

The following is a short list of studies contained in the scientific references included in the **Pesticide Reduction Resource Guide For Citizens and Municipalities of Massachusetts**, 2002.

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## **Pesticides and Childhood Cancer**

SOURCE: Shelia Hoar Zahm and Mary H. Ward, Occupational Epidemiology Branch, Division of Cancer Etiology, National Cancer Institute, Rockville, Maryland, Environ Health Perspect 106(Suppl 3):893-908 (1998).

Children are exposed to potentially carcinogenic pesticides from use in homes, schools, other buildings, lawns and gardens, through food and contaminated drinking water, from agricultural application drift, overspray, or off-gassing, and from carry-home exposures of parents occupationally exposed to pesticides. Parental exposure during the child's gestation or even preconception may also be important. Malignancies linked to pesticides in case reports or case-control studies include leukemia, neuroblastoma, Wilms' tumor, soft-tissue sarcoma, Ewing's sarcoma, non-Hodgkin's lymphoma, and cancers of the brain, colorectum, and testes. Although these studies have been limited by nonspecific pesticide exposure information, small numbers of exposed subjects, and the potential for case-response bias, it is noteworthy that many of the reported increased risks are of greater magnitude than those observed in studies of pesticide-exposed adults, suggesting that children may be particularly sensitive to the carcinogenic effects of pesticides. Future research should include improved exposure assessment, evaluation of risk by age at exposure, and investigation of possible genetic-environment interactions. There is potential to prevent at least some childhood cancer by reducing or eliminating pesticide exposure.

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The summaries below are provided by Ellie Goldberg, GreenDecade Coalition, Newton (compiled by Wayne Sinclair, M.D. (Board Certified Immunology) Allergy, Asthma, Immunology, Vero Beach, Florida, and Richard Pressinger, M.Ed. Tampa, Florida).

### **Living Near Agriculture Increases Risk of Brain Cancer**

SOURCE: Drs. A. Aschengrau, D. Ozonoff, P. Coogan, R. Vezina, T. Heeren, Department of Epidemiology and Biostatistics, Boston University School of Public Health, American Journal of Public Health, 86(9): 1289-96, 1996

Living closer than 2600 feet to an agriculture area has been found to increase the risk for developing brain cancer. This 1996 research project studied cancer rates among over 600 people. Brain cancer overall showed a twofold increase risk for people living within the 2600 foot distance. An astounding 6.7 fold increased risk was found for the brain cancer 80 type known as astrocytoma for people living within 2600 feet from an agriculture area

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For more information on brain cancer and neuroblastoma see: [www.chemtox.com/cancerchildren](http://www.chemtox.com/cancerchildren).- brain cancer research summaries and [www.chemtox.com/neuroblastoma](http://www.chemtox.com/neuroblastoma) - neuroblastoma research summaries

### **Golf Course Superintendents Face Higher Cancer Rates**

SOURCE: Drs. Kross, B.C., Burneister, L.F., Ogilvie, L.K., Fuortes, L.J., Department of Preventive Medicine Health, University of Iowa, American Journal of Industrial Medicine, 29(5):501-506, 1996

Working as a Golf Course Superintendent has been found to significantly increase the risk of dying of four cancer types including - brain cancer, lymphoma (non-Hodgkin's lymphoma, NHL), prostate and large intestine cancer. A study was conducted of 686 deceased members of the Golf Course Superintendents Association of America from all U.S. states who died between 1970 and 1992. Brain cancer rates for the Superintendents was found to occur at over twice the national average, while non-Hodgkin's lymphoma also occurred at over twice the national average. Prostate cancer occurred at nearly 3 times the national average and large intestinal cancer occurred at 1.75 times the national average. The researchers stated that a similar pattern of elevated NHL, brain and prostate cancer mortality along with excess deaths from diseases of the nervous system has been noted previously among other occupational groups exposed to pesticides.

### **Common Lawn Pesticide Linked to Cancer**

SOURCE: Newsweek, May 16, pg.77, 1988; Science News, September 13, 1986

The lawn pesticides, mancozeb and chlorothalonil (used by commercial lawn spray companies as fungicides), have been classified by EPA as "probable" cancer causing chemicals in humans as they have been found to cause cancer in animals (1). **Mancozeb** has also been found to react with sunlight to form a new compound EPA categorizes as a "known" human carcinogen (1). The common lawn pesticide **2,4-D** has been shown to increase the risk of lymphatic cancer in farmers six times the normal rate according to a National Cancer Institute report (2).

