

## Permethrin

Permethrin is a Type I pyrethroid insecticide. Permethrin is a general use pesticide registered for use on food and feed crops such as tree nuts and lettuce, on livestock, pets, clothing, and for structural pest control, residential use and mosquito abatement. It is also used as a treatment of head lice and scabies. According to U.S. EPA (2006a), approximately two million pounds of permethrin are applied annually in the U.S., with approximately 70 percent being used in non-agricultural settings. Exposures to the general public and to workers are expected given the multiple uses of permethrin.

Permethrin passed the animal data screen, underwent a preliminary toxicological evaluation, and is being brought to the Carcinogen Identification Committee for consultation. This is a compilation of the relevant studies identified during the preliminary toxicological evaluation.

### Epidemiological data

No cancer epidemiology studies were identified.

### Animal carcinogenicity data

- Long-term diet studies in mice
  - Two-year studies in male and female CD-1 mice: Hogan and Rinehart (1977) / Bio/dynamics Mouse I (1977), as described in CDPR (1994)
  - 98-week studies in male and female Alderley Park (Swiss-derived) mice: Ishmael and Litchfield (1988) / ICI (1977), as described in IARC (1991) and in CDPR (1994)
  - Two-year studies in male and female CD-1 mice: Tierney and Rinhart (1979) / Bio/dynamics Mouse II (1979) as described in CDPR (1994) and as FMC “mouse II” in U.S. EPA (2002)
  - 91-week studies in male and female CFLP mice: James (1980) / Wellcome (1980), as described in CDPR (1994)
  - FMC 100-week carcinogenicity/reversibility studies in female CD-1 mice: as described in U.S. EPA (2002)
  
- Long-term diet studies in rats
  - Two-year studies in male and female Alpk:AP (Wistar-derived) rats: Ishmael and Litchfield (1988) / ICI (1977) as described in CDPR (1994) and in IARC (1991), and briefly discussed in U.S. EPA (2002, p. 14)
  - Two year studies in male and female Long Evens rats: Braun and Rinehart (1977) / Bio/dynamics (1977) as described in CDPR (1994) and briefly discussed in U.S. EPA (2002, p. 15)
  - 103-week studies in male and female Wistar rats: McSheehy *et al.* (1980) / Wellcome (1980) as described in CDPR (1994)

## Other relevant data

- Genotoxicity
  - *Salmonella typhimurium* reverse mutation assays: Pednekar *et al.* (1987); Herrera and Laborda (1988)
  - Chromosomal aberration assay in human lymphocyte cultures: Barrueco *et al.* (1994)
  - Chromosomal aberration assay in Chinese hamster ovary cells: Barrueco *et al.* (1994)
  - Micronucleus assay in human whole blood lymphocyte cultures: Surrallés *et al.* (1995)
  - Micronucleus assay in isolated human lymphocyte cultures: Surrallés *et al.* (1995)
  - Reviews: IARC (1991, pp. 342-344); CDPR (1994, pp. 23-24); U.S. EPA (2002, p. 5, 15)
  
- Structure activity considerations
  - Structurally similar to resmethrin, another Type I pyrethroid, which is a Proposition 65 carcinogen. Resmethrin induces liver tumors in female rats and male mice (U.S. EPA, 2006b)
  - Structurally similar to metofluthrin, another Type I pyrethroid, which induces liver tumors in male and female rats (U.S. EPA, 2006c)

## Reviews

- U.S. EPA (2006a, pp. 11-12)
- U.S. EPA (2002)
- CDPR (1994)
- IARC (1991)

## References<sup>1</sup>

Barrueco C, Herrera A, Caballo C, de la Peña E (1994). Induction of structural chromosome aberrations in human lymphocyte cultures and CHO cells by permethrin. *Teratog Carcinog Mutagen* **14**(1):31-8.

California Department of Pesticide Regulation (CDPR, 1994). Permethrin Risk Characterization Document (Revised). Medical Toxicology and Worker Health and Safety Branches. California Environmental Protection Agency.

---

<sup>1</sup> Copies of these listed references, as either the abstract, the relevant sections of the publication, or the complete publication, have been provided to members of the Carcinogen Identification Committee. These references have been provided in the order in which they are discussed in this document.

Herrera A, Laborda E (1988). Mutagenic activity in synthetic pyrethroids in *Salmonella typhimurium*. *Mutagenesis* **3**(6):509-14.

International Agency for Research on Cancer (IARC, 1991). *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Occupational Exposures in Insecticide Application, and Some Pesticides*, Vol. 53, IARC, Lyon, France.

Pednekar MD, Gandhi SR, Netrawali MS (1987). Evaluation of mutagenic activities of endosulfan, phosalone, malathion, and permethrin, before and after metabolic activation, in the Ames *Salmonella* test. *Bull Environ Contam Toxicol* **38**(6):925-33.

Surrallés J, Xamena N, Creus A, Catalán J, Norppa H, Marcos R (1995). Induction of micronuclei by five pyrethroid insecticides in whole-blood and isolated human lymphocyte cultures. *Mutat Res* **341**(3):169-84.

U.S. Environmental Protection Agency (U.S. EPA, 2002). *Memorandum: Permethrin: Report of the Cancer Assessment Review Committee (Third Evaluation)*. EPA PC code 109701. Cancer Assessment Review Committee, Health Effects Division, Office of Pesticide Programs, October 23, 2002.

U.S. Environmental Protection Agency (U.S. EPA, 2006a). Regregistration Eligibility Decision (RED) for Permethrin. EPA 738-R-06-017. Prepared by Office of Prevention, Pesticides and Toxic Substances, Washington, DC.

U.S. Environmental Protection Agency (U.S. EPA, 2006b). Regregistration Eligibility Decision (RED) for Resmethrin. EPA 738-R-06-003. Prepared by Office of Prevention, Pesticides and Toxic Substances, Washington, DC.

U.S. Environmental Protection Agency (U.S. EPA, 2006c). Cancer Assessment Document. Evaluation of the Carcinogenic Potential of Metofluthrin. PC Code 109709. Cancer Assessment Review Committee. Health Effects Division. Office of Pesticide Programs. June 6, 2006.