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To: Robert Taylor
 Product Manager PM 25
 Special Review and Reregistration Division (H7508W)

From: Elizabeth Behl, Head (Acting) *Estella Waldman*
 Ground Water Technology Section
 Environmental Fate & Ground Water Branch/EFED (H7507C) *for EB*

Thru: Henry Jacoby, Chief *Henry Jacoby*
 Environmental Fate & Ground Water Branch/EFED (H7507C)

Attached, please find the EFGWB review of...

Reg./File # : _____

Chemical Name : Alachlor

Type Product : Herbicide

Product Name : Lasso

Company Name : Monsanto Agricultural Company

Purpose : Review 6(a)2 ground water monitoring data.

Action Code : 405 EFGWB #(s): 92-0493 Total Review Time: 1 day

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

| | | | | |
|-------|-------|-------|-------|-------|
| 161-1 | 162-1 | 164-1 | 165-1 | 166-1 |
| 161-2 | 162-2 | 164-2 | 165-2 | 166-2 |
| 161-3 | 162-3 | 164-3 | 165-3 | 166-3 |
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1. CHEMICAL

Common name: Alachlor
Chemical name: 2-Chloro-2'-6'-diethyl-N-(methoxymethyl)-acetanilide
Structure: See page 6.

2. TEST MATERIAL:

Not applicable.

3. STUDY/ACTION TYPE:

Review 6(a)2 monitoring data concerning detections of alachlor and alachlor metabolites in ground-water.

4. STUDY IDENTIFICATION:

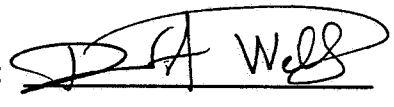
Submission of data package from Monsanto Agricultural Company. January 29, 1992.

DP Barcode: D174028
EFGWB: 92-0493
Case: 283208
Submission: S410996
Action Code: 405 Adverse Data Submission

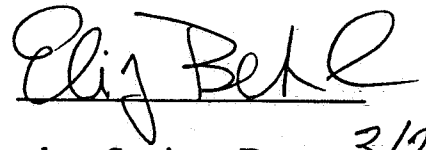
Documents submitted by:

Monsanto Agricultural Company
800 N. Lindbergh Boulevard
St. Louis, Missouri 63167

5. REVIEWED BY:

David Wells Signature: 
Hydrologist
EFED/Ground-Water Technology Section - Date: 3/2/92

6. APPROVED BY:

Elizabeth Behl Signature: 
Acting Section Head
EFED/Ground-Water Technology Section - Date: 3/2/92

7. CONCLUSIONS:

Wells located in Indiana and Ohio have been found to contain the polar alachlor degradation product ESA.

A significant finding of the submitted data is that the EnviroGard immunoassay methods is able to detect the degradates of alachlor in ground-water. This information demonstrates that immunoassay techniques can be useful screening methods for residues in ground-water. However, positive results from these techniques should be further analyzed for residues in order to accurately quantify wells at which they occur. As more studies analyze for ESA and other alachlor degradates, and as the popularity and usage of immunoassay methods increase, we believe that the frequency of alachlor degrade detections will increase.

8. RECOMMENDATIONS:

- A. We recommend that this information be reviewed by HED for possible toxicological concerns for alachlor degradates in ground water.
- B. We would like to request that Monsanto submit the complete results of the 1991 sampling from the Heidelberg College Water Quality Laboratory, preferably in magnetic form (floppy disc).

9. BACKGROUND:

Alachlor is a pre-emergent soil applied herbicide used principally in the spring on corn, soybeans and peanuts. It has approximately the second highest volume of use of any pesticide in the United States.

NAWWS 1990 Study:

In 1985, Monsanto designed a statistically-based, large-scale retrospective ground-water sampling program similar to EPA's National Pesticide Survey. This study, termed the "National Alachlor Well Water Survey" (NAWWS), sampled private, rural drinking water wells in alachlor use areas for detectable levels of alachlor at or above 0.2 ppb. Monsanto collected extensive data from the sampling areas and ground-water samples from 1,430 wells. This statistical sampling of wells represented over 6 million private, rural, domestic wells in the alachlor use area, serving 6.5 million households and twenty million people.

The results of the study found few detections of alachlor in ground water. It is estimated that less than one percent of the six million wells contained detectable levels of alachlor, and an estimated 0.02 percent exceeded the proposed MCL of 2 ug/L. Although in this study samples were analyzed for five herbicides (four other than alachlor) and nitrate, they were not analyzed for any of the alachlor degradates (Holden and Graham, 1990; ICF Inc., 1991).

