



# Instructions on Household Pesticide Labels: Comparison with Agricultural Pesticide Labels

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## Abstract

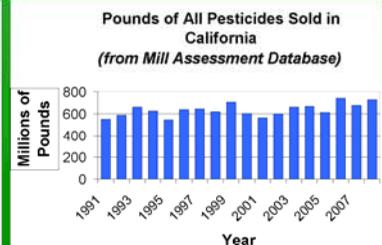
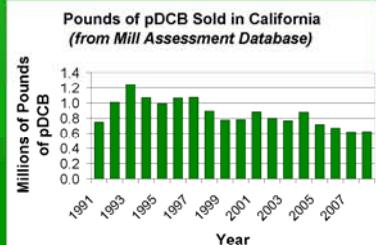
Label instructions for agricultural pesticides differ from those with only home uses. Agricultural product labels specify: maximum application rate; re-entry interval (REI) following application; and treatment interval. Consider a volatile organic compound such as 1,3-dichloropropene (aka 1,3-D) which is used for agricultural fumigations versus a household pesticide such as para-dichlorobenzene (pDCB), approved for home use as mothballs to protect clothing from insects and mildew. For 1,3-D, a maximum application rate is clearly defined. For para-dichlorobenzene, only a minimum rate ("at least one pound per 50 cubic feet") is specified. For the agrochemical pesticide 1,3-D, a re-entry interval is specified and an irritating warning agent is often added to the formulation to alert bystanders of exposure. For para-dichlorobenzene, no airing period is specified & a pleasant, masking odor (such as cedar or lavender) is often added. Implications of these differences as they affect exposure are considered in this presentation.

## Questions

1. How & where is para-dichlorobenzene (pDCB) used in California?
2. Is there evidence for para-dichlorobenzene (pDCB) related illnesses in the California Pesticide Illness Surveillance Program (PISP) database and/or the open literature?
3. What do biomonitoring studies reveal about exposure to pDCB?
4. Should label instructions be altered to reduce exposure?

## Use of para-Dichlorobenzene (pDCB) in California

In California, pDCB is licensed only for home use to protect clothing and fabrics from moths, carpet beetles, and mildew and to protect birds from mites. These products are sold in the form of flakes, balls, cakes, sachettes, or are embedded in hangers. California collects a fee (called the Mill Assessment) for all pesticides sold in-state regardless of use. This includes products sold for home & garden use. The Mill Assessment database provides an estimate of pounds of para-dichlorobenzene (pDCB) sold compared with the total pounds of all pesticides sold per year. The Pesticide Use Report (PUR) database documents all agricultural uses of each pesticide used in CA. Although these databases are intended for different purposes and the data are not directly comparable, it is possible to get a rough estimate of the percent of pDCB used for agricultural versus non-agricultural purposes. Using the Mill Assessment database, the graphs below show total pounds of pDCB sold in California annually from 1991 through 2008 and the total pounds of pesticides sold over the same period. Sales of pDCB ranged from ~0.621-1.24 million pounds per year. During this same period, total pesticide sales ranged from 543-743 million pounds per year. Thus, it is estimated that pDCB sales represent 0.086 to 0.187% of total pesticide sales in California each year. From 1991 to 2008, home use of pDCB represented ~99.99 to 100% of total use. This suggests that the majority of users of pDCB have no special training in pesticide use and rely on label instructions for safe application. In addition to its use as a household pesticide, prior to 2006 pDCB was also used in homes as an air freshener and as a deodorizer for garbage cans and toilet bowls. In 2006 the Air Resources Board (ARB) discontinued these uses in California. This action is expected to mitigate exposure to pDCB. Currently, the Department of Pesticide Regulation is evaluating the remaining legal uses to determine if they are safe.



## Illness Reports in California

The Pesticide Illness Surveillance Program (PISP) in the California Dept of Pesticide Regulation maintains a database of pesticide-related illnesses. This provides a way to evaluate the adequacy of safety regulations for pDCB. As summarized in the table below, between 1992 & 2007, there were 16 cases of pDCB-related illnesses due to acute exposure. There were no illnesses reported in the years not specifically listed. The symptoms commonly reported are: headache, nausea, skin or eye irritation, chest tightness, and difficulty in breathing. A limitation is that this database may underestimate the number of cases. Also, it does not track effects of long term exposures.

