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Product Manager PM 51
Special Review and Reregistration Division (H7508W)

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THRU: Henry Jacoby, Chief
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Attached, please find the EFGWB review of...

Reg./File #: 2080

Common Name: cacodylic acid

Product Name: Cacodylate 3.25, Herb-all, Leaf-all, Cotton Aide HC, Moncide, Montar, Rad-E-Cate 25

Company Name: Luxembourg Industries (PAMOL) Ltd.

Purpose: Review of 162-4 and response to comments on 164-1 studies for reregistration

Type Product: Herbicide Action Code: 627 Review Time: 4.5 days

EFGWB Guideline/MRID/Status Summary Table: The review in this package contains...

161-1		162-4	430360101	N	164-4		166-1				
161-2		163-1			164-5		166-2				
161-3		163-2			165-1		166-3				
161-4		163-3			165-2		167-1				
162-1		164-1	43331101	N	165-3		167-2				
162-2		164-2			165-4		201-1				
162-3		164-3			165-5		202-1				

A = Acceptable (Study satisfied the Guideline)/Concur U = Upgradeable (Study may become satisfactory with the submission of additional information)
S = Supplemental (Study provided useful information, but Guideline was not satisfied) N = Unacceptable (Study was rejected)/Non-Concur

1. CHEMICAL:

Common name:

Cacodylic acid.

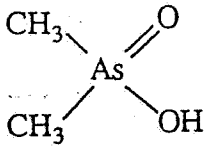
Chemical name(s):

Dimethyliarsinic acid. (IUPAC)
Hydroxydimethylarsine oxide.

Trade name(s):

Cacodylate 3.25, Herb-all, Leaf-all, Cotton Aide HC, Moncide, Montar, Rad-E-Cate 25.

Structure:



Formulations:

Concentrated solution.

Physical/Chemical properties:

Molecular formula:	$C_2H_7AsO_2$.
Molecular weight:	138.0.
Physical state:	Colorless crystalline solid.
Melting point:	192-198 C.
Solubility (25 C):	2 kg/kg water; soluble in short-chain alcohols; insoluble in diethyl ether.

2. TEST MATERIAL:

Study 1: Active ingredient.

3. STUDY/ACTION TYPE:

Review of aerobic aquatic metabolism studies and registrant response to comments on previously reviewed terrestrial field dissipation studies in support of reregistration.

4. STUDY IDENTIFICATION:

162-4: Aerobic aquatic metabolism
Atkins, R.H. 1993. Aerobic aquatic metabolism of [^{14}C]cacodylic acid. PTRL Project No. 756; PTRL Report No. 1564. Unpublished study performed by PTRL East, Inc., Richmond, KY, and submitted by Luxembourg Industries (PAMOL), Ltd., Tel Aviv, Israel. (43036101)

5. REVIEWED BY:

David Edelstein
Soil Scientist
EFGWB EFED OPP
Review Section #3

Signature: David Edelstein

Date: OCT - 5 1994

6. APPROVED BY:

Akiva D. Abramovitch
Chief
EFGWB/EFED/OPP
Review Section #3

Signature: for AA
Date: OCT - 5 1994

7. CONCLUSIONS:

162-4: Aerobic aquatic metabolism (MRID 43036101; not acceptable at this time)
This study is appears to be scientifically sound and meets EPA guidelines. However, it cannot be considered fully acceptable because supplemental data on the aerobic soil metabolism of cacodylic acid (MRID 42616001, reviewed 6/27/86) suggest that cacodylic acid does biodegrade under aerobic conditions, releasing measurable quantities of alkyl arsines and CO_2. This study may be upgraded if the registrant can explain why cacodylic acid did not biodegrade in this study, and under what conditions it might be expected to biodegrade.

Reported results of the study were that cacodylic acid did not degrade in sandy loam soil that was flooded with aerated water and incubated in the dark at approximately 25 C for 30 days.

164-1: Terrestrial field dissipation (42843101, registrant response; not acceptable at this time)
The registrant offers several conjectures to explain the rapid loss of cacodylic acid in the field when compared with the results of the 162-1 Laboratory Aerobic Soil Metabolism study (MRID 42616001, reviewed 11/30/93). In the 162-1 study, cacodylic acid did not degrade, and was fully extractable throughout the study. In the field, the first half-life for cacodylic acid was only 20 days, and the registrant contends that this could be due to irreversible soil binding of cacodylic acid, even though previous method studies had shown successful extraction of cacodylic acid using 2 M NH_4OH.

