Shaughnessy No.: 009001

Date Out of EAB: JUL 5 1988

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To: George LaRocca
Product Manager #15/12
Registration Division (TS 767)

From: Paul Mastradone, Acting Chief
Environmental Chemistry Review Section #1
Exposure Assessment Branch/HED (TS-769C)

Thru: Paul F. Schuda, Chief
Exposure Assessment Branch/HED (TS-769C)

Attached, please find the EAB review of:

Reg./File Symbol: 239-2518

Chemical Name: Lindane

Type Product: Insecticide

Product Name: Isotox

Company Name: Chevron Chemical

Purpose: Review Waiver Request for Terrestrial Part of Forestry Dissip.

Date Received: 05/10/83

Action Code: 650

Date Completed: 04/24/87

EAB #(s): 70293

Monitoring Study Requested: _____

Total Reviewing Time: 3.0 days

Monitoring Study Voluntarily: _____

Deferrals To:

_____ Ecological Effects Branch

_____ Residue Chemistry Branch

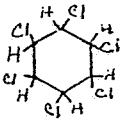
_____ Toxicology Branch

1

o. Chemical: Lindane

Common Name: gamma isomer of BHC (wrongly named); isotox

Chemical Name: hexachlorocyclohexane

Structure: 

2. Test Material: N/A

3. Study/Action Type: USDA intends to fulfill data gaps related to forestry uses for lindane. RD wants to know whether the information submitted fulfills the terrestrial aspects of the forestry dissipation study requirement of Subpart N (waiver request), because USDA prefers to fund just the aquatic aspects of the forestry dissipation study.

4. Study Identificaton:

This submission consists of 12 documents: 2 literature surveys, 9 published papers and one progress report. None of the documents have accession numbers.

Document #1: Insecticide Background Statements: Lindane. U. S. Forest Service. Dr. F.C. Berisfrord, Ms. G.M. Cowie, and Dr. R.A. White Jr. Sept. 1986.

Document #2: NAPAP Project: "Fate of Herbicides and Insecticides in Tree Stems Used for Firewood". Final Report. May 1986.

Document #3: Degradation and Persistence of Gamma-HCH and Chlorpyrifos-methyl in Ponderosa Pine Bark. Marion Page. Pestic. Sci. Vol 14, pg 571-575. 1983.

Document #4: Carbaryl and Lindane Protect White Spruce from Attack by Spruce Beetles (Coleoptera: Scolytidae) for Three Growing Seasons. R.A. Werner, F. L. Hastings, E.H. Holsten, and A.S. Jones. J. Econ. Entomol. Vol 79, no.4. Aug. 1986.

Document #5: Ecological Impact of Lindane on a Pine Plantation Soil Microarthropod Community. James B. Hoy. Environ. Entomol. April 1980.

Document #6: Residues of DDT and Lindane on Treated Conifer Seedlings and in Forest Soil. H. Eidmann, O. Bergman, B. Henningsson, and C. Moller. Studia Forestalia Suecica NR151. 1979.

Document #7: The Effect of Lindane on Soil and Litter Mesofauna: 1. Mountain. 11. Piedmont, Comparison with fenitrothion. In Press. 1986. F. L. Hastings, U.E. Brady, and A.S. Jones. Env. Entomol.

Document #8: The Persistence and Distribution of Some Insecticides-Nematicides in Pine Litter. G. Melkebeke, A. Heungens, W. Steurbout, W. Denonckheane and R.H. Kips. 1981. Med. Fac. Landbouww. Rijksuniv. Gent. 46/1.

Document #9: Accumulation of Chlorinated Hydrocarbon Vapours in Pine Needles. 1985. C. Gaggi and E. Bacci. Chemosphere, Vol 14, No. 5, pp. 451-6.

Document #10: Effects of Lindane, Chlorpyrifos, and Carbaryl on a California Pine Forest Soil Arthropod Community. 1981. J.B. Hoy and P.J. Shea. Environ. Entomol. 10:732-40.

Document #11: Comparison of Lindane and Chlorpyrifos-Methyl for Preventive Contrl of the Southern Pine Beetle. 1981. F.L. Hastings, C.J. Kislow, A.S. Jones, and L.J. Metz. J. Georgia Entomol. Soc. Vol. 16, No. 3, 396-407.

Document #12: (Progress Report) Ocala Seed Orchard Pesticide Monitoring. 1984. M.J. Phillips, D.G. Neary, P.B. Bush, and J.W. Taylor. Progress Report FY84.

5. Reviewed By:

Patricia Ott
Chemist
Environmental Chemistry Review Section #1

Signature: Pat Ott
Date: 7/1/88

6. Approved By:

Paul Mastradone
Acting Chief
Environmental Chemistry Review Section #1

Signature: Paul J Mastradone
Date: JUL 5 1988

7. Conclusions:

Taken together, the 12 documents do not adequately elucidate the dissipation and mobility behavior of lindane in a forest environment, because the individual study purposes/design addressed efficacy, phytotoxicity, non-target organisms, etc. However, some useful information (supplemental) was obtained from Docu- #7 and is reviewed in detail.

