DDT Use for Malaria Vector Control:

**ENVIRONMENTAL IMPACTS**

**How does DDT used for malaria vector control affect the environment?**
**What kind of environmental contamination can occur by DDT exposure?**
**What is needed to clearly detect the environmental risks related to the use of DDT?**

There is an on-going debate about the elimination of DDT used against malaria due to its negative impact on the human and environmental health. This factsheet provides answers to frequently asked questions about environmental concerns related to the use of DDT for malaria vector control.

### Background

Malaria control represents one of the world's greatest public health challenges, especially in sub-Saharan Africa where most of the infections occur today. Indoor residual spraying (IRS) of houses with the organochloride insecticide DDT (dichloro-diphenyl-trichloroethane) is a method widely used in various countries for malaria vector control.

DDT was first applied in the 1940s, and until the 1970s in large amounts in agriculture worldwide. After discovering its persistence and toxicity to wildlife (Carson 1962), it was substituted in agriculture (UNEP 2003), and banned in most industrialized countries. In 2002, the Stockholm Convention on Persistent Organic Pollutants added DDT to the list of chemicals that its 152 member states decided to eliminate. However, for public health purposes, the insecticide continued to be used since the 1970s, particularly in the attempt to eradicate mosquitoes that transmit malaria and other diseases.

### Evidence

DDT was one of the first pesticides, where unwanted hazardous side effects were recognised. Major environmental concerns about DDT are closely related to its high persistence. Its resistance to degradation, its long-range transmission to remote areas, and its accumulation in organisms along the food chain caused concern and activated the search for alternatives.

- **Global Distribution**

  One of the environmental concerns of DDT is its global distribution. The fact that DDT reaches higher latitudes, where it is far more persistent is giving cause for concern. DDT contamination from former applications in agriculture has been found almost all over the world. Worrying recent examples of its longevity include melting glaciers in Switzerland that release DDT which had been archived in ice for many decades (Bogdal et al. 2010). Older evidence includes its accumulation in Inuit people from eating highly contaminated fish (Dewailly et al. 1999).

- **Ocean and Atmosphere**

  The results of a global long-term simulation of DDT cycling suggest that until the 1970s the ocean acted as a global sink for DDT. But vertical transport of DDT into the deep ocean was not sufficient to compensate for high atmospheric deposition from its extensive agricultural use. Even though the atmospheric level of DDT declined following the ban of DDT across countries, emissions have been re-circulated from the ocean. Even atmospheric concentrations over the European continent may have been affected by long-range atmospheric transport of DDT evaporated (re-released) from the seawater (Stemmler and Lammel 2009).

- **Soil**

  The lifetime of DDT in soils depends on many factors including temperature, type of soil, and soil humidity. Half-lives of DDT are rather short in tropical soils (3–7 months) and much longer in colder areas (up to 15 years) in temperate soils (ATSDR 2002).

  Van Dyk et al. 2010 show that outdoor pollution from indoor applications of DDT cannot be avoided. Soils get contaminated by sweeping of the floors and wash-outs of walls and ceilings. DDT used for IRS is affecting soils locally, but tropical soils can degrade these compounds quickly. However, data from Vieira et al. 2001 show that soils were still contaminated even ten years after stopping DDT spraying in Brazil.

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- **Water**
  The transfer of DDT in water leads to biomagnifications in fish or accumulation in sediments. A study of residual levels in mussels indicates the contamination by DDT used for food production and public health purposes in some Asian countries. The findings show that water still gets contaminated where DDT is used for public health purposes (Monirith et al. 2003).

- **Animals**
  There are various studies that measure DDT concentrations in lipid tissues or other parts of the animal body, reaching levels many thousands of times higher than in water (Kajiwara et al. 2004, Moura et al. 2009, McKinney et al. 2009).

  In areas where houses are sprayed indoors, birds are exposed by their DDT contaminated diet. Barnhoorn et al. 2009 show increased DDT concentrations in fish and fish-eating birds in a South African region where DDT IRS occurred. Effects like egg thinning and reduced reproduction are expected, but besides DDT other chemicals may also play an important role. Also terrestrial birds are affected by DDT, probably from eating contaminated insects (Barnhoorn et al. 2009). Van Dyk et al. 2010 measured DDT values above WHO guidelines in the air, vegetables and chicken in the homesteads of the DDT-sprayed villages in South Africa. Furthermore, high DDT concentrations in dolphin blubber and fish in the Ganges River in India are strongly connected to the use of DDT in vector control.

  DDT metabolites and isomers are known as endocrine disruptor chemicals as they mimic or antagonize the action of hormones (Kelce et al. 1995). So far it has been difficult to demonstrate that endocrine disrupting effects relate to DDT IRS. There are some links between aquatic animal exposure and IRS that could lead to endocrine-disrupting effects. Barnhoorn et al. 2009 pointed to such effects in mossambicus fish from South Africa, where DDT clearly originates from IRS.

**Challenging Research and Monitoring**

Characterizing risks associated with wildlife exposure to DDT is challenging because DDT contamination often occurs with other persistent chemicals. It can be assumed that many animals suffer from similar DDT related health effects as humans (see Human Health Factsheet). However it is difficult to monitor such effects in wildlife and separate the DDT signal from impacts of other pollutants (Turusov 2002).

**Conclusion**

1. The heavy use of DDT in agriculture in the past caused major damage to ecosystems, in particularly to wildlife.
2. The environmental effect of DDT use for public health today, cannot be trivialized by the much lower quantities of the chemical used.
3. IRS applications are an additional threat, both within as well as in the vicinity of the sprayed houses, on top of the legacies from former use.
4. More work is needed to monitor the consequences of additional DDT input to the environment, and the precautionary principle needs to be strictly applied.

**Recommendation**

In view of increasing global concern about the effects of chemicals on human health and the environment, including the concern over the spreading of DDT use for public health purposes, it is recommended, to:
1. eliminate DDT for vector control,
2. carefully monitor and assess the consequences of DDT exposure to the environment,
3. rapidly introduce and expand already available sustainable alternatives to DDT in integrated vector control management (e.g. through supporting the Global Alliance of the Stockholm Convention).
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References


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Further Reading


The insecticide DDT is still used in specific areas of South Africa for indoor residual spray (IRS) to control malaria vectors. The aims of this study were to determine the levels of DDT contamination on the environment as a result of IRS and to evaluate the possible routes of human exposure.