. Record Setting Ozone Hole. September 2000. URL: http://science.nasa.gov/headlines/y2000/ast08sep_1.htm
11. This is derived by multiplying the short-term ODP of methyl bromide (conservatively estimated to be 10) by the tonnes of methyl bromide consumed by the U.S. in 2004 and comparing the result to global CFC consumption for 2004 as measured in ODP tonnes.
12. Numbers derived from a combination of Reports of the following Meetings of the Parties to the Montreal Protocol: the 1st Extraordinary Meeting Of the Parties, the16th Meeting of the Parties, the 2nd Extraordinary Meeting of the Parties, and the 17th Meeting Of the Parties. Montreal Protocol on Substances that Deplete the Ozone Layer. UNEP: Ozone Secretariat.
13. International Plant Protection Convention. International Phytosanitary Measure No. 15: Guidelines for regulating wood packaging material in international trade. 2002.
14. Private Conversations with Danielle Grabiel/Environmental Investigation Agency
15. Hicks, Michael. "Changing Regulations on Packing Material: Will You Be Affected?—solid wood packing material, pests—Statistical Data Included." AgExporter, Jan. 2001. US Department of Agriculture, Foreign Agricultural Service.
16. UNEP Scientific Assessment of Ozone Depletion: 2002. Executive Summary. Pg 11.
17. Global Benefits and Costs of the Montreal Protocol on Substances that Deplete the Ozone Layer. Applied Research Consultants. Environment Canada. 1997.
18. Skin Cancer Facts. The Skin Cancer Foundation. URL: http://www.skincancer.org/skincancer-facts.php
19. Skin Cancers Growing in Young People - A Case for Prevention. Mayo Clinic Press Release. October 9, 2005. URL: http://www.mayoclinic.org/news2005-rst/2989.html
20. Environmental Effects of Ozone Depletion 2002 Assessment. United Nations Environment Programme. Page 17.
21. VISION 2020: The Right to Sight, the Global Initiative for the Elimination of Avoidable Blindness. World Health Organization Fact Sheet. 2002. URL: http://www.v2020.org/Eye_disease/cataract.asp
22. Model of Risk of Cortical Cataract in the US Population with Exposure to Increased Ultraviolet Radiation due to Stratospheric Ozone Depletion. American Journal of Epidemiology. Sheila K. West, Janice D. Longstreth, Beatriz E. Munoz, Hugh M. Pitcher and Donald D. Duncan
23. Karentz, D. 1991. Ecological considerations of Antarctic Ozone Depletion. Antarctic Science. 3(1). Pgs. 3-11.
24. Madronich, S. McKenzie, R.L., Bjorn, L.O. & Caldwell, M.M. 1998. Changes in biologically active ultraviolet radiation reaching the earth's surface. Journal of Photochemistry and Photobiology.
25. Environmental Effects of Ozone Depletion 2002 Assessment. UNEP. Page. 42.
26. Caldwell, et. al. "Terrestrial Ecosystems, increased solar ultraviolet radiation, and interactions with other climatic change factors." Published as part of the UNEP: Environmental effects of ozone depletion and its interactions with climate change: 2002 assessment. URL: http://www.gcrio.org/UNEP2002/8unep2002Terrestrial.pdf
27. "Health Effects of UV Radiation." World Health Organization. URL: http://www.who.int/uv/health/en/
28. Children suffer the most from the effects of ozone depletion. Press Release. World Health Organization and United Nations Environment Programme. September 16, 2003. URL: http://www.who.int/mediacentre/news/releases/2003/pr66/en/
29. Tanner, Lindsey. Rise of Melanoma in Kids Alarming Doctors. Associated Press, April 28, 2005. URL: http://www.infowars.com/articles/science/melanoma_kids.htm
30. "Ultraviolet Radiation and the INTERSUN Programme." World Health Organization. 2006. URL: http://www.who.int/uv/faq/skincancer/en/index1.html
31. Derwent, R.G. et al. "Update on Methyl Bromide and Ozone Depletion." Conference on Alternatives to Methyl Bromide. Lisbon, Portugal. Sept. 27-30, 2004.

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