PISP Summary of p-DCB Related Illnesses 1992-2007						
Year	Cases	Disability Days	<sup>a</sup> Hosp Cases	<sup>a</sup> Hosp Days	<sup>b</sup> Category	Details
1992	2	0	0	0	Definite-1 Probable-1	Apartment manager spilled repellent containing pDCB. Some became airborne exposing manager & tenant of adjacent apartment.
1993	2	0	0	0	Probable	Worker had mothball in packet at poorly ventilated office. Later, he discarded it in a bathroom. Eleven workers became ill; two sought medical attention.
1995	1	1	0	0	Probable	Home care provider became ill after an hour of packing clothing in mothballs in a hot, poorly ventilated metal storage shed.
1999	8	8	1	2	Possible	Hospital workers were disturbed by skunks under building and by applications meant to repel skunks. Mothballs & insecticidal fogger were both placed in the crawl space. One person with documented allergies was hospitalized to control respiratory problems.
2004	3	0	0	0	Possible	Three workers developed symptoms after drinking water from a cooler containing mothballs allegedly added by co-worker. This is a suspected case of workplace horseplay.
Total	16	9	1	2	Definite=1 Probable=4 Possible=11	

<sup>a</sup>Hosp = Hospital  
<sup>b</sup>Definitions of "Category":  
**Definite:** Both physical and medical evidence document exposure and consequent health effects.  
**Probable:** Limited or circumstantial evidence supports a relationship to pDCB exposure.  
**Possible:** Health effects correspond generally to the reported exposure, but evidence is not available to support a relationship.

## Open Literature Illness Case Reports

Case reports in the open literature suggest that prolonged and liberal use of pDCB products in the home or workplace can lead to cataract formation, liver damage, thrombocytopenia, lymphocytopenia, dermatological problems and neurological symptoms. Some of these cases involve intentional ingestion of mothballs. One involved prolonged, daily work with pDCB in a poorly ventilated fur storage vault. Another case involved an elderly person who sat for prolonged periods of time on a chair in which mothballs were scattered around the seat cushions and slept in bedding treated with mothballs. These cases are inconsistent with labels which warn against ingestion, inhalation of dust or vapors, and contact with eyes or skin. The question being addressed by the Department of Pesticide Regulation is whether pDCB is safe when used according to label directions.

## Monitoring Results

pDCB is classified by IARC as 2B, possibly carcinogenic. Therefore, information about chronic exposure from indoor air is needed to estimate cancer risk over a lifetime of exposure. Air sampling, personal monitoring, and measurement of blood levels of pDCB have been done by various studies to estimate this exposure. (See references 1-5 below.) These studies have shown elevated personal levels of para-dichlorobenzene due to residential indoor air exposure. Possible sources of pDCB in these studies include: toilet bowl deodorizers, room fresheners, and moth balls/crystals/flakes. pDCB levels vary among ethnic groups. Hispanics, Blacks, and Southeast Asians have exposure levels of concern with respect to increased lifetime cancer risk. Exposure appears to be mitigated by increased home ventilation. A brief summary of these studies is shown in the table below.

Group Studied	Where pDCB Was Monitored	Study Conclusions	Ref
Inner city children Minneapolis, MN	Personal, Outdoor, Indoor Home & School Air Samples	Home air is source of exposure. Higher exposures for Hispanics, Blacks, & Southeast Asians compared with Whites	1
Adults (982), NHANES-III	Blood levels pDCB found in at least 10% of samples assessed	More likely have elevated levels if Black, Hispanic, or if residing in South or West. Higher levels noted in association with recent use of solid toilet bowl deodorizers	2
Adults (age 20-59), NHANES 1999-2000	Personal air	Higher exposures for Blacks & Hispanics. Open windows associated with decreased exposure. Air freshener use more common in high exposure group than mothball use	3
Adults in Houston, TX; Los Angeles, CA; Elizabeth, NJ;	Personal & Home Air, Home Air Exchange Rate	Hispanics have higher exposures than non-Hispanic Whites in NJ and TX, but not in CA. Cancer risk decreased with higher home air exchange rates	4
High School Students in NYC & LA; TEACH project	Personal, Outdoor, & Indoor Home Air Samples	High exposures due to indoor sources. pDCB measured concentrations were significantly higher than those modeled by US EPA	5

## Current para-Dichlorobenzene Labels

1. Do not specify maximum application rate which may result in excessive use. (Some consumers may reason: if a little is good, more is better.)
2. No specific instructions are given for an airing out period prior to using treated materials.
3. Pleasant masking odor may obscure the presence of pDCB.
4. Practical limitation: most containers, closets, storage chests, etc. are not air tight.
5. No instructions for ventilation.
6. Concern about using pDCB in rooms of infants and invalids.

## Conclusion

There are very few reports of illnesses due to acute exposure to pDCB. However, because it is possibly carcinogenic, risks associated with long-term exposure are being evaluated by DPR. Reports in the literature published between 2001 and 2009 suggest that some populations are being exposed to indoor air containing levels of concern of pDCB. Some of this exposure has been attributed to the use of air fresheners and toilet bowl deodorizers which contain pDCB. California has prohibited the use of such fresheners and deodorizers since 2006 and this will mitigate exposure. Work is in progress by DPR to determine whether exposure levels are of concern when pDCB is restricted to uses defined by the current labels. If exposure is a concern, mitigation measures will be recommended.

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