

US EPA ARCHIVE DOCUMENT

DATA EVALUATION RECORD

STUDY IDENTIFICATION:

Jordan, E. G. 1988. Metabolism of Lindane in Soil Under Aerobic and Anaerobic Conditions. Centre International d' Etudes du Lindane (CIEL)/Rhone-Poulenc File No.40223. MRID No. 406225-01.

REVIEWED BY:

Richard J. Mahler, Hydrologist  
Review Section I, EFGWB

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

APPROVED BY:

Paul J. Mastradone, Chief  
Review Section I, EFGWB

Signature: *Paul J. Mastradone*  
Date: *AUG 21 1989*

TYPE OF STUDY: Aerobic Soil Metabolism

CONCLUSIONS:

1. EFGWB concludes that the study is scientifically valid and satisfies the data requirement for an aerobic soil metabolism study.
2. Based on the results of the study, EFGWB concludes that lindane is persistent in the aerobic soil environment with a half-life of 980 days in the sandy loam soil tested.

MATERIALS AND METHODS:

Lindane-UL-<sup>14</sup>C (Specific activity: 4.20 mCi/mM, radiopurity = 97.66%) was added (1.97 ug/g soil) to a fine sandy loam soil with the following characteristics : pH 6.4; CEC, 10.0 meq/100 g; sand, 70%; silt, 15%; clay 15%; organic matter, 2.8%; 1/3 bar moisture content, 14.15%.

Moisture content was maintained at 75.12% of field capacity. The treated soil was incubated aerobically at 24.5°C in the dark with an air flow rate of 250 ml/min.

Volatilized <sup>14</sup>C was trapped in NaOH, polyurethane foam plugs, and XAD-2 and XAD-4 resins.

Soil samples were taken and analyzed at 0, 7, 14, 28, 56, 84, 112, 140, 168, 224, 280, and 336 days after treatment. Trapping solutions were sampled and changed every 7 days through the length of the study.

Soil samples were extracted 3X with acetone-methanol-toluene (AMT) to determine extractable <sup>14</sup>C compounds. Air-dried extracted soil samples were combusted in a sample oxidizer to determine soil bound residues after extraction with AMT.

The AMT extracted soils were air dried and acid hydrolyzed with 2% HCl-methanol to determine soil bound residues not readily extractable with AMT. The 2% HCl-methanol solutions were further

separated with NaCl and ethyl acetate. The acid hydrolyzed soils were air dried and combusted in a sample oxidizer to determine soil bound residues not acid hydrolyzable.

The amount of radioactivity in soil extracts, combusted samples and as volatilized products were determined using Liquid Scintillation Counting (LSC). Thin Layer Chromatography (TLC) analysis was used with two solvent systems to identify the products by comparing the results with known standards of gamma 1,2,3,4,5,6-hexachlorohexane (lindane), 2,3,4,5,6,-pentachlorocyclohexene (PCCH) and alpha 1,2,3,4,5,6-hexachlorohexane (BHC).

#### REPORTED RESULTS:

The author reported that material balance varied from 95.25% at day 0 to 91.87% of the applied radioactivity at day 366 (Table 2). The radioactivity in the AMT extracts decreased with increasing incubation time (94.44 to 79.06% of applied radioactivity); while soil bound radioactivity increased with time (0.81 to 6.6 % of applied radioactivity).

Volatilization of lindane was not a major mechanism of loss from the soil since no more than 1.34 % of the applied radioactivity was recovered in the resin or polyurethane plugs at day 336.

Degradation products of lindane were identified as CO<sub>2</sub>, PCCH and BHC accounting for 4.81%, 3.84% and 0.77%, respectively of the applied radioactivity at day 336.

TLC autoradiographic analysis of the AMT extracts showed that 73.43% of the applied radioactivity was recovered as parent lindane at day 336 (Table 9).

TLC autoradiographic analysis showed that the majority of the radioactivity extracted by acid hydrolysis of the bound residue was lindane (Table 12).

The overall percent recovery of lindane-UL-14C from the soil as reported by the author, decreased with time from 92.0% to 76.52% of the applied radioactivity (Table 13).

The author calculated the aerobic half-life of lindane to be 980 days using linear regression on the data in Table 13.

#### DISCUSSION:

1. EFGWB concludes that the study is scientifically valid and satisfies the data requirements for the aerobic soil metabolism study.
2. Based on the results of the study, EFGWB concludes that lindane does not dissipate rapidly in the soil under aerobic conditions based on the calculated half-life of 980 days. Extractable products were parent lindane, and degradation products, PCCH and BHC.

3. The extracted and volatile products were qualitatively identified by co-chromatography with known standards of lindane, PCCH and BHC using two solvent systems.

4. The anaerobic and aerobic soil metabolism studies were combined into one report making it difficult to follow either study.