

HEALTH DAMAGE CAUSED BY INDOOR USE OF PENTACHLOROPHENOL CONTAINING WOOD PRESERVATIVES

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Introduction

Due to their fungicidal and/or insecticidal properties, pentachlorophenol (PCP) as well as gamma-hexachlorocyclohexane (gamma-HCH, Lindane) were used in solvent-containing wood preservatives, usually 5% PCP and 0,5% gamma-HCH, respectively. Until 1978, the manufacturers especially recommended also indoor application of these products.

Aim of the study

In 1977 for the first time the public was informed through television about possible health damage through the use of PCP containing wood preservatives in indoor areas (Parlar, ARD television NDR, 1977). Numerous reactions from people exposed to wood preservatives were triggered by the article of Elvira Spill in the "stern" magazine ("Gefahr im Gebälk", 1982) and reached our department. We developed a questionnaire in 1982/83 and sent it to people affected by wood preservatives in their homes.

The aim of this study ("Kiel Study") was to investigate the possible correlation between effects of PCP containing wood preservatives (including their impurities, polychlorinated dibenzodioxins and -furans, PCDD/F) and the appearance of health damage, called "wood preservative syndrome". The main interest is focussed not only to acute poisoning, but to the chronic exposure to low doses causing sub-chronic/chronic toxicological effects in humans. Due to their volatility, even after 10-20 years the active principles of wood preservatives, PCP, Lindane and its contaminants PCDD/F, evaporate from old applications causing chronic contamination of inhabitants (Gebefügi et al., 1976; Dahms and Metzner, 1979; Krause and Englert, 1980). These authors found elevated indoor concentrations of PCP 7-8 years after treatment with PCP containing wood preservatives. For the contaminants PCDD/F a much longer evaporation period is assumed (Eckrich, 1987).

Questionnaire

In order to examine possible relationships between PCP/Lindane/PCDD/F exposure and the frequency of reported health defects the following main questions were asked in the questionnaire:

- 1) General personal questions.
- 2) Questions about illnesses and subjectively perceived health problems over

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the last 10 years, both before and after the use of wood preservatives.

3) Questions to determine a PCP exposure caused by wood preservatives.

4) Analytical data concerning PCP in serum and/or in urine.

5) Occupation and main place of residence.

Due to inconsistent availability of PCP data in serum and/or urine, two groups of people were formed in the "Kiel Study":

- Group I: PCP concentration determined in serum and/or urine (n = 210).

- Group II: No determination of PCP in serum and/or urine (n = 92).

Controls

1996 persons from the so called "normal population" were interviewed for an extensive epidemiological study by Bundeszentrale für Gesundheitliche Aufklärung (BZGA Study, 1984) on their daily life, life style, diet, health, occupation and recreation behaviour (1036 women, 867 men and 93 children). Due to the differing age structure of the children (> 14 years in the BZGA Study and > 1 year in the "Kiel Study"), appropriate controls were chosen from the "uncontaminated group" of children of the "Hamburger Kindergarten Studie" (Behörde für Arbeit, Gesundheit und Soziales, Hamburg, 1990).

For descriptive and analytical data evaluation only the following illness variables were used which were found for both collectives (wood preservative exposed, "Kiel Study", and not exposed people, BZGA-Study):

- | | |
|---------------------|---------------------------------------|
| - Allergies, eczema | - Circulatory problems |
| - Asthma | - *Liver and/or gall-bladder diseases |
| - * Eye diseases | - Stomach problems |
| - * Blood diseases | - Fatigue, weariness |
| - Bronchitis | - Pneumonia |
| - Diarrhoea | - Sleep disturbance |
| - * Heart diseases | - Nausea |
| - Coughing | - Restlessness |
| - Hypertonus | - Hypotony |
| - Headaches | |

The symptoms marked * represent combined illnesses of the eyes, blood, skin, liver/gall-bladder.

The evaluation was achieved using the SAS statistic programme (SAS Institute, 1985).

Statistical Analyses

Using regression analysis an association between illness and exposure is examined, taking into account relevant confounding factors. An association is taken as significant if the possible error is $p < 0,05$, this means when less than 5% of the cases are random. Tendential associations are assumed at a possible error of $p \geq 0,05 < 0,10$. To judge the contamination-frequency-relationship comparative values are calculated, which show how much more often deviations occur by exposed relative to not exposed persons. The relative risk serves as parameter, in the following it is estimated as Odds-Ratio (OR) (Kleinbaum et al. 1982). The zero value of the Odds-Ratio for the not exposed is "1". For the exposed OR is calculated using the estimated β -parameter by the formula $OR = e^{n \times \beta}$. β is estimated using the "maximum likelihood method". The exponent "n" represents the number of steps of a variable minus 1.

Results and Discussion

Due to differing values of PCP in serum and/or urine, two different groups of wood preservative indoor-exposed persons were formed in the "Kieler Study" (Group I: with values of PCP in serum and/or urine, n = 210; Group II: without values of PCP, n = 92). The groups differ in relation to contamination time (years), exposure data (amount of wood preservative used, treated surface area, the quotient treated surface area/room volume), average number of symptoms per person (Group I: 7/person; Group II: 3/person) and, in part, with regard to the wood preservative contents (use of a PCP containing wood preservative in 97% (Group I) and 61% (Group II), respectively). The wood preservative-exposed of both groups showed proportional psychopathological disturbances, illnesses of the respiratory tract and the throat, nose and ear areas as well as of the skin and organs attached to the skin. Using logistic regression, statistically significant associations ($p < 0,05$) could be estimated for the exposed from Group I, presented as Odds-Ratio (OR). These indications represent an increased risk for persons indoor-exposed to wood preservatives to suffer from the following complaints and affections of the organ complexes (*) more than non-exposed (OR = 1):

Complaints Organ complexes(*)	Odds Ratio, wood preservative exposed groups			
	Women I	Men Group I	Children	Women Group II
Nausea	8,80	6,42	9,01	-
* Blood diseases	5,91	7,83	-	-
Allergies, eczema	4,23	7,04	4,26	-
Fatigue, weariness	4,08	3,50	-	2,71
* Liver, gall-bladder	2,93	2,49	-	-
Diarrhoea	2,73	3,67	-	-
Headache	-	3,59	-	-
Stomach complaints	-	-	18,26	-

Despite the limitations of the study, the applied analytical methods demonstrated for the first time symptoms typical for exposure to wood preservatives in persons contaminated by indoor use of wood preservatives ("wood preservative syndrome"). It is possible, that in the future damage claims may be filed against the manufacturers of wood preservatives and that health damage caused by wood preservatives may be recognized as an occupational disease.

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