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## Pesticides and Breast Cancer Risk, An Evaluation of Dichlorvos

*This fact sheet reviews the science-based information on whether or not dichlorvos affects breast cancer risk. Dichlorvos was once a very popular insecticide for use in homes and offices and many people may have come in contact with it in the past. Whether or not dichlorvos affects breast cancer risk cannot be determined from the studies that have been done so far. However, there is evidence that dichlorvos causes other cancers and toxic effects in laboratory animals. We have included information about dichlorvos use, how people may have come in contact with it and steps that you can take to minimize your exposure to this chemical.*

### What is dichlorvos?

Dichlorvos, or DDVP, is a synthetic chemical that is used to kill insects (insecticide). It belongs to the group of related chemicals called "organophosphate pesticides." Dichlorvos kills insects upon direct contact, or when eaten or inhaled by the insect.

### What is the history of dichlorvos use?

Commercial manufacture of dichlorvos started in 1961. Since then, dichlorvos has been used to protect stored crops like grains from insect damage and to control insects and flies in mushroom houses and tobacco warehouses. It has been used to keep livestock facilities and animals free of pests such as fleas, ticks and mites in the dairy, cattle, swine, poultry and other livestock industries. It was also mixed into feed to treat animals against intestinal worms and parasites. Dichlorvos was used to get rid of insects in passenger airplanes, and in swamps to kill mosquitoes and prevent the spread of malaria. Dichlorvos was used in homes and buildings, in foggers (bug-bombs) to control fleas, flies, caterpillars, mosquitoes and cockroaches. It was also used in flea collars for domestic cats and dogs. It was a common practice to hang plastic strips that slowly released dichlorvos into the air of offices and homes, to keep the rooms free of flies, mosquitoes and other insects.

### How is dichlorvos used currently?

Studies done on experimental animals in the late 1980s raised a concern about the cancer-causing potential of dichlorvos. Following these studies, the Environmental Protection Agency

(EPA) initiated a Special Review of dichlorvos. The Special Review is a formal process used by the EPA to determine if a pesticide poses unreasonable risks to people or the environment. All labels of dichlorvos products were revised to include the caution words "Danger-Poison" and instructions for its proper use. In 1995, Amvac, the only manufacturer of pure dichlorvos, voluntarily agreed to stop producing dichlorvos products for certain uses. Aerial spraying, application in passenger airplanes, and use of dichlorvos in certain food processing operations was stopped. Some uses of dichlorvos by licensed pest-control operators that were allowed to continue include its use in warehouses of packaged or bagged foods, silos and dairy barns. The use of dichlorvos in homes is now limited to pet flea collars and plastic pest strips. Use of foggers and aerosols containing dichlorvos is restricted to licensed pest-control operators.

### How do federal agencies regulate dichlorvos to protect the consumer?

EPA has set the maximum amount of dichlorvos that is permitted to remain in or on raw food at the time of harvest, called "tolerances." Foods that contain residues above these limits can be seized and destroyed by federal or local officials. Dichlorvos is known to break down rapidly in water and has not been found in drinking water in the United States (U.S.). However, dichlorvos has been declared a hazardous substance and discharges of 10 pounds or more from any commercial source need to be reported to the National Response Center (toll free: 1-800-424-8802). The National Response Center is the federal point of contact that collects and relays such information and coordinates an emergency response.



The Occupational Safety and Health Administration (OSHA) has set the maximum level of dichlorvos that may be allowed in the workplace at one milligram per cubic meter for an eight hour day and 40 hours per week work schedule.

### **Who might have been exposed to dichlorvos in the past?**

People most likely to have been exposed to this insecticide in the past are:

- Workers involved in the manufacture of dichlorvos, as well as other organophosphate pesticides that breakdown to produce dichlorvos
- Workers and applicators at food processing and storage plants where dichlorvos was used
- Workers in buildings that housed livestock where dichlorvos was used to treat the facility or the animals
- Farmers and agricultural workers who mixed or applied dichlorvos to stored crops, barns, greenhouses and livestock buildings
- Pest control operators who used dichlorvos to treat commercial facilities and homes
- Home owners who used foggers, fumigants, aerosols, flea collars or plastic pest strips that contained dichlorvos
- Veterinarians, pet groomers and pet owners who used dichlorvos-containing materials to treat animals against worms, ticks or fleas, or handled flea collars containing dichlorvos

### **What are the ways by which we may be exposed to dichlorvos today?**

Surveys conducted by the Food and Drug Administration (FDA) did not find dichlorvos in a variety of different meals that were tested. Washing and cooking destroys almost all the dichlorvos on food. Dichlorvos has not been found in drinking water in the U.S. Hence, food and water are not expected to be the cause of exposure for people. Dichlorvos does not stay in the environment for a long time and does not accumulate in animal fat.

Some home use of dichlorvos continues. People may still be exposed to small amounts of dichlorvos at home through the use of foggers and plastic pest strips that release dichlorvos into the air. People may be exposed to dichlorvos while handling flea collars and petting animals that are wearing them.

Dichlorvos can also enter the environment as a breakdown product of other organophosphate insecticides, such as trichlorfon and naled. Workers involved in the manufacture of dichlorvos and other organophosphate insecticides may be exposed to this insecticide.

### **Does dichlorvos cause cancer in laboratory animals?**

In one study, female mice that were fed high doses of dichlorvos over a long time had a higher frequency of stomach cancers than untreated mice. High doses of dichlorvos fed over two years caused an increase in the number of male rats that had pancreatic tumors and leukemia, (a type of cancer that affects the blood).

