



Breast Cancer and Environmental Risk Factors

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FACT SHEET #11

Q & A's from the Cornell University Program on Breast Cancer
and Environmental Risk Factors in New York State

Pesticides and Breast Cancer Risk, An Evaluation of Chlordane

What is chlordane?

Chlordane is a man-made mixture of chemicals that was widely used as an insecticide in the United States (U.S.). Although no longer used, chlordane is very persistent and can still be found in some soils. Chlordane contains heptachlor, another persistent insecticide (see fact sheet *Pesticides and Breast Cancer Risk, An Evaluation of Heptachlor*). The most common trade names for chlordane sold in the U.S. were Octachlor and Velsicol 1068.

What is the history of chlordane's use?

Chlordane was used extensively as an insecticide in the U.S., from its introduction in 1947, through the 1980s. The most common use of chlordane was for termite control. It was poured or injected around foundations to protect homes and buildings from termite damage. Its use was especially high in areas where termites caused structural damage, such as the southern U.S. It was also used to kill insects in the soil, to prevent them from damaging food crops, gardens and turf, and was used as an herbicide to control weeds in turf. Another use was to prevent fire ants from building nests in power transformers. Chlordane's use on food crops was canceled in 1978 by the U.S. Environmental Protection Agency (EPA). Its use for protection of buildings and power transformers continued for another 10 years. In 1988, all commercial and domestic use of chlordane in the U.S. was banned by the EPA.

Why was chlordane use banned?

Laboratory mice that were fed chlordane over long periods of time had a higher incidence of liver cancer than untreated mice. These results raised concerns about chlordane's ability to cause cancer in humans. Chlordane was also found to stay

in the environment and build up in animal and fish fat. There was a concern that people may be exposed to this insecticide by eating food contaminated with chlordane, including fish, shellfish, dairy, meat and poultry products. Its use was subsequently banned due to these concerns.

Is chlordane still made commercially?

Chlordane is still made in the U.S. for export. Formulations containing chlordane are available internationally for termite control and wood treatment.

How do federal agencies regulate chlordane to protect the consumer?

All chlordane sales and use in the U.S. were canceled by the EPA in 1988. Since chlordane is still made in the U.S., the Occupational Safety and Health Administration (OSHA) regulates chlordane levels in the workplace. The EPA limits the amount of chlordane that can be released from any industrial source into waste waters. The EPA also sets the maximum level of chlordane allowed in drinking water. This "maximum contaminant level" for chlordane has been set at no more than 2 micrograms of chlordane per liter of drinking water (one liter is approximately one quart). The Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) monitor the levels of chlordane and its breakdown products in domestic and imported foods.

Who might have been exposed to chlordane?

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

- Insecticide applicators who treated buildings with chlordane
- People who treated their own homes with chlordane



- People who lived in homes treated with chlordane
- Farmers and agricultural workers who treated fields with chlordane, or worked with treated soil
- People involved in the manufacture of chlordane
- People who treated lawns and turf with chlordane
- People who handled or laundered chlordane-contaminated work clothing

How can we be exposed to chlordane today?

Chlordane is very stable in the environment. It can remain in some soils for over 20 years. People digging around the foundations of buildings treated with chlordane in the past could still expose themselves to this highly persistent chemical. Children may be exposed by playing with chlordane-contaminated soil found near the foundations of chlordane-treated buildings and homes. Chlordane can be found in the air of some homes 15 years after its use. Because of extensive use of chlordane for termite control in urban areas, small amounts of chlordane in soil can be carried into water run-off, and contaminate river and lake beds where fish feed. Chlordane can build up and accumulate in the fat tissue of fish and shell fish that have lived in contaminated bodies of water. Those working in factories that make chlordane should follow current OSHA workplace protection guidelines to minimize their exposure to chlordane.

Does chlordane cause cancer in experimental animals?

Chlordane caused an increase in the incidence of liver cancer in male and female mice and thyroid cancer in female rats when it was fed to these laboratory animals over long periods of time. Chlordane may also act with other carcinogens to “promote” liver tumors in male mice. Diethylnitrosamine (DEN) is a known cancer-causing substance (carcinogen). Male mice that were given DEN in drinking water and then fed a diet containing chlordane, were twice as likely to develop liver tumors than when given DEN alone.

Does chlordane cause cancer in humans?

There is inadequate evidence to show that chlordane causes cancer in humans. In a few reports, chlordane exposures have been linked with cancer. But since most of the people who have been exposed to chlordane have also been exposed to other pesticides, establishing a clear link between chlordane exposure and cancer is difficult. In one study, an

increase in deaths due to lung cancer was observed among pesticide applicators. However, there was no significant increase in deaths from any cancers among men who worked in chlordane-manufacturing plants. In another study, agricultural workers who handled chlordane and other pesticides were observed to have a higher risk of developing a type of cancer called non-Hodgkin’s lymphoma. But other studies have not observed an increase in the risk for this cancer among chlordane-exposed agricultural workers. Unfortunately, similar studies on women exposed to chlordane through their work in agriculture or at chlordane manufacturing plants have not been done.

Does chlordane cause breast cancer?