The submitted information does not satisfy the forestry dissipation study requirements of the Subpart N Environmental Chemistry Guidelines Data Requirements. The specific reasons why each of the 12 documents does not meet Subpart N Guidelines requirements are:

Document #1: This is a literature survey and does not include detailed studies with raw data.

Document #2: This is an efficacy study, which does not contain any relevant information, involving application of herbicides and insecticides to turkey oak and analyzing tree stems, as well as burning trees and analyzing combustion gases.

Document #3: This is an efficacy study and lindane was only measured in pine bark.

Document #4: This is an efficacy study and lindane was analyzed in white

pine bark only.

Document #5: This study analyzed arthropods such as mites, and every other page is missing.

Document #6: This study was not conducted in the U. S., and every other page is missing.

Document #7:

Part #1: This part of the study (referred to as the Mountain Study) does not satisfy the terrestrial portion of Subpart N data requirements for a forestry dissipation study, because soil samples did not define the depth of leaching, there was no confirmatory method of analysis, degradates were not monitored, no half-lives were reported, foliage was not analyzed, averages instead of ranges were reported, and soil characteristics were unreported.

Part #2: This part of the study (referred to as the Piedmont Study) does not satisfy Subpart N data requirements because lindane was sprayed on the litter and soil and is not representative of actual usage, which is application to bark and foliage to control insects. Also, soil samples did not define the depth of leaching, there was no confirmatory method of analysis, degradates were not monitored, no half-lives were reported, foliage was not analyzed, averages instead of ranges were reported, and soil characteristics were unreported.

Document #8: This is an efficacy study and the outdoor experiment appears to have been conducted in pots with azaleas. Also, every other page is missing.

Document #9: This study was not conducted in the U. S. Also, the purpose of this study is to evaluate the kinetics involved in the transfer of chlorinated hydrocarbon vapors from air to plants. Every other page is missing.

Document #10: The purpose of this study is to evaluate the effect of lindane on arthropods (non-target organisms). Every other page is missing.

Document #11: This paper studied efficacy, phytotoxicity, and bioassay. The litter and soil were only measured 3 times (1 day, 1 week, and 5 months post-treatment). Also, a non-specific method of detection was used (flame ionization) without a confirmatory method of analysis.

Document #12: This is a progress report only, for a study whose purpose is to obtain field data to validate the CREAMS model. This study does not satisfy Subpart N Guidelines because soil was sampled to 12" but no soil analyses were included, no half-lives were reported, a non-specific method of analysis was used (EC-GLC) with no confirmation, foliage was not analyzed (only foliage washoff samples were taken), and soil leachate samples (measured by lysimeters) were only taken to a depth of 12". Analytical methodology details were missing, such as the extraction/cleanup method, %recovery, and limit of detection, as well as soil characteristics. No information was supplied about the method of soil sampling or the formulation used. The study consisted of only a total of 4 treated trees and 1 control tree.

8. Recommendations:

EAB recommends that a complete forestry dissipation study (terrestrial and aquatic aspects) be done. It is suggested that RD send USDA a copy of the Subpart N Guidelines (Environmental Chemistry).

9. Background:

USDA intends to fulfill data requirements for the forestry uses of lindane. This submission is a waiver request for the terrestrial aspects of the forestry dissipation study, and includes 12 documents.

10. Review of Individual Studies: See Study 7 review

11. Completion of One-Liner: N/A

12. CBI Appendix: N/A

DATA EVALUATION RECORD

Study 7

Lindane

The Effect of Lindane on Soil and Litter Mesofauna: 1. Mountain. 11. Piedmont, Comparison with fenitrothion. In Press. 1986. F.L. Hastings, U.E. Brady, and A.S. Jones. Env. Entomol.

Direct Review Time = 3 days for submission

Reviewed By: Patricia Ott
Signature:
Title: Chemist
Date:

Approved By: Paul Mastradone
Signature:
Title: Acting Chief
Org: Environmental Chemistry Review Section #1
Date:

Conclusions:

This study does not meet the Subpart N Guidelines data requirements for the terrestrial portion of a forestry dissipation study because:

Part 1 (Mountain Study): Soil samples did not define the depth of leaching, there was no confirmatory method of analysis, degradates were not monitored, no half-lives were reported, foliage was not analyzed, soil characteristics were not reported, and averages, not ranges, were reported.

Part 2 (Piedmont Study): Lindane was sprayed on the litter and soil, which is not representative of actual usage, because lindane is normally sprayed on foliage and bark to control insects. Also, soil samples did not define the depth of leaching, there was no confirmatory method of analysis, the study was not run long enough to show decline of parent or for 12 months, no half-lives were reported, degradates were not monitored, foliage was not analyzed, soil characteristics were not reported, and averages, not ranges, were reported.

