

DATA EVALUATION RECORD

STUDY IDENTIFICATION:

1. Spare, William C. 1988. The Volatilization of Lindane From Soil. (A Laboratory Study). 20% Emulsifiable Concentrate. Amended Final Report. Submitted by Rhone-Poulenc, Inc. on behalf of Centre International d' Etudes du Lindane (CIEL). MRID Number 406225-04.
2. Spare, William C. 1988. The Volatilization of Lindane From Soil. (A Laboratory Study). 25% Wetttable Powder. Amended Final Report. Submitted by Rhone-Poulenc, Inc. on behalf of Centre International d' Etudes du Lindane (CIEL). MRID Number 406225-05.
3. Spare, William C. 1988. The Volatilization of Lindane From Soil. (A Laboratory Study). 40% Flowable Liquid. Amended Final Report. Submitted by Rhone-Poulenc, Inc. on behalf of Centre International d' Etudes du Lindane (CIEL). MRID Number 406225-06.

REVIEWED BY:

Richard J. Mahler, Hydrologist  
Review Section I, EFGWB

Signature: *Richard J. Mahler*  
Date: *August 21, 1989*

APPROVED BY:

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Signature: *Paul J. Mastradone*  
Date:

TYPE OF STUDY:

Laboratory Volatility.

CONCLUSIONS:

1. EFGWB concludes that the three laboratory volatility studies do not meet EPA data requirements for a laboratory volatility study.
2. The studies were not carried out over a sufficient length of time to define lindane volatility decline curves;
3. There was no a satisfactory explanation of how the author determined the actual concentration of lindane added to the soil or in the test soil;
4. The experiments should have been replicated because of the variation in reported results;
5. All major formulation categories were not tested.

BACKGROUND:

These three studies were previously submitted to EFGWB for review under MRID Nos. 40067302-04 but were found to not satisfy the data requirements based on specific deficiencies. The amended final reports, submitted as MRID Nos. 40622504-06, addressed the deficiencies mentioned in the review as follows:

1. The study was not carried out over a long enough period of time to clearly define the dissipation of lindane by volatilization.

CIEL Reply: The attached plots show that all tests reached an equilibrium plateau.

EFGWB Response: The results of the studies show that lindane does volatilize to the extent of 2-4% per day during the 6 or 8 days the experiments were carried out. However, the question still remains as to how long this volatilization would continue, since there does not appear to be a decline in volatility during the length of the experiments. EFGWB concludes that CIEL has not adequately responded to the deficiency

2. The rate of volatilization was incorrectly calculated and could not be determined given the information within the report.

CIEL Reply: The rate of volatilization and air concentration calculation are now corrected to guideline requirements in the amended report.

EFGWB Response: EFGWB concludes that CIEL has adequately responded to this deficiency.

3. The conditions of the study; ie., sterile and anaerobic, do not closely compare to actual field conditions.

CIEL Reply: The soil must be sterilized to assess only lindane volatility and not lindane degradation by microorganisms. The use of nitrogen gas in volatility studies is well documented and is referenced in the guidelines.

EFGWB Response: EFGWB concludes that CIEL has adequately responded to this deficiency since the method they utilized is one of three methods that have historically been used to determine pesticide volatilization from soil (W. F. Spencer and M. M. Cliath. 1969. Vapor density of dieldrin. Environ. Sci. Technol. 3:670-674).

4. The surface area of the soil was not reported.

CIEL Reply: Soil surface area was 12.57 cm<sup>2</sup> and has been included in the amended report.

EFGWB Response: EFGWB concludes that CIEL has adequately responded to this deficiency.

5. There was no data reported for the 0% humidity trials for the 25% WP or 40% flowable.

CIEL Reply: All data for the 0% humidity trials for the 25% wettable powder and the 40% flowable products are included in the final reports.

EFGWB Response: EFGWB concludes that CIEL has adequately responded to this deficiency.

6. No sample gas chromatograms were included.

CIEL Reply: Sample chromatograms are included in the amended reports.

EFGWB Response: EFGWB concludes that CIEL has adequately responded to this deficiency.

7. All major formulation categories were not tested. Dust, wettable powder/dust, soluble concentrate, ready to use, and pressurized liquid must also be tested.

CIEL Reply: Prior to undertaking the study, CIEL met with EPA representatives who agreed that using three representative formulation types for testing would be sufficient.

EFGWB Response: EFGWB could not find any reference to a waiver for testing only three of the major lindane formulations. EFGWB suggests that the PM check his files for reference to such a waiver and inform both EFGWB and the registrant as to the results of this search.

8. The design of the experimental apparatus was not clearly explained.

CIEL Reply: The experimental apparatus design is detailed in Figure 2 of the amended reports.

EFGWB Response: EFGWB concludes that CIEL has adequately responded to this deficiency.

9. Each of the lindane end-use products appeared to be significantly under formulated.

CIEL Reply: The formulations of lindane used in the soil volatility study were not verified as part of the original study. Reference in the November 26, 1986 reports to the "formulation check" was actually the recovery of lindane from the soil after treatment with the formulation. However, each formulation for lindane has subsequently been analyzed and the results demonstrate that none are under formulated.