The claim of irreversible binding is not credible, however. Cacodylic acid is the least strongly bound of the proposed species (cacodylic acid, monosodium methanearsonate, and inorganic arsenate) because the binding occurs through the hydroxyl group. Cacodylic acid has only one such group, while MSMA has two and arsenate has three. 2 M NH_4OH is an extractant for total arsenic, which means that it is capable of extracting not only cacodylic acid, but the more tightly bound arsenic species as well. In addition, the test site in this study was specifically chosen for its relatively low soil concentrations of iron and aluminum, which are the binding sites for arsenicals. Based on the properties of the bound species, the available binding sites, and the extractant, it appears unlikely that the loss of cacodylic acid can be attributed to irreversible binding.

An alternative explanation, not consistent with submitted data but supported by the open literature, is that cacodylic acid does biodegrade in soil (Alexander, M. 1977. Introduction to Soil Microbiology, 2nd edition, pp. 396-398). Cacodylic acid biodegradation is consistent with the reported twenty day field half-life, and would also eliminate the questionable conjecture of irreversible binding. EFGWB will revisit the field study when acceptable aerobic soil metabolism and mobility data are received, as this should aid in the interpretation of field results. The registrant is encouraged to discuss laboratory study results in terms of their implications for the field study.

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ENVIRONMENTAL FATE ASSESSMENT

Cacodylic acid appears to be persistent, but not mobile. Some of its degradates may be volatile. Cacodylic acid is stable to photolysis in soil and water. While mobility data are incomplete, inorganic arsenic can form insoluble salts in soil solution, and is not usually considered mobile. Cacodylic acid appears to resist aerobic and anaerobic biodegradation. However, supplemental data have indicated that biodegradation may occur slowly, releasing CO_2, volatile alkyl arsines, and inorganic arsenicals.

In the field, cacodylic acid appeared to dissipate far more rapidly than would be expected from the laboratory data. The route of dissipation is unclear, as little cacodylic acid appeared to degrade to monosodium methanearsonate, and cacodylic acid does not appear to be mobile. Additional data on cacodylic acid dissipation in the field will be needed. However, the immobility of inorganic arsenic and the fact that it cannot be degraded indicate that repeated applications of cacodylic acid will increase the probability of environmental exposure to arsenic.

Cacodylic acid does not accumulate in fish.

8. RECOMMENDATIONS:

1. Inform the registrant that the aerobic aquatic metabolism study may be upgraded with an explanation of why the slow biodegradation observed in previous studies of cacodylic acid did not occur in these studies. If the data itself is inadequate (eg., inactive microbial population), a new study may be required.

2. The registrant's response to comments on the terrestrial field dissipation study confirm EFGWB's long-standing contention that there is an unexplained difference in the results of the 162-1 Aerobic Soil Metabolism study and the 164-1 study. Although the 162-1 study indicates that cacodylic acid is stable in viable soil, the results of the 164-1 study appear to be best explained by microbial degradation of cacodylic acid. Therefore, EFGWB recommends that the question of the acceptability of the cacodylic acid field study be revisited following the submission of the previously requested acceptable laboratory aerobic soil metabolism and mobility studies (see memo of 5/18/94).

Data requirement status for cacodylic acid is listed in Table 1.

9. BACKGROUND:

Cacodylic acid is a non-selective post-emergence herbicide used to control weeds in non-crop situations, for lawn renovation at 11-17 kg/ha, and for killing unwanted trees by injection.

10. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

Refer to attached review.

11. COMPLETION OF ONE-LINER:

The data do not support an update of the one-liner at this time.

12. CBI APPENDIX:

No claim of confidentiality is made for the data reviewed in this package.

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DATA REQUIREMENT STATUS: CACODYLIC ACID (TERRESTRIAL FOOD CROPS)

GUIDELINE	MRID #	EFGWB#	DATE	STATUS
HYDROLYSIS				NOT SATISFIED
AQUEOUS PHOTOLYSIS	41662601	91-0541	10/91	SATISFIED
PHOTOLYSIS ON SOIL	41662602	91-0541	10/91	SATISFIED
AEROBIC SOIL METABOLISM	42616001	93-0332	8/93	NOT SATISFIED
ANAEROBIC SOIL METABOLISM	42616001	6452	6/86	SATISFIED
ANAEROBIC AQUATIC METABOLISM	42572601	93-0249	8/93	NOT SATISFIED
AEROBIC AQUATIC METABOLISM				NOT SATISFIED
LEACHING/ ADSORPTION/ DESORPTION		6452	6/86	NOT SATISFIED
TERRESTRIAL FIELD DISSIPATION	41302101 42843101	91-0541 93-0939	10/91 8/93	NOT SATISFIED
BIOACCUMULATION IN FISH				WAIVED