Shaughnesy No.: 009001

Date Out of EAB: MAR 9 1988

To: George LaRocca
Product Manager #15
Registration Division (TS-767C)

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 #: 52904-C

Chemical Name: Lindane

Type Product: Insecticide/Acaricide

Company Name: Centre International d'Etudes du Lindane

Purpose: Review fish bioaccumulation study

Date Received: 3/31/87

Action Code: 660

Date Completed: 3/2/88

EAB#(s): 70464

Monitoring Study Requested: _____

Total Reviewing Time: _____

Monitoring Study Voluntarily: _____

Deferrals To:

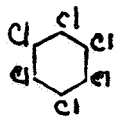
_____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

1. Chemical:

Common Name: Lindane
Chemical Name: hexachlorocyclohexane
Type of Pesticide: insecticide, acaricide



2. Test Material: see individual review

3. Study/Action Type: response to Lindane Registration Standard and the Special Data Call-In Notice of January 23, 1986.

4. Study Identification:

Uptake, Depuration and Bioconcentration of ^{14}C-Lindane by Bluegill Sunfish (Lepomis macrochiurus). Centre International d'Etudes du Lindane. Alan D. Forbis. Performed by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO. November 4, 1986. Accession #400561-01.

Metabolite Characterization of ^{14}C-Lindane in Bluegill Sunfish (Lepomis macrochirus). Centre International d'Etudes du Lindane. Leanne Forbis and Del Teeter. Performed by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO. October 16, 1986. Accession #400561-02.

5. Reviewed By:

Pat Ott
Chemist
Section #1, EAB, HED

Signature: Pat Ott
Date: 3/7/88

6. Approved By:

Paul Mastradone
Acting Chief
Environmental Chemistry Review Section #1

Signature: Paul J Mastradone
Date: MAR 9 1988

7. Conclusions:

Lindane bioaccumulates in bluegill sunfish to an appreciable degree during the 28 day treatment period (780x in fillet, 1400x in whole fish and 2500x in viscera), but rapidly eliminates 96%, 85% and 95% of the residues during the 14 day depuration period, respectively. With constant exposure to 0.54 ppb lindane for 28 days, maximum residues found were: 420 ppb (fillet), 710 ppb (whole fish) and 1200 ppb (viscera).

During the study period, lindane in edible and nonedible fish tissue did not metabolize.

8. Recommendations:

This study satisfies Subpart N data requirements for 165-4, Laboratory Studies of Pesticide Accumulation in Fish.

The study was well conducted. However, both TLC and electron capture GLC are non-specific detection methods. The agency would have preferred to see confirmation of the identity of lindane in one of the samples taken for metabolite identification, using a specific method of detection (GC-MS, for example).

9. Background:

Lindane is an insecticide/acaricide with terrestrial food, terrestrial nonfood, greenhouse food, greenhouse nonfood, forestry, domestic outdoor and domestic indoor, commercial outdoor, wood, and wooden structure treatment uses. It is used mainly for seed treatment, livestock treatment, and hardwood lumber treatment.

A Registration Standard was done for lindane in May, 1985. Subsequently, it was put into Special Review (triggers were oncogenicity and blood effects) and a data call-in was issued. Currently, it is not in Special Review.

10. Review of Individual Studies: see individual review

11. Completion of One-Liner: N/A

12. CBI Appendix: N/A

10. Review of Individual Studies:

A. Study Identification:

Uptake, Depuration and Bioconcentration of ^{14}C-Lindane by Bluegill Sunfish (Lepomis macrochirus). Centre International d'Etudes du Lindane[1]. Alan D. Forbis. Performed by Analytical Bio-Chemistry Laboratory, Inc., Columbia, MO. November 4, 1986. Accession #400561-01.

Metabolite Characterization of ^{14}C-Lindane in Bluegill Sunfish (Lepomis macrochirus). Centre International D'Etudes du Lindane[1]. Leanne Forbis, Dee Teeter. Performed by Analytical Bio-Chemistry Laboratory, Inc., Columbia, MO. October 16, 1986. Accession # 400561-02.

