

para-dichlorobenzene

Review Date: 10/01/2014

CAS #: 106-46-7

Type	Fumigant insecticide, miticide, and repellent.
Controls	Mites, moths, carpet beetles and their eggs.
Mode of Action	"Toxic" by inhalation (Reference 1).

Thurston County Review Summary:

Para-dichlorobenzene (also known as 1,4-dichlorobenzene) is the active ingredient in mothballs for use as a moth and beetle repellent. It is also used to repel lice and mites in bird cages and is formulated into varpel rope which is used to repel snakes, mice, rats, and bats. Para-dichlorobenzene is rated high in hazard and products containing it fail Thurston County's pesticide review criteria because it is classified as "possibly carcinogenic to humans" by International Agency for Research on Cancer.

MOBILITY

Property	Value	Reference	Value Rating
Water Solubility (mg/L)	80	1	Moderate
Soil Sorption (Kd=mL/g)	Value not found		
Organic Sorption (Koc=mL/g)	275 to 833	1	High

Mobility Summary:

Para-dichlorobenzene is not registered for outdoor uses and the hazard of mobility is intended to rate the risk of an active ingredient to move off the site of application with rain or irrigation water. The hazard of mobility indicates the potential to have the active ingredient get into surface or groundwater or to move to an area where it can cause an unexpected exposure to a non-target organism. If mothballs are used outdoors and exposed to the environment, the active ingredient is likely to dissipate into the air. However, if it is exposed to rain, it will not bind well to soil and is likely to move off the site of application with water. The hazard for mobility is rated high (if it is placed outside and exposed to rain). When used indoors para-dichlorobenzene will dissipate and move with air.

PERSISTENCE

Property	Value	Reference	Value Rating
Vapor Pressure (mm Hg)	0.4 mmHg	1	Low
Biotic or Aerobic Half-life (days)	About 1 (soil)	4	High
Photolysis Half-life (days)	Not expected to degrade in sunlight	4	High
Terrestrial Field Test Half-life (days)	50 (atmospheric)	4	Moderate
Hydrolysis Half-life (days)	Not a major route of degradation	4	High
Anaerobic Half-life (days)	About 385	4	High
Aquatic Field Test Half-life (days)	About 1 (water)	4	High

Persistence Summary:

Para-dichlorobenzene is a volatile chemical that dissipates readily into the air. The half-life of para-dichlorobenzene in the atmosphere is about 30 to 50 days (References 1 and 4). Since mothballs are expected to dissipate and not to be used in water or outdoors, the persistence hazard is rated on atmospheric degradation. The hazard for persistence is rated moderate because it is likely to degrade to half of the applied concentration between 14 and 60 days.

BIOACCUMULATION

Property	Value	Reference	Value Rating
Bioaccumulation Factor	Value not found		
Bioconcentration Factor	33 to 720	4	Low to moderate
Octanol/Water Partition Coefficient	log Kow = 3.52	1	Moderate

Bioaccumulation Summary:

Measured bioconcentration factors in fish range from 33 L/kg (carp) to 720 L/kg (rainbow trout) for 1,4-dichlorobenzene (Reference 4). The bioconcentration factors indicate a moderate potential for accumulation. The octanol / water partition coefficient (log Kow = 3.5) also indicates a moderate potential for accumulation. The hazard for bioaccumulation potential is rated moderate.

ACUTE WILDLIFE TOXICITY VALUES and Risk Assessment

Test Subject	Value	Reference	Toxicity Rating
Mammalian (LD50)	3,790 mg/kg - 353 mg/kg	3	Low
Avian (LD50)	1,608 mg/kg	4	Moderate
Honey bee or insect (LD50)	Value not found		
Annelida -worms (LC50)	Value not found		
Fish (LC50)	1.18 mg/L	1	High
Crustacean (LC50)	2.2 to 11 mg/L	4	Moderate
Mollusk (LC50)	Value not found		
Amphibian (LD50 or LC50)	Value not found		

Acute Toxicity Testing and Ecotoxicity Summary:

Single-dose toxicity testing indicates that para-dichlorobenzene is low in toxicity to mammals, moderately toxic to birds and aquatic invertebrates but highly toxic to some fish species. Since there are no registered outdoor uses of para-dichlorobenzene, the EPA did not perform an ecological risk assessment (Reference 3). A risk assessment for pets that inhale or eat a mothball could not be found and, therefore, the risk can not be rated. Risk to wildlife from labelled uses of para-dichlorobenzene is considered low because there are no outdoor uses and it is used to repel animals that enter indoor spaces.

