Chlordane
CAS No. 57-74-9

Heptachlor
CAS No. 76-44-8

General Information
Chlordane and heptachlor are structurally related organochlorine pesticides and were used in the U.S. from the early 1950's until the mid-1980's. As a result of the manufacturing process, the technical grade product of each chemical contains 10%-20% of the other chemical, in addition to trace amounts of numerous other related compounds (ATSDR, 2007). Technical grade chlordane had contained 7% trans-nonachlor. Chlordane is not currently produced or used in the U.S. Since 1992, heptachlor use has been limited to treatment of fire ants near power transformers. Until 1988, chlordane was used to kill termites and other insects on agricultural crops, lawns, buildings, and in soil. Heptachlor was used as a soil and seed treatment and for termite control in and around buildings until 1988. Both pesticides are persistent in soils and sediments and have been detected in water from agricultural run-off and near production and disposal facilities (ATSDR, 1994, 2007). Heptachlor and chlordane are somewhat volatile and may be detected in the air and dust of buildings long after treatment for termite or insect control (Whitemore et al., 1994).

Heptachlor and chlordane and their metabolites bioaccumulate in fatty animal tissues. Consequently, foods high in fat such as meat, fish, and dairy products are the usual sources of exposure to these chemicals in the general population. Both of these chemicals and their metabolites can cross the placenta and are excreted into breast milk, which results in exposure to the fetus and nursing infant (Dallaire et al., 2002; Rogan, 1996; Takahashi et al., 1981). Chlordane and heptachlor are absorbed after oral, dermal, and inhalation exposure. Chlordane is metabolized primarily to oxychlordane and to a lesser extent, to heptachlor. The major metabolite of heptachlor is heptachlor epoxide, which is also persistent in the body (ATSDR, 2007). Elimination of all these chemicals and their metabolites from the body occurs over months to years, and breast milk is a major excretion route in lactating women.

Human health effects from either chlordane or heptachlor at low environmental doses or at biomonitored levels from low environmental exposures are unknown. Acute, high doses of either chlordane or heptachlor block inhibitory neurotransmitters and result in central nervous system toxicity, characterized by seizures and paralysis. In laboratory animal studies, chronic doses of heptachlor have produced liver enlargement and injury; both chlordane and heptachlor induced hepatic cytochrome P450 enzymes and increased the incidence of liver tumors (NTP, 1977a, 1977b; Smith, 1991). Chronic feeding studies with either chlordane or heptachlor have demonstrated reduced fertility, neonatal mortality, and alterations in immune function of offspring. Subtle
neurodevelopmental effects have been observed rodents after prenatal exposure to heptachlor (IPCS, 2006). Epidemiologic studies have not demonstrated teratogenic or developmental effects (Baker et al., 1991; Le Marchand et al., 1986). No clear evidence of excessive cancer rates was demonstrated in human epidemiologic studies (ATSDR, 2007; IARC, 2001; Shindell and Ulrich, 1986). IARC considers chlordane and heptachlor as possibly carcinogenic to humans. OSHA has established occupational exposure criteria, and NIOSH and ACGIH have recommended workplace exposure levels for each pesticide. The U.S. EPA has established environmental criteria for chlordane and heptachlor, and the U.S. FDA established allowable residues of chlordane, heptachlor, and heptachlor epoxide in foods and bottled water. Information about external exposure (i.e., environmental levels) and health effects of chlordane and heptachlor is available from ATSDR at: http://www.atsdr.cdc.gov/toxprofiles/. A recent assessment of heptachlor is available at: http://www.inchem.org/documents/cicads/cicads/cicad70.htm#ref.

Biomonitoring Information

Serum oxychlordane and trans-nonachlor levels in NHANES 1999–2000, 2001–2002, and 2003–2004 subsamples were comparable to levels measured in Swedish women from 1996–1997 (Glynn et al., 2003). In serum samples obtained in between 1994 and 1997 from Inuit women in different Arctic countries, the reported oxychlordane and trans-nonachlor geometric mean levels from Canada and Greenland groups were about threefold to fivefold higher than among females in the Fourth Report (van Oostdam et al., 2004). A small sample of Polish women had mean levels of oxychlordane and trans-nonachlor that were about fivefold lower than in females in the NHANES 2001–2002 subsample (Jaraczweska et al., 2006). Serum trans-nonachlor levels among females in the NHANES 1999–2001 subsample were about one half the levels obtained between 1994 and 1996 from women in New York (Wolff et al., 2000).

Levels of heptachlor epoxide among females in the Fourth Report were approximately one tenth of the corresponding 90th percentile for a cohort of pregnant women in California studied from 1963 to 1967 (James et al., 2002). Two episodes (one each in Arkansas and Hawaii) of inadvertent heptachlor contamination of dairy cattle feed occurred in the early-to-mid 1980’s, resulting in human exposure to heptachlor epoxide that was excreted into the milk. For the exposed persons drinking milk in the Arkansas episode, mean serum heptachlor epoxide and oxychlordane levels were about sevenfold and threefold higher, respectively, than the 90th percentile values of NHANES 1999–2000 (Stehr-Green et al., 1988). In the Hawaii episode, the mean serum heptachlor epoxide and oxychlordane levels were more than twice as high, respectively, than the 90th percentile values of NHANES 1999–2000 (Baker, 1993).

Finding a measurable amount of oxychlordane, trans-nonachlor, or heptachlor epoxide in serum does not mean that the level of oxychlordane, trans-nonachlor, or heptachlor epoxide causes an adverse health effect. Biomonitoring studies on levels of oxychlordane, trans-nonachlor, and heptachlor epoxide provide physicians and public health officials with reference ranges so that they can determine whether people have been exposed to higher levels of heptachlor and chlordane than are found in the general population. Biomonitoring data can also help scientists plan and conduct research on exposure and health effects.

References

http://www.cdc.gov/biomonitoring/ChlordaneHeptachlor_BiomonitoringSummary.html


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