### **Home Pesticides Increase Risk of Leukemia in Children**

SOURCE: Dr. John Peters, University of Southern California, Journal of the National Cancer Institute, July 1987

Children who live in homes where indoor or outdoor pesticides are used face a far greater chance of developing leukemia (leukemia is a cancer of the blood). The study, published in July's 1987 issue of the Journal of the National Cancer Institute, studied 123 Los Angeles children with leukemia and 123 children without the malignancy. The results showed the children living in the pesticide treated homes had nearly a 4 times greater risk of developing the disease. If the children lived in homes where pesticides were used in the garden as well, the risk of developing leukemia was 6.5 times greater. All of the children in the study were 10 years of age or younger.

### **Brain Damage Linked to Lawn Pesticides**

SOURCE: 1. Toxicology and Applied Pharmacology, 65:23, 1982; 2. British Journal of Psychiatry, 141:273, 1982; 3. Annual Reviews in Public Health, 7:461, 1986

The pesticide MCPA, used as an ingredient in some lawn pesticides, has been found to damage a part of the brain known as the blood brain barrier (1). The blood brain barrier is the brain's primary defense system which works to keep toxic substances out of the brain cells and is literally protecting all of us from developing immediate neurological illness. The blood brain barrier has been found to be defective more often in patients with Alzheimers and some psychiatric disorders (2). In fact, the lack of functioning of the blood brain barrier in the human infant has been reported on many occasions as being the reason why an infant is being found to develop brain damage after exposure to common chemicals while an adult with a mature blood brain barrier does not. Unfortunately, EPA neurotoxicologist Dr. Bill Sette stated EPA does not yet require chemical companies to test any of their pesticides for causing blood brain barrier damage. Another study of 56 men exposed to organophosphate pesticides detected memory problems and difficulty in maintaining alertness and focusing attention (3). Each of these studies will be listed here in greater detail shortly as our web site completes development. As the understanding of blood brain barrier function is of critical importance to understanding why one individual can receive more damage to his/her nervous system than someone else, we will also include a blood brain barrier site with the address [www.chemtox.com/bbb](http://www.chemtox.com/bbb).

### **Pesticide Inhalation Associated with Brain and Lung Cancer**

SOURCE: Journal of the National Cancer Institute, 71(1), July 1983

A study of 3,827 Florida pesticide applicators employed for 20 or more years found they had nearly 3 times the risk for developing lung cancer. The same study also showed the pesticide applicators had twice the risk for brain cancer.

There was not any increased cancer risk when applicators were studied for only 5 years implying it takes over 5 years to accumulate enough damage to the genetic structure to develop the cancers.

### **Children are Especially Vulnerable to Toxics**

*The National Academy of Sciences finds that children are more susceptible to chemicals.*

- National Research Council, National Academy of Sciences, Pesticides in the Diets of Infants and Children, National Academy Press, Washington, DC, 1993: 184-185.

*Children take in more pesticides relative to body weight than adults and have developing organ systems that are more vulnerable and less able to detoxify toxic chemicals.*

- US EPA, Office of the Administrator, Environmental Health Threats to Children, EPA 175- F-96-001, September 1996

*Pesticides can increase susceptibility to certain cancers by breaking down the immune system's surveillance against cancer cells.*

Infants and children, the aged and the chronically ill are at greatest risk from chemically induced immune-suppression.

- Repetto, R., et al., Pesticides and Immune System: The Public Health Risk, World Resources Institute, Washington, DC, March 1996.

### **Children and Cancer**

The probability of an effect such as cancer, which requires a period of time to develop after exposure, is enhanced if exposure occurs early in life.

- Vasselinovitch, S., et al., "Neoplastic Response of Mouse Tissues During Perinatal Age Periods and Its Significance in Chemical Carcinogenesis," *Perinatal Carcinogenesis, National Cancer Institute Monograph 51, 1979.*

The rate of childhood cancer is increasing approximately 1% on average per year, and cancer is the leading cause of death by disease among non-infant children under the age of 15.

- Cushman, J., "U.S. Reshaping Cancer Strategy as Incidence in Children Rises," *New York Times, September 29, 1997. American Cancer Society, Cancer Facts and Figures, Oakland, CA, 1996.*

Between 1973 and 1991, the overall incidence of childhood cancer increased 10%. Soft tissue sarcoma and brain cancer incidence increased more than 25%.

- *Ries, L., edited by Harras, A., Cancer Rates and Risks, National Institutes of Health Publication No.96-691, May 1996.*

Children with brain cancer are more likely than normal controls to have been exposed to insecticides in the home.

- *Gold, E. et al., "Risk Factors for Brain Tumors in Children," American Journal of Epidemiology 109(3): 309-319, 1979.*

A study sponsored by the National Cancer Institute indicates that household and garden pesticide use can increase the risk of childhood leukemia as much as seven-fold.

