IPEN

DDT & Malaria
Answers to Common Questions

International POPs Elimination Network
Pesticide Working Group

DDT[1] is a pesticide that was used heavily worldwide in the 1950s and 1960s both in agricultural production and for malaria control. Concerns about impacts on wildlife populations—particularly predatory birds—led to the phaseout of DDT in many countries in the 1970s. Use of the pesticide for malaria control has continued in some regions, though most countries now rely on combinations of other control methods.

DDT has been in the news in recent years as negotiations of the Stockholm Convention, an international treaty to phase out persistent organic pollutants, raised the possibility of eventual elimination of DDT and therefore its "loss" as a tool for malaria control. At the same time, much more is now known about the human health effects of exposure to DDT and its breakdown products. The Stockholm Convention was signed by 91 countries and the European Community on May 23, 2001. It will enter into force and become legally binding when it is ratified by 50 countries.

Below are some common questions that arise in public discussions of the DDT issue.

What does the Stockholm Convention say about DDT?

The Stockholm Convention includes special provisions for the phaseout of DDT. It provides for DDT's continued use for malaria control in countries which request a specific exemption for this use, calls for increased investments in and periodic evaluations of alternatives, and requires the ultimate elimination of DDT when countries are satisfied the alternatives are workable.[2]

How many countries use DDT?

According to the World Health Organization's (WHO) Roll Back Malaria campaign, an estimated 19 countries (mostly in Africa) are currently using DDT to fight malaria, and another six are recent users. Thirty-one of the 91 countries that signed the Stockholm Convention requested exemptions for DDT use to control malaria.

The 31 countries requesting public health exemptions for DDT under the Stockholm Convention are listed below. Those that report current use (according to WHO) are listed in italics. Some of the countries requesting exemptions have not used DDT for malaria control for more than a decade (e.g., Kenya). [3]

Countries requesting DDT exemptions under the Stockholm Convention: Algeria, Bangladesh, Cameroon, *China*, Comoros, Costa Rica, Cote d'Ivoire, *Ecuador*, *Eritrea, Ethiopia*, *India*, Iran, Kenya, *Madagascar*, Malawi, Mauritius, *Morocco,* Mozambique, *Papua New Guinea*, Russian Federation, Saudi Arabia, *South Africa*, *Sudan, Swaziland,* Togo, Uganda, United Republic of Tanzania, *Venezuela, Yemen*, Zambia, Zimbabwe (as of 22 May 2001).

WHO lists these additional countries as current users of DDT for vector control: *Namibia, Solomon Islands, Myanmar, Thailand, Belize*. The following countries are classified as "recent users" by WHO: Malaysia, Argentina, Guyana, Peru, Zimbabwe and Botswana.[4]

Where is DDT produced? How much?

According to the *Farm Chemicals Handbook 2001*, DDT is produced in India and China. Hindustan Insecticides Limited (HIL) is the government-owned company responsible for production in India, and Shenzhen Jiangshan Commerce and Industry Corporation in Shenzhen produces DDT in China.[5]

Accurate production data are difficult to confirm**.** In India, the first DDT plant was constructed in 1954. HIL is the sole manufacturer of technical grade DDT in India, and has capacity to produce an estimated 9,000 metric tons of DDT per year. According to data provided by Chemexil, India exported DDT to the following countries in 1998 and 1999: Australia, Bangladesh, Belgium, Nepal, Israel, Italy and the United States.[6] No production or export information is available from the Shenzhen plant in China.

Does DDT harm people?

DDT and its breakdown product DDE are classified as "probable" human carcinogens.[7] Exposure is linked to human developmental disorders, and reproductive disorders are well documented in animal studies.[8] Recent studies have also linked exposure to reduced lactation in nursing women, [9] and U.S. researchers recently linked DDE levels in American women with increased risks of premature delivery and reduced infant birth weight.[10]

*The **IPEN Pesticide Working Group** is one of several Working Groups of the International POPs Elimination Network. This factsheet was developed by Working Group members Pesticide Action Network North America and Worldwatch Institute, with input from Red de Acción sobre Plaguicidas y Alternativas en México, Toxics Link India and other Working Group members. Colleagues at World Wildlife Fund also provided helpful input. For a full list of Working Group members, see www.ipen.org.*

In its 2000 toxicological profile of DDT and DDE, the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) notes that evidence of hormone disrupting impacts of DDT and DDE in wildlife and laboratory animals raise concerns about human health effects. Researchers report that "exposure to DDT early in life might cause harmful effects that remain or begin long after exposure has stopped." ATSDR also notes that "key endocrine processes can be profoundly affected by exposure to extremely small amounts of active chemicals during critical windows of embryonic, fetal, and neonatal development."[11]

Humans are exposed to DDT primarily through our diet. DDT and DDE residues have been documented in the food supply of many countries, from the United States to India.[12] Meat, fish, poultry and dairy products are primary sources of DDT exposure. Particularly high levels of DDT have been documented among indigenous people in the Arctic who eat traditional foods (e.g., seals, caribou, narwhal whales).[13]

There is also some evidence that workers in DDT production facilities and malaria control workers exposed to DDT have chronic health effects. Retired malaria control workers in Costa Rica and India, for example, showed reduced neurobehavioral functions.[14]

Residues have been found in tests of human blood, serum and breastmilk around the world. An infant born anywhere in the world today is likely to have DDT or DDE in its blood and tissues. Levels of DDT found in humans have dropped significantly in those countries that have banned the chemical - particularly its widespread use in agriculture common in the 1950s and 1960s.[15]

Does DDT harm wildlife?