### **Does dichlorvos cause cancer in humans?**

The risk for developing non-Hodgkin's lymphoma or multiple myeloma (cancers that affect the blood) was not significantly affected in male farmers who had used dichlorvos. A higher number of leukemia cases were reported in one study among male farmers who used dichlorvos for more than ten days per year, compared to those who had not used dichlorvos. A higher number of childhood brain cancer cases were reported among families that used dichlorvos, than families that did not. Both of these studies looked at a very small number of people who were also exposed to other chemicals, making it difficult to determine if dichlorvos was the cause of the cancers. However, the results indicate the need for larger studies on humans who may have been exposed to dichlorvos in their past, especially during childhood.

### **Does dichlorvos cause breast cancer?**

No studies of breast cancer rates in women exposed to dichlorvos were found. One study reported that laboratory rats that were fed dichlorvos for two years had a higher number of benign mammary (breast) tumors than other rats. Malignant mammary tumors were not increased significantly in the dichlorvos-fed rats. This result needs to be confirmed in another rat study.

### **How can dichlorvos affect breast cancer risk?**

Mice that were treated with leukemia-causing cells were found to develop leukemia faster if they were also fed dichlorvos. This result indicates that dichlorvos may increase the effect of another cancer-causing agent, or act as a "tumor promoter." However, researchers have not tested



experimental animals with breast cancer-causing cells or chemicals to see if dichlorvos can or cannot “promote” breast tumors.

The immune system helps the body to fight against infection and cancer. There is a concern that chemicals that damage the immune system may also affect cancer risk. Dichlorvos was found to weaken or suppress the immune system in experimental animals. However, the animals with the immune suppression were not tested for the ability to fight breast cancer.

### **Is dichlorvos present in breast milk?**

Dichlorvos does not persist or accumulate in the breast tissue or breast fat. There has been only one report of the presence of dichlorvos in breast milk, in a single sample of breast milk from Taiwan.

### **Conclusions**

No studies were available on breast cancer incidences in women exposed to dichlorvos to assess whether dichlorvos increases breast cancer risk in humans. The evidence for the breast cancer risk from dichlorvos is limited to the one study in experimental rats in which it caused an increase in the frequency of benign mammary tumors only. Hence, we conclude that at the present time the evidence is not adequate to determine whether dichlorvos is a human breast carcinogen.

While the evidence specific to breast cancer risk is not adequate, we advise caution when dealing with this insecticide for the following reasons: there is sufficient evidence for its carcinogenic potential at other, non-mammary sites in experimental animals, and limited evidence that it may affect cancer risk by causing immune suppression, or by acting as a tumor promoter.

The potential for high exposures for the general population is extremely low since use of dichlorvos has become restricted and it does not remain in the environment for long periods of time. However, dichlorvos was once a very popular insecticide and hence we recommend that populations exposed in the past be followed for breast cancer incidence.

### **Where is more research needed?**

- No studies were available on breast cancer incidences among women who were exposed to dichlorvos. Women exposed to dichlorvos, through its use in agriculture or during manufacture and application, need to be followed for their incidence of breast cancer.

- In the study that reported increased numbers of benign mammary gland tumors in experimental rats, many of the animals did not survive the two years of the experiment. Another study is needed: 1) to confirm that there is indeed an increase in benign breast tumors, and 2) to see if the benign tumors become malignant with the increasing age of dichlorvos-fed rats.
- One study observed that the use of pesticides, including dichlorvos, had been more frequent among families with children who had childhood brain cancer. Children who were exposed to dichlorvos through its use in the home should be followed for their incidence of brain cancer.
- The risk for developing leukemia was found to be higher in a small group of farmers that had used dichlorvos on animals frequently. Larger populations of men and women, who have used dichlorvos for dairy, poultry or other livestock, should be surveyed for leukemia and other cancers.
- One study in laboratory mice has raised a concern about the “tumor promotion” effects of dichlorvos. Further studies in experimental animals treated with known breast cancer causing agents are needed to determine if dichlorvos promotes breast tumors.
- Dichlorvos treatments affected the immune systems of experimental animals. Animals with dichlorvos-caused immune system suppression need to be evaluated for their susceptibility to cancer.

### **Is more research being done?**

A large group of female and male agricultural workers are being surveyed for pesticide exposure and cancer in an ongoing study at the National Cancer Institute. In another study at the University of Wisconsin, Madison, scientists seek to understand how organophosphate pesticides can alter the immune system. A group of researchers at the University of California, Davis, will investigate if there is an association between exposure to organophosphate pesticides and frequency of injuries among 500 Hispanic migrant farmworkers.

### **How can I minimize exposure to dichlorvos?**

- Limit home use of dichlorvos-containing products such as foggers, plastic pest strips and pet flea collars.
- If you do use a dichlorvos-containing product such as a pet flea collar, wash hands thoroughly after handling.




- Wash mushrooms well before eating them.
- If you are getting your house treated with pesticides, find out about the pesticides that will be applied and follow the manufacturer's guidelines on when to re-enter the house.
- Follow all directions posted on buildings that have been recently treated with pesticides, and follow guidelines for when to re-enter.

Please note: An extensive bibliography on *Dichlorvos and Breast Cancer Risk* is available on the BCERF web site (<http://www.cfe.cornell.edu/bcerf/>).

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