EFGWB Response: EFGWB concludes that CIEL has responded to this deficiency provided CIEL can show that the batches of lindane formulation analyzed were the same batches used in the experiments.

#### MATERIALS AND METHODS:

Three different forms of lindane at varying rates were applied to the test soil to determine volatility:

1. 20% emulsifiable concentrate at rates from 1.21 to 1.60 ppm a.i.
2. 25% wettable powder at rates from 0.77 to 1.43 ppm a.i.
3. 40% flowable at rates from 1.41 to 1.58 ppm a.i.

The test soil was a sandy loam soil from Frederick County, Maryland with the following properties: sand, 63.2%; silt, 20.0%; clay, 16.8%; organic matter, 1.9%; pH, 7.5; CEC, 6.1 meq./100 g; field capacity, 15.8%; bulk density, 1.2 g/cc.

Prior to use, the soil was air dried, sieved through a 2 mm screen and autoclaved to eliminate microbial activity.

Two hundred grams of dried soil was weighed into a sterile brown bottle and an appropriate volume of lindane was added to the soil. The bottle was then sealed and placed on a roller mill for at one hour.

The treated soil was transferred to a 200 ml capacity airless-ware cylindrical funnel fitted with a coarse frit and a sidearm stopcock that served as the gas saturation vessel and the relative humidity was adjusted as needed. One polyurethane foam plug was used to trap volatilized lindane, while a second plug was used to determine the amount of lindane breakthrough. The foam plugs were replaced each day with new ones. Nitrogen gas flow was adjusted to 300 ml/min. Temperature was controlled at  $25 \pm 10^{\circ}\text{C}$ .

The studies were carried out in the dark at either 0% or 100% relative humidity (RH). For the 0% RH study, the dried soil was used without further preparation; while the soil moisture content was raised to 75% field capacity for the studies conducted at 100% RH.

The plugs were extracted with hexane and sonicated for 15 to 30 minutes. Aliquots of hexane were removed for injection into the GC.

Soil samples were extracted with a mixture of 80:20 v/v hexane/ethyl acetate and an aliquot of the extract was diluted with hexane prior to injection into the GC.

### REPORTED RESULTS:

1. 20% EC: Analyses of the polyurethane plugs and the residual soils are presented in Table 1. At 100% RH approximately 2-4% of the lindane dose was volatilized per day; while no lindane was detected to volatilize under 0% RH. The concentration of lindane in air ranged from 11.9 to 28.9  $\mu\text{g}/\text{m}^3/\text{day}$  with a volatility of 1.19 to  $2.89 \times 10^{-5} \mu\text{g}/\text{cm}^3/\text{hour}$ .
2. 25% WP: Analyses of the polyurethane plugs and residual soils are presented in Table 3. Approximately 2-4% of the lindane was volatilized per day at 100% RH, while no lindane was found to volatilize from the soil at 0% RH. The concentration of lindane in air was 9.33 to 20.9  $\mu\text{g}/\text{m}^3/\text{day}$  with a volatility of 0.933 to  $2.09 \times 10^{-5} \mu\text{g}/\text{cm}^3/\text{hour}$ .
3. 40% Flowable: Analyses of the polyurethane plugs and the soils are presented in table 5. Approximately 2-4% of the lindane was volatilized per day at 100% RH, while no lindane was found to volatilize from the soil at 0% RH. The concentration of lindane in air was approximately 19.3  $\mu\text{g}/\text{m}^3/\text{day}$  with a volatility of about  $1.93 \times 10^{-5} \mu\text{g}/\text{cm}^3/\text{hour}$ .

The author concluded that results of these studies parallel the results of volatility studies previously reported by others in which volatility was shown to be an important mode of lindane dissipation from soil. The author further concludes that the combined volatility results of all three formulations indicate that the volatility of lindane from soil is independent of the formulation and dependent on the moisture level in the soil.

### DISCUSSION:

1. EFGWB concludes that the results of the three studies indicate that lindane in the formulation studied volatilized at a rate of approximately 2-4% per day during the 6 days of the experiment. However, the question still remains as to how long the volatilization would continue since examination of the data does not reveal an apparent decline in volatility.
2. The author did not adequately explain nor could EFGWB determine what was meant when the author wrote that the analysis of the dosed soils demonstrated the actual doses of lindane added to the soils were different than the theoretical value of 290  $\mu\text{g}$  (1.45 ppm) (See attached RESULTS AND DISCUSSION sections for each report). In future reports, the author should explain how the actual doses were determined and include some sample chromatograms and tables.
3. None of the experiments were replicated and it appears that the variation in results may have be too great to make any meaningful conclusions. For example, with regard to the 20% EC formulation, the author does not offer an explanation as to why 242  $\mu\text{g}$  lindane added to the soil resulted in 30% less

volatization than when 230 ug lindane was added to the soil (Table 1).

4. Because of the deficiencies listed above, this study probably can not be repaired and should be repeated taking into consideration the above mentioned deficiencies.