B. Materials and Methods:

A flow-through bioconcentration study of bluegill sunfish using ^{14}C-lindane (uniformly ring-labelled) (>98% pure) in 2 tanks (one was a control) of 120 fish each was conducted from May 7, 1986, to June 18, 1986. The fish were exposed to a constant concentration of 0.54 ($\pm$0.13) ug/l (ppb) for 28 days, followed by a 14 day depuration period.

Fish and water were sampled on treatment days 0,1,3,7,14, 21 and 28 and during the depuration period on days 1,3,7,10 and 14. Fish for metabolite characterization were sampled on treatment days 21 and 28 and on the 14th day of the depuration period.

Analytical Method

1. Water

About 500 ml of water were removed from the control and test aquaria and the samples were analyzed directly for total radioactivity by LSC. The limit of detection was 0.01 ppb for Liquid Scintillation Counting analysis of water.

2. Fish

On the sampling dates, 3 fish from each aquaria were pooled into control and treated samples. The fish were dissected into fillet/edible (body, muscle, skin, skeleton) and viscera/nonedible (fins, head, internal organs) or analyzed as whole fish.

Individual samples were homogenized with dry ice, weighed and combusted in an oxidizer, followed by LSC analysis. The limit of detection for LSC was 0.6 ppb in fillet, whole fish, and viscera.

Metabolite Analysis:

For metabolite identification in fillet and viscera, fish samples were taken on treatment days 21 and 28. Reference standards for nine possible metabolites were prepared (hexachlorobenzene, hexachlorocyclohexene, 1,2,3,4-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 2,3-dichlorophenol, 2,4-dichlorophenol, 2,3,5-trichlorphenol, and 2,4,6-trichlorophenol for analysis in fish tissue.

1. A 3-member consortium of (1) Rhone-Poulenc, Inc., (2) Celamerk GmbH and Co., KG (and its US affiliate, E.M. Industries, Inc.) and (3) Inquinosa.

Fish tissue was extracted 3x with dichloromethane and cleaned up with gel permeation chromatography. The unextracted residue was combusted and analyzed by LSC. The method gave an 87% average recovery. The extraction efficiency (comparison of pre- and post-extraction combustion results) was 95%. Two detection methods were used: TLC and GLC. The TLC method involved development of plates with hexane: acetone (9:1) and analysis of radioactivity with a radioisotope plate scanner. The silica gel was scraped off and the radioactivity was dissolved in methanol and quantified by LSC. The GLC method used was electron capture GLC. No confirmatory analysis using a specific method of detection was used.

During the preliminary method development, the post-extracted dichloromethane residue was also extracted with 0.5 N NaOH, which separated the chlorophenols from the other compounds. Further extraction of the filter cake with alcoholic KOH resulted in the extraction of <1% of the bound residue.

C. Reported Results:

On treatment day 28, fillet contained 420 ppb, whole fish 710 ppb and viscera 1200 ppb. The bioconcentration factors reached a high of 780x on day 28 in fillet, 1400x on day 21 in whole fish and 2500x on day 14 in viscera.

After 14 days of depuration, the level of ^{14}C-radioactivity in fish fell to 18 ppb in fillet, 110 ppb in whole fish and 56 ppb in viscera. This represents a depuration of 96% in fillet, 85% in whole fish and 95% in viscera.

All residue that was extracted was identified as ^{14}C-lindane parent and none of the 9 metabolites co-chromatographed were present, as verified by TLC and GLC.

Sample Type	Treatment Day	ppm Lindane Found (not corrected for the 86% method recovery)		ppm Bound Residue
		TLC	GLC	
Viscera	21	1.04	1.19	0.06
Fillet	21	0.34	0.39	0.02
Viscera	28	0.96	1.16	0.06
Fillet	28	0.45	0.40	0.03

D. Reviewer's Discussion and Interpretation of Results:

During the 28 day treatment period, lindane bioconcentrated to an appreciable degree in bluegill sunfish, but the compound was rapidly eliminated from fish during the 14 day depuration period.

During the study period, lindane in edible and viscera fish tissue did not metabolize.