10. DISCUSSION:

Monsanto submitted data from the Water Quality Laboratory of Heidelberg College (Tiffin, Ohio) reporting detections of the polar alachlor soil degradation product 2-[(2,6-diethylphenyl)-(methoxymethyl)amino]-2-oxo-ethanesulfonic acid, called ESA.

This study sampled 4,445 private wells in Indiana and Ohio using EnviroGard¹ immunoassay testing to test for alachlor. Two hundred thirty-six samples (5 %) indicated alachlor above 0.2 ppb, and 145 samples (3 %) indicated alachlor levels above 0.5 ppb. Twenty-two of these wells (0.5 %) appeared to contain residues of alachlor above the MCL of 2 ppb; however further analysis found that only one sample contained detectable levels of the parent compound alachlor. Six of the "positive" immunoassay samples were analyzed further by Mann Testing Laboratories and found to contain the alachlor soil metabolite ESA. The presence of ESA was confirmed by LC/MS/MS techniques in each of the six samples submitted for additional analysis. This compound is believed to be responsible for the majority of the positive responses in the alachlor immunoassay results.

Immunosystems laboratories also analyzed a portion of the positive detections. Dr. Baker provided the lab with six ground-water samples and each was found to contain ESA residues ranging from 4 to 74 ppb. Five surface-water samples were also re-analyzed and three of the five samples contained ESA residues at 0.6, 1, and 2 ppb. A total of eleven ground- and surface-water samples were reportedly re-analyzed for the presence of ESA by Immunosystems, Inc. using GC/GC-MS techniques. The limit of detection in water was reported as 0.5 ppb.

A portion of the positive immunoassay results was reported from St. Joseph County, Indiana. Positive wells were found in the northwest portion of the county, but further analysis reported that they did not contain residues of alachlor (Lasso). David Baker (Director, Heidelberg Water Quality Lab) demonstrated that the detections in St. Joseph County were from wells clustered in a very specific portion of the county, and that the results were reproducible and probably not from faulty sample plates. Additional testing by Monsanto on several of the positive samples also confirmed that the samples contained no metolachlor (Dual) residues, a herbicide known to also produce positive results on the EnviroGard Alachlor Immunoassay tests. This suggests that the positive results are also from the degradate ESA.

¹ Millipore Corporation

Of 3,440 wells sampled in Indiana using the alachlor immunoassay method, the results were summarized as:

Indiana-Alachlor Immunoassay Results (n=3,440)

| < 0.1 ppb | 0.1 - < 0.2 | 0.2 - < 1.0 | 1.0 - < 2.0 | ≥ 2.0 ppb |
|-----------|-------------|-------------|-------------|-----------|
| 3,185 | 101 | 110 | 22 | 22 |
| (92.6%) | (2.9%) | (3.2%) | (0.6%) | (0.6%) |

This data shows a significant number of positive detections under 2.0 ppb. Since ESA was found repeatedly to be the compound causing positive results for the category ≥ 2.0 ppb, it is likely also the cause of positive detections less than 2.0 ppb.

Monsanto's data package included a copy of a memorandum from Bruce Ferguson of Immunosystems, Inc. to David Baker, Heidelberg Water Quality Lab. Mr. Ferguson states that "... EPA has not stated a concern for any possible metabolites or breakdown products of alachlor: the regulations pertain to parental alachlor at or above the federal standard of 2.0 PPB" (Ferguson to Baker, 15 November, 1991). This is not the policy of EPA. Since the mid-1980's, OPP's Ground-Water Section has been requesting more information on the metabolites of alachlor. Although we were unsuccessful in getting Monsanto to identify important metabolites and having them included as analytes in the NAAWS, these important studies shed light on the fate alachlor, and the potential for residues to leach to and persist in ground-water. EPA has not set drinking water standards (MCL's) for the metabolites of alachlor.

Monsanto Report of Environmental Fate and Toxicology

Included in the data package is a report by Dr. A. Bachmann and Dr. G. Schraa on the environmental fate of alachlor, prepared for Monsanto Agricultural Products Company. They report that alachlor soil metabolites tend to be tightly bound or "incorporated" to soil organic matter.

Dr.'s Schraa and Bachmann include a discussion of the occurrence of the metabolite 2,6-diethylaniline found in a fungus culture. This metabolite is not known to be formed in soils however, when it was incubated in soil-water slurries under aerobic conditions, it was found to have a half-life of about ten hours and degrade to "a mixture of oligomeric products and soil-bound material." They conclude that there is no toxicological risk to humans from drinking water for this compound.

Dr. J. Malik prepared the portion of the summary on soil and water metabolite identification. He concludes