In 1999, the U.S. National Academy of Sciences (NAS) confirmed that the decline of the bald eagle population in 1960s in the United States was "primarily because of exposure to DDT and its metabolites." Since DDT was banned in many countries in the early 1970s, many of the bird populations facing extinction at that time have recovered. However, DDE levels high enough to cause reproductive failure have been documented in recent years in eggs and prey species around the world.[16] In the toxicological profile noted above, the U.S. ATSDR recites a long list of the chemicals' known hormone disrupting impacts in wildlife and laboratory animals.[17]

In northern countries, DDT is largely associated in the public's mind with weakened eggshells and declining bird populations. Recent efforts to phase out DDT, however, are motivated in large measure by concerns about human health arising from research on the health effects of DDT in wildlife and laboratory animals and related studies of high DDT concentrations in people living in areas sprayed for malaria control purposes.[18]

Is DDT used in agriculture?

Public health applications are the only remaining legal uses of DDT. There is significant evidence, however, of continued illegal use in agriculture. Production figures, for example, are much higher than reported public health uses, and stockpiles of DDT are often stored at insecure sites and may be illegally diverted for agricultural use.[19]

How is DDT used to control malaria?

For malaria control, DDT is sprayed on the walls inside homes in areas where mosquitoes are known to be present.

Application in such close proximity to human activities means that risk of exposure is high. Researchers in Mexico and South Africa found elevated levels of DDT in the blood of those living where DDT was used to control malaria. The researchers estimated that breast-fed children in those areas were receiving more DDT than the "safe" level recommended by the World Health Organization (WHO) and Food and Agricultural Organization (FAO).[20] These findings contributed to both countries' substituting alternative control methods.

While it may seem that indoor DDT spraying limits environmental exposure, there is evidence that residues seep into nearby waterways, and elevated DDT levels in cows milk has been documented in areas where indoor DDT treatments have taken place.[21]

Does DDT work to control malaria?

Yes, when used in a focused way and in limited settings, DDT continues to help save thousands of lives each year. At the same time, DDT's limits and failures should be recognized.

WHO's Expert Committee on Malaria still finds use of DDT acceptable but has noted that it "should only be used in well defined, high or special risk situations." The Pan American Health Organization (PAHO) has expressed strong reservations about broad-scale application of DDT for malaria control, and reports that indoor spraying has not been helpful in interrupting malaria transmission in situations of political or social instability.[22]

Do mosquitoes develop resistance to DDT?

Yes, mosquitoes develop resistance to DDT. The lack of spraying in parts of Africa for a number of years may make it possible to use DDT effectively again, but this prospect may weaken over time as DDT exposure creates new resistance. In India, vector species are resistant to DDT and malathion both when used separately and when sprayed together.[23]

How do countries control malaria without DDT?

Countries that have moved away from DDT use for malaria control use a combination of drugs, bednets treated with synthetic pyrethroids, and applying chemicals to breeding areas or houses. The World Wildlife Fund has documented the experience in the Kheda district in India, where non-chemical approaches were demonstrated to be cost-effective. In the Philippines the national program has relied on treated bed nets and spraying of alternative chemicals.[24]

How is malaria controlled in India and Mexico?

INDIA*:* India, which spends one-third of its current national health budget on malaria control, is an important case study to understand that the effectiveness of DDT is on the wane. The rural mosquito vector that transmits 65 percent of India's malaria is resistant to DDT (and also to two other pesticides).

DDT is no longer used for malaria control in urban areas under the Urban Malaria Scheme (UMS) in favor of pesticides like malathion and synthetic pyrethyroids, though in cities like Delhi even this is being replaced by integrated nonchemical approaches. DDT is still used in rural areas in indoor spraying applications.[25]

In 1997, the World Bank approved $164 million for the Malaria Control Project in India to promote alternatives to indoor spraying of DDT. Alternatives include selective vector control using targeted spraying, non-insecticide methods such as larvae-eating fish and biological larvicides, more environmentally friendly pesticides, medicated mosquito nets and institutional strengthening.[26]

Biological larvicides and polystyrene beads (used to kill mosquito larva and pupa), have proven highly effective. In the Hassan district in Karnataka and in Maharashtra bioenvironmental methods have reported up to a 70% reduction in malaria cases.[27]

MEXICO: Relying on a range of effective and affordable chemical and non-chemical strategies, Mexico has been so successful that its DDT manufacturing plant has ceased production due to lack of demand. The Director of Mexico's malaria control program declared that it is 25 percent cheaper for Mexico to spray a house with other chemicals--synthetic pyrethroids--than with DDT.[28]

Currently, Mexico uses an integrated vector and malaria management approach that includes: a) epidemiological surveillance that allows early detection of the malaria cases and prompt medical treatment, b) community participation in the notification of the cases and in the cleaning of the streams were the mosquito eggs are; and c) chemical control with pyrethroids. Specific chemical controls include the pesticide deltamethrin indoors, outdoor spraying of permethrin, and use of a low volume yet effective spray technology for application of these pesticides.[29]

What does the World Health Organization (WHO) say about DDT?