ACUTE HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Risk Rating
Adult accessing treated area	Inhalation (within treated area)	6 mg/cubic meter	0.85 mg/cubic meter	7	3	Moderate
Adult within a treated home	Inhalation (within treated home)	6 mg/cubic meter	0.66 mg/cubic meter	7.9	3	Moderate
Applying moth balls to closet	Dermal	3 mg/kg/day	0.009 mg/kg/day	330	3	Low
Applying moth balls to drawer	Dermal	3 mg/kg/day	0.0013 mg/kg/day	2240	3	Low

Acute Toxicity Risk Assessment Summary:

The risk assessment performed for short-term inhalation exposures to para-dichlorobenzene used a dose of concern based on a No Observable Adverse Effect Level (NOAEL) of 180 mg/cubic meter of air and a safety factor of 30. The resulting dose of concern was 6 mg/cubic meter of air. The risk assessments were calculated for potential exposures to adults applying mothballs to closets and drawers and to adults inhaling the vapors after the application. The risk from the potential skin exposures during application was determined to be low in hazard. The potential exposures from inhaling para-dichlorobenzene within the a treated closet or in a treated home are rated moderate in hazard.

CHRONIC HUMAN TOXICITY HAZARDS

Property	Value	Adverse Effect	Reference	Rating
Carcinogenicity	2B (IARC)	Possibly carcinogenic to humans	2	High
Mutagenicity	470 and 823 ug/mL	DNA fragmentation	4	Unknown hazard
Neurotoxicity - (NOAEL)	Value not found			
Endocrine Disruption	10 mg/L	Reduced gonad weight	1	Potential disruptor
Developmental Toxicity (NOAEL)	30 mg/kg/day	Increased number of deceased pups	4	High
Reproductive Toxicity (NOAEL)	Value not provided	Interfered with spermiogenesis	4	High
Chronic Toxicity (NOAEL)	25 mg/kg/day	Increased liver weights	3	Raing based on risk

Chronic Toxicity Hazard Summary:

Para-dichlorobenzene tests were positive for endocrine disruption potential and interfered with spermiogenesis in reproductive toxicity testing (References 1 and 4). The International Agency for Research on Cancer (IARC) of the World Health Organization classifies paradichlorobenzene as 2B- possibly carcinogenic to humans. The National Toxicology Program of the National Institutes of Health determined that there was clear evidence of carcinogenicity, and the EPA determined that it was not likely to be carcinogenic to humans (References 1 and 2). Developmental toxicity test data did not indicate an increased susceptibility to developing fetuses exposed to para-dichlorobenzene before or after birth (Reference 3), although test data show there was an increased number of deceased pups without significant maternal toxicity (Reference 4). Effects of mutagenicity were observed in the cells of rat hpatocyte cultures but were not observed in human cultures using the same experiments (Reference 4). DNA fragmentation was observed in human liver cells, but the study did not state if the test conditions were also toxic to the cells, therefore, the significance of the effects are unable to be determined (Reference 4). There was inadequate data to determine the mutagenic potential of para-dichlorobenzene (Reference 4).

CHRONIC HUMAN TOXICITY - Risk Assessment

Subject and Scenario	Route	Dose of Concern	Exposure	Margin of Safety	Reference	Risk Rating
Adult in treated home	Inhalation (seasonal use)	1,964 ug/cubic meter	36 ug/cubic meter	55	3	Low
Adult in treated home	Inhalation (6 to 12 months)	110 ug/cubic meter	21 ug/cubic meter	5.2	3	Moderate
Other long-term exposures were not evaluated						
Combined exposures were not evaluated						

Chronic Toxicity Risk Assessment Summary:

The EPA evaluated the potential risk to adults living in homes treated with mothballs when applied seasonally (1 to 6 months) or continuously for 6 to 12 months. Long-term exposures are expected to be from inhaling the mothball fumes and not from contact with skin or from ingestion. When used seasonally (1 to 6 months), the potential inhalation exposure of para-dichlorobenzene within a treated home is rated low in hazard. When para-dichlorobenzene applications are ongoing for 6 to 12 months, the potential inhalation exposure is rated moderate in hazard.

Long-term oral and dermal (skin) exposures are not expected from registered uses, so the EPA did not evaluate their risk (Reference 3).

Metabolites and Degradation Products:

Paradichlorobenzene breakdown products that do not volatilize include 1,4-dichlorobenzene dihydrodiol, 2,5-dichloro-cis,cis-muconic acid, 2-chloromaleyl-acetic acid, and 2-chloroaceto-acrylic acid.2 (Reference 1). Rats metabolize para-dichlorobenzene to 2,5-dichlorophenol (Reference 3).

Comments:

Paradichlorobenzene is considered a moderate eye irritant (EPA Toxicity Category II) and a skin irritant (EPA Toxicity Category III) but not a skin sensitizer (Reference 1).

References

1. National Pesticide Information Center (NPIC). Oregon State University. Paradichlorobenzene Technical Fact Sheet. December 2010.
2. International Agency for Research on Cancer. Agents Classified by the IARC Monographs, Volumes 1-102. <http://monographs.iarc.fr> (Accessed 10/10/2012).
3. USEPA. Prevention, Pesticides and Toxic Substances. EPA 738-R-07-010. Reregistration Eligibility Decision for Para-dichlorobenzene. Revised December 2008.
4. National Library of Medicine. Hazardous Substance Database. TOXNET, Toxicology Data Network. 1,4-Dichlorobenzene. March 20, 2012.