Environmental Implications of the Data:

For litter, there was very little contamination due to spray drift from lindane ground application to tree trunks, of adjacent upslope control plots and downslope control plots with 9 m buffer strips between all plots. About 6 m from the application site, levels found in soil and litter were $\leq$10% of the levels found at the application site throughout the study period (up to 963 days), indicating that lindane did not readily run-off (30% slope and 152 cm rain/year).

In a forest environment, lindane appears to concentrate in litter, probably because of the high organic matter. Litter contained high levels of lindane (458 ppm on day 28 post-treatment), and remained high for several months, meaning lindane would be present to impact on non-target organisms and/or move to soil.

With regard to soil levels during the study period (963 days), soil was only monitored 5 times in about 3 years. However, the data appear to indicate that lindane did not contaminate soil to any significant degree, relative to the levels found in the litter. Soil was only sampled pretreatment, 64, 161, 302, 693, and 963 days post-treatment. A high of 12 ppm (average value) was detected at the 693 day sampling interval. The report indicated the site receives 152 cm rain per year, but actual rainfall for each year in the study period was not given.

Soil and litter levels reported were averages of 6 samples (two samples from each of 3 treated plots).

Arthropod populations were monitored in both mountain and piedmont studies and were adversely affected. Litter arthropods did not return to pre-treatment levels for 2 years, and soil mesofauna did not recover, even after about 3 years (author's conclusions). This is consistent with the high levels of lindane found in litter. This data was not reviewed by EAB.

Materials and Methods:

Part 1 (Mountain Study in Franklin, NC):

Tree trunks of 20-21 year-old white pines in Franklin, NC, were treated with a 20% EC formulation diluted with water to give a final concentration of 0.5% lindane for control of the bark beetle. The pines were growing on a 30% slope and received 152 cm of rain/year at an elevation of 716 m. Actual dates of application and sampling were not given.

The study area consisted of 3 blocks (size not given), each containing 4 plots (2 upslope 4-tree plots and 2 downslope 4-tree plots). Three upslope plots were randomly chosen for treatment and the other upslope plots were controls, as well as the downslope plots. Buffer strips of 9 m were left between plots.

Four samples (60 cm^3 or about 3.6 in^3) of forest litter and soil were taken at equal distances from the trees within each plot 1 week before treatment and at varying intervals for about 3 years. However, levels reported in tables indicate they were averages of 6 samples (2 samples from each of 3 treated plots).

Bark, soil, and litter samples were chopped. Two 5-gm subsamples from each sample were leached for 24 hours in 40 ml of hexane (extraction efficiency = 95% and comparable to blender maceration). Extracts were dried and analyzed by electron capture GLC.

There was not recovery data. From the data tables, the limit of detection for soil appears to be 0.02 ppm. The limit of detection was not given for litter but levels down to 0.05 ppm were reported, so the limit of detection is below this level. Arthropods were also analyzed but the data was not reviewed.

Part 11 (Piedmont Study in New Hope Forest, NC)

This study did not duplicate actual usage and is only briefly reported. Lindane was sprayed on soil and liter in a stand of loblolly pines. There were 2 replicates with 3 treatments: 2% fenitrothion, 0.5% lindane, and water only.

Nine random litter and soil samples were taken from each treatment plot at

one week pretreatment and at various intervals, up to 182 days post-treatment. Arthropod samples were also taken.

Reported Results (Mountain Study Only):

Litter

Litter was analyzed pretreatment, 0.2, 14, 28, 64, 98, 161, 302, 693, and 963 days post-treatment.

In the litter, lindane (parent) was found on the day of treatment at 172 ppm (average of 6 samples, 2 from each of 3 treated plots). On day 14, 400 ppm was found and day 28 samples contained a high of 458 ppm. By day 161, the average level had dropped to 174 ppm. Levels at day 693 and day 963 were 43 and 57 ppm, respectively.

Upslope control plots contained 0.06-1.3 ppm throughout the study period. Downslope control plots contained $\leq$0.65 ppm.

Soil

Soil was analyzed pretreatment and at 64, 161, 302, 693, and 963 days post-treatment. Pretreatment soil samples contained 0.3 ppm "apparent" lindane. (A non-specific method of detection was used for all samples.)

The highest level found was 12 ppm on day 693. At day 963, soil contained 5.6 ppm lindane. Adjacent upslope control plots contained 0.04-0.09 ppm throughout the study (sampled same days as treatment samples).

Litter and soil were also measured 0, 1.5, 3, 6, and 12 m downslope from the treated tree trunks. At 6 m away, levels in soil and litter were $\leq$10% of the 0 meter distance samples.

Discussion:

1. This study was not designed to study mobility.

2. No sediment or water samples were taken.

3. Soil samples were shallow (60 cm^3 or about 3.6 in^3).