The following statement is from WHO's action plan submitted to the UN Environment Program as part of the negotiation of the Stockholm Convention:

"WHO is taking the challenge of reducing reliance on DDT and assuring protection of human health and the environment very seriously. WHO is working with countries to: a) improve the use and management of insecticides for vector control; b) evaluate and introduce chemical and non-chemical alternatives to DDT; and c) safeguard human health and the environment while decreasing the burden of malaria and other vector borne diseases. To successfully meet this challenge, WHO intends to broker financial resources for countries, provide technical support, and coordinate activities with an array of partners including UN Agencies, national governments, research institutions and non-governmental organizations."[30]

Will millions of people die of malaria if DDT is banned?

The public health community has learned over time not to place too much reliance on any single magic bullet. DDT saved millions of lives decades ago, and is still used in about two dozen countries, but most countries rely on other methods of malaria control.

Successful malaria control remains a major challenge in many areas where public health programs are underfunded and the cheapest drugs are no longer effective. More effective anti-malaria programs are needed, with increased funding for research and field application of alternative control methods.

The Mexican experience shows that eliminating DDT as a means of malaria control does not simply mean replacing it with less persistent pesticides, but requires an integral vector management strategy based on community participation and epidemiological surveillance. The coordination of community-based strategies with programs for improved housing, basic sanitation, and effective policies to fight poverty will result in more sustainable malaria control efforts and guarantee the people's right to health and a healthy environment.

For more information about DDT, contact the following organizations:

National Toxics Network
47 Eugenia Street, Rivett
2611 Canberra, Australia
Tel/Fax: (61-2) 62-885-881
Email: biomap@oztoxics.org

Pesticide Action Network, Mexico
(RAPAM)
Amado Nervo 23-B, Col. San Juanito
C.P. 56121 Texcoco, Mexico
Tel/Fax: (52-595) 95- 47744
Email: rapam@prodigy.net.mx

Pesticide Action Network North America
49 Powell Street, Suite 500
San Francisco, CA 94102, USA
Tel: (1- 415) 981-1771
Fax: (1- 415) 981-1991
Email: kristins@panna.org
Websites: http://www.panna.org,
http://www.pesticideinfo.org

Toxics Link
H-2 Jangpur Extension
New Delhi 110014, India
Tel: (91-11) 432-8006
Fax: (91-11) 432- 1747
Email: ravig@del6.vsnl.net.in

World Wildlife Fund - US
1250 24th Street, NW
Washington, DC 20037-1193, USA
Tel: (1-202) 778-9644
Fax: (1-202) 530-0743
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For more information about IPEN or the IPEN Pesticide Working Group, see www.ipen.org or contact the IPEN Pesticide Working Group coordinating office:

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Notes & References

1 dichloro-diphenyl-trichloroethane

2 Stockholm Convention on Persistent Organic Pollutants (POPs), Annex B (Restriction), Part II, para. 1-7. Treaty text available online at www.chem.unep.ch/pops/

3 UNEP, "Revised List of Requests for Specific Exemptions in Annex A and Annex B and Acceptable Purposes in Annex B Received by the Secretariat Prior to the Commencement of the Conference of the Plenipotentiaries on 22 May 2001," UNEP/POPS/CONF/INF/1/Rev.3.

4 The list of current users is published in the Roll Back Malaria Newsletter, Issue #2, March 2001. Available on line at http://mosquito.who.int/docs/rbm_news3.pdf. For more on the Roll Back Malaria Program, see www.rbm.who.int. Mexico was listed by WHO as a current user, but has been deleted here because it recently banned all uses of DDT.

5 *Farm Chemicals Handbook 2001*, Meister Publishing Company, Willoughby Ohio, USA. Volume 87.

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7 DDT is classified as "reasonably anticipated to be a human carcinogen" *Ninth Report on Carcinogens* (U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, January 2001) available at http://ehis.niehs.nih.gov/roc/ninth/rahc/ddt.pdf; DDT falls into Group 2B ("possibly carcinogenic to humans") under the IARC Carcinogenicity Classification scheme in Overall Evaluations of Carcinogenicity to Humans, compiled from IARC Monographs Vol. 1-79, available online at http://193.51.164.11/monoeval/crthall.html

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21 Waliszewski, op. cit.

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