In studies conducted so far, chlordane has not been directly linked with causing breast cancer in either animals or in humans. Since chlordane can build up in breast fat, three studies have looked at the levels of a chemical contained in chlordane mixtures (*trans*-nonachlor) and chlordane breakdown products (oxychlordane) in the breast fat of women with and without breast cancer. The results of these studies have not been consistent. Two of these studies did not find significantly higher levels of chlordane or its breakdown products in the breast fat of women with breast cancer compared to women without the disease. Both of these studies tested small groups of women (20 or less). The one study that did find elevated levels of oxychlordane in women with breast cancer compared to women without breast cancer is of very limited value because of the very small number of women studied (only 5 in each group) and other problems in the design of the study.

It is difficult to make any definite conclusions from the very few small studies that have been conducted to date. Larger, more carefully designed studies are needed to further investigate whether higher body levels of chlordane and its breakdown products are associated with an increased risk of developing breast cancer. Several studies involving larger groups of women are in progress.

How may chlordane affect breast cancer risk?

A woman’s lifetime exposure to estrogen has been linked to increased breast cancer risk. Estrogen is a female hormone that helps control the reproductive cycles and breast growth. There is a concern that synthetic chemicals that act like estrogen or cause other chemicals to act like estrogen may increase a woman’s risk of developing breast cancer. In one laboratory experiment designed to test for a chemical’s ability to act like estrogen, chlordane did not act like



estrogen when it was tested alone. There is currently no evidence that chlordane can enhance the estrogen-like effects of other environmental pollutants. The one study that had suggested that chlordane can enhance the estrogen-like effect of other pesticides is considered invalid because the results of this study could not be reproduced.

Another way a chemical may affect breast cancer risk is if it “disrupts” the way the body makes or breaks down estrogen. Estrogen can be broken down in the liver by several routes. One route yields a very weak form of estrogen that is excreted from the body. Other routes yield forms of estrogen that may be cancer promoting. Chlordane increases the rate of estrogen breakdown in the liver. However, scientists have not determined if chlordane causes breakdown of estrogen into a more or less cancer-promoting form.

The immune system of the body plays an important role in the body’s defense against cancer. There is concern that chemicals that damage the immune system may affect cancer risk. The development of one part of the immune system has been shown to be adversely affected in young experimental animals that were exposed to chlordane before birth. However, these studies did not determine if the chlordane-exposed animals were more prone to develop breast cancer as adults. Therefore, more animal studies are needed to determine if chlordane-induced changes in the immune system can affect breast cancer risk.

Is chlordane present in breast milk?

Since chlordane can build up and be stored in breast fat, human milk can carry this chemical from a mother to a breast-fed infant. At the levels of contamination found in breast milk samples in the U.S., researchers have concluded that the estimated risk of cancer is far outweighed by the beneficial effects of breast feeding an infant. The amount of chlordane that an infant in the U.S. may receive from breast milk has been estimated to be well below the “Allowable Daily Intake” set by the World Health Organization.

Conclusions

There is not enough evidence to show that chlordane directly causes breast cancer in humans or laboratory animals. However, there is limited evidence that chlordane has the potential to affect breast cancer risk: it may affect estrogen levels in animals, compromise the animal’s immune system and act with other carcinogens to “promote” liver tumors. Further studies are needed to determine if chlordane affects breast cancer risk through these mechanisms.

Where is more research needed?

- Larger, case-control studies are needed to see whether higher levels of chlordane or its breakdown products in body tissues of women are associated with higher incidences of breast cancer. Studies are now in progress to address this research need (see following section).
- There is some evidence that chlordane can act with carcinogens as a liver tumor “promoter” in male mice. Studies are needed to test if chlordane can also act as a “promoter” with carcinogens known to cause breast cancer in experimental animals.
- Studies should test whether chlordane promotes estrogen breakdown in the liver into the cancer-promoting forms or to other forms of estrogen.
- Further animal studies are needed to determine if chlordane can damage the immune system, and affect the body’s defense against breast cancer.
- Further studies should test whether chlordane can increase the ability of other environmental contaminants to mimic estrogen.

Is more research being done?

The National Institutes of Health (NIH) has recently funded two large new studies to determine any possible association between higher body levels of pesticides such as chlordane and breast cancer risk. One study based in California is looking at blood levels of a variety of persistent pesticides, including chlordane and its breakdown products, in African-American women. Another large scale study is being conducted on women residing in Long Island, New York to determine if chlordane exposure is associated with increased breast cancer risk. When the results of these studies are available, they will be included in any updated versions of this fact sheet.

How can I minimize exposure to chlordane that may still be in the environment?

- Avoid digging in the soil, or planting gardens within 2 to 3 feet of foundations of older buildings that have been treated with chlordane.
- Do not allow children to play with or handle the soil around foundations of homes that were treated with chlordane.
- If unsure about chlordane contamination, check with the local fish and game or health authorities before eating sport fish caught from local streams and rivers.



- If you still have containers with chlordane in your home or garage, contact your regional environmental authorities on how to handle and dispose of chlordane properly.

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

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The program involves faculty and staff from the Cornell Ithaca campus (College of Agriculture and Life Sciences, College of Arts and Sciences, the College of Human Ecology, the College of Veterinary Medicine, the Division of Biological Sciences and the Division of Nutritional Sciences), Cornell Cooperative Extension, and the Cornell Medical College and Strang Cancer Prevention Center.

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