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**CHLORDANE IN AIR FORCE FAMILY HOUSING:
A STUDY OF HOUSES TREATED PRIOR TO CONSTRUCTION
JUNE 1982**

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Airborne chlordane levels were measured in 2,113 family housing units on 4 USAF installations during the winter and spring of 1981-82. The ventilation ducts were in or below the slab in all houses. Also, the soil below the houses was treated with chlordane before the slabs were poured to prevent termite infestation. The airborne chlordane concentration exceeds the action level (5 µg/m ³) in only 2 of the houses. It is recommended that plans to sample other houses that were treated only prior to construction be cancelled because the probability of exceeding the action level is extremely low.		

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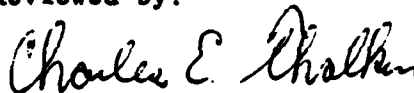
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I. INTRODUCTION

Airborne chlordane contamination has been reported in Air Force (Callahan 1970), Army (Vinopal and Olds 1977) and civilian (Malina et al. 1959; Savage 1975; Wright and Leidy 1982) houses following treatment for termites. Contamination has occurred in newly constructed houses that were pretreated (unpublished data) as well as in older houses treated by subslab injection (Callahan 1970). In all cases, the ventilation system was in close proximity to the treated soil.

The Air Force has conducted extensive tests in houses with ventilation ducts in or below the slab. Callahan (1970) investigated two houses at Webb AFB TX after 15 gallons of a 2% chlordane solution was accidentally injected into the subslab ducts. Other studies were conducted at Wright-Patterson AFB in newly constructed houses that were pretreated with chlordane (unpublished data 1976). Livingston et al. (1981) reported the contamination of houses at Scott AFB following the application of chlordane by subslab injection.

Reports of airborne chlordane in family housing and a lack of information concerning its impact on human health prompted the Air Force Medical Service Center (AFMSC) to request guidance from the National Academy of Sciences (NAS) Committee on Toxicology. The Committee recommended a level of 5 micrograms of chlordane per cubic meter of air ($\mu\text{g}/\text{m}^3$) as the maximum allowable limit for continuous exposure in the home (NAS 1979). The AFMSC adopted the NAS recommendation and established the following priority for evaluating approximately 6,400 Air Force family housing units for chlordane contamination:

- a. Priority 1: houses treated by subslab injection after construction (Lillie 1981).
- b. Priority 2: houses treated prior to construction.
- c. Priority 3: houses located on installations where studies were conducted during 1975.

The primary objective of this report is to present the results for follow-up samples collected in priority 1 houses and for initial and follow-up samples collected in priority 2 houses. Additionally, a comparison of the airborne chlordane concentrations in priority 1 and priority 2 houses is provided along with recommendations for future studies.

II. MATERIALS AND METHODS

The airborne chlordane concentration in housing units was determined by collecting one sample from near a heater supply vent in the living room of each house. A tube containing Chromosorb^R 102 was attached to the suction side of a Millipore^R miniature vacuum pump and the flowrate of the pump was set at 4 liters/minute using a portable precision rotameter. The pump was allowed to run unattended for two hours. Inside temperature, inside relative humidity, outside high temperature, outside low temperature, and barometric pressure were recorded during the sampling period. The samples were analyzed according to methods established by Thomas and Seiber (1974) and Thomas et al. (1980).

Results from the initial sampling were used to determine if any follow-up action was required. In accordance with DOD Safety and Occupational Health Program Policy Memorandum 81-2 (15 Jul 1981), houses with a chlordane concentration of $<3.5 \mu\text{g}/\text{m}^3$ remained occupied without further action; houses with a chlordane concentration between 3.5 and $6.5 \mu\text{g}/\text{m}^3$ were resampled, two samples per house, to determine if the average concentration exceeded $5 \mu\text{g}/\text{m}^3$; and houses with a chlordane concentration of $>6.5 \mu\text{g}/\text{m}^3$ were scheduled for corrective action.

III. RESULTS

The chlordane concentration exceeded $5 \mu\text{g}/\text{m}^3$ in 35 (4%) priority 1 houses (Table 1). The data were analyzed using analysis of variance, stepwise regression, Pearson's correlation, and Spearman's correlation. There was no correlation between the airborne chlordane level and the inside temperature, inside relative humidity, outside temperature, barometric pressure, number of months posttreatment against termites, or the difference between the inside and outside temperature. Only 2 (<1%) priority 2 houses had a chlordane concentration $\geq 5 \mu\text{g}/\text{m}^3$ (Table 2).

TABLE 1: NUMBER OF PRIORITY 1 HOUSES WITH AIRBORNE CHLORDANE CONCENTRATIONS ABOVE AND BELOW THE ACTION LEVEL.