- *Lowengart, R. et al., "Childhood Leukemia and Parent's Occupational and Home Exposures, " Journal of the National Cancer Institute 79:39, 1987.*

Studies show that children living in households where pesticides are used suffer elevated rates of leukemia, brain cancer and soft tissue sarcoma.

- *Gold, E. et al., "Risk Factors for Brain Tumors in Children," American Journal of Epidemiology 109(3): 309-319, 1979;*
- *Lowengart, P., et al., "Childhood Leukemia and Parents' Occupational and Home Exposures," Journal of the National Cancer Institute, Vol. 79, No. 1, pp.39-45, 1995;*
- *Reeves, J., "Household Insecticide-Associated Blood Dyscrasias in Children,"(letter)*
- *American Journal of Pediatric Hematology/Oncology 4:438-439, 1982;*
- *Davis, J., et al., "Family Pesticide Use and Childhood Brain Cancer," Archives of Environmental Contamination and Toxicology 24:87-92, 1993;*
- *Leiss, J., et al., "Home Pesticide Use and Childhood Cancer: A Case-Control Study," American Journal of Public Health 85:249-252, 1995;*
- *Buckley, J., et al., "Epidemiological characteristics of Childhood Acute Lymphocytic Leukemia," Leukemia 8(5):856-864, 1994.*
- *Whitmore, R., et al., "National Home and Garden Pesticide Use Survey Final Report,"Research Triangle Park, NC: Research Triangle Institute, March 1992.*

The most commonly used non-agriculture herbicide, 2,4-D,11 has been linked to non-Hodgkin's lymphoma in scientific studies.

- *Hoar, S., et al., "Agricultural Herbicide Use and a Risk of Lymphoma and Soft-TissueSarcoma, "Journal of the American Medical Association, 259(9): 1141-1147, 1986;*
- *Wigle, D., et al., "Mortality Study of Canadian Farm Operators: Non-Hodgkin's Lymphoma Mortality and Agricultural Practices in Saskatchewan," Journal of the National Cancer Institute 82(7):575-582, 1990;*
- *Woods, J., "Non-Hodgkin's Lymphoma Among Phenoxy Herbicide-Exposed Farm Workers in Western Washington State," Chemosphere 18(1-6):401-406, 1989;*

- Zahm, S., et al., "A Case Control Study of Non-Hodkin's Lymphoma on the Herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) in Eastern Nebraska" *Epidemiology* 1(5):349-356, 1990.

Animal studies link pesticides in the organochlorine, organophosphate (OP), and pyrethroid families to hyperactivity. OPs are also linked to developmental delays, behavioral disorders and motor dysfunction in animal studies.

- Shettler, T., et al., "Known and suspected developmental neurotoxicants," In *Harms Way: Toxic Threats to Child Development, Greater Boston Physicians for Social Responsibility: Cambridge, MA, 2000.*

An internal Office of Pesticide Program, US EPA, memo states that further studies need be conducted, because of "evidence that odor and petroleum-related carriers" in OP pesticide products may be contributing to neurobehavioral effects in people exposed to OPs.

- Darcy, S., "Chlorpyrifos, Diazinon Rank High in Residential Child Poisoning Incidents, EPA Internal Memo Says," *Pesticide Report*, vol. 3, no. 3, July 9, 1999, citing an Blondell, J., "Review of Poison Control Center Data for Residential Exposures to Organophosphate Pesticides, 1993-1996," U.S EPA Memorandum, February 11, 1999.

A 1996 study found that 2,4-D can be tracked from lawns into homes, leaving residues of the herbicide in carpets.

- Nishioka, M., et al., "Measuring Transport of Lawn-Applied Herbicide Acids from Turf to Home: Correlation of Dislodgeable 2,4-D Turf Residues with Carpet Dust and Carpet Surface Residues," *Environmental Science Technology*, 30:3313-3320, 1996.

EPA's Non-Occupational Pesticide Exposure Study (NOPES) found that tested households had at least 5 pesticides in indoor air, at levels often 10X greater than levels measured in outdoor air.

- U.S. EPA, "Nonoccupational Pesticide Exposure Study" (NOPES), Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, North Carolina, EPA/600/3-90/003, January 1990.

Another EPA study found 23 pesticides in indoor household dust and air that was recently applied or used in the home. The study also found residues of pesticides in and around the home even when there had been no known use of them on the premises.

- Lewis, R., et al., "Determination of Routes of Exposure of Infants and Toddlers to Household Pesticides: A Pilot Study," *Methods of Research Branch, U.S. EPA, Research Triangle Park, NC, 1991.*