INSTALLATION	$<5 \mu\text{g}/\text{m}^3$	$\geq 5 \mu\text{g}/\text{m}^3$	TOTAL	% $\geq 5 \mu\text{g}/\text{m}^3$
Arnold	40	0	40	-
Chanute	11	1	12	8
Laughlin	98	2	100	2
Mt. Home	65	3	68	4
*Scott	476	22	498	4
Sheppard	21	0	21	-
Vance	223	7	230	3
TOTAL	934	**35	969	4

*From Livingston et al. 1981

**In a recent status report (Lillie 1982), 49 houses were listed in the $\geq 5 \mu\text{g}/\text{m}^3$ category. Only the initial results were available for the status report. After subsequent sampling, the average concentration in 14 of the 49 houses was $<5 \mu\text{g}/\text{m}^3$.

TABLE 2: NUMBER OF PRIORITY 2 HOUSES WITH AIRBORNE CHLORDANE CONCENTRATIONS ABOVE AND BELOW THE ACTION LEVEL.

INSTALLATION	$\leq 5 \mu\text{g}/\text{m}^3$	$\geq 5 \mu\text{g}/\text{m}^3$	TOTAL	% $> 5 \mu\text{g}/\text{m}^3$
Blytheville	830	0	830	-
Cannon	760	0	760	-
Lackland	124	1	125	<1
Laughlin	397	1	398	<1
TOTAL	2,111	*2	2,113	<1

*In a recent status report (Lillie 1982), 3 houses were listed in the $\geq 5 \mu\text{g}/\text{m}^3$ category. Only the initial results were available for the status report. After subsequent sampling, the average concentration in 1 of the 3 houses was $< 5 \mu\text{g}/\text{m}^3$.

IV. DISCUSSION

Airborne chlordane can be detected in most houses following treatment for termites, but the probability of exceeding $5 \mu\text{g}/\text{m}^3$ is low in sub- or intra-slab ducted houses that were treated only prior to construction (Table 2). The need to sample such houses in the future (Table 3, Type b) is not necessary because the chlordane concentration was extremely low ($<1 \mu\text{g}/\text{m}^3$) in most houses. Approximately 3,159 houses could be eliminated from the 1983-84 sampling schedule.

TABLE 3: NUMBER OF HOUSES CURRENTLY SCHEDULED FOR SAMPLING IN 1983-1984.

INSTALLATION	NO. HOUSES
USAF Academy CO	9 ^a
Bergstrom AFB TX	16 ^a
Offutt AFB NE	40 ^a
Moody AFB GA	100 ^{b*}
Offutt AFB NE	1,591 ^b
Wright-Patterson AFB OH	734 ^b
Langley AFB VA	143 ^b
Andrews AFB MD	591 ^b
Hill AFB UT	14 ^c
McGuire AFB NJ	2 ^c
Pease AFB NH	72 ^c
	3,312

^aCrawl space houses

^bSubslab ducted houses treated prior to construction

^cSubslab ducted houses treated after construction

^{*}HQ AFMSC/SGPA 14 July 82 ltr removed Moody from the b class

The low concentrations of airborne chlordane should not be used to justify construction of sub- or intraslab ducted houses because subsequent treatment to control termites may be required after construction. The probability of exceeding $5 \mu\text{g}/\text{m}^3$ is higher in houses treated after construction (Table 1); the pesticide may be forced into cracks in the ducts or slab during high pressure subslab injection. Experience has also shown that pesticide applicators may inadvertently puncture a duct.

There was no correlation between the airborne chlordane concentration and various environmental parameters. Similar results were reported by Livingston et al. (1981) and Wright and Leidy (1982). This is not surprising because only one sample was collected/house and the data were pooled to perform the statistical tests. In order to pool the data, one must assume that all houses are identical in design and procedures used for termite treatment. Such an

assumption is invalid. Correlations between the chlordane concentration and weather parameters should not be denied without further study.

V. CONCLUSIONS

1. Houses with sub- or intraslab ducts cannot be treated for subterranean termite infestation by subslab injection because of the possibility of contaminating the living space with termiticide vapors.

2. The airborne chlordane level is not likely to exceed $5 \mu\text{g}/\text{m}^3$ in sub- or intraslab ducted houses that were treated only prior to construction.

VI. RECOMMENDATIONS

Future plans to collect samples in the 3,159 houses with sub- or intraslab ducts that were treated only prior to construction should be cancelled. HQ AFMSC/SGPA concurred with this conclusion by letter dated 14 July 1982. Chlordane sampling in sub- or intraslab ducted houses treated prior to construction will be cancelled for those houses in Table 3 with the exception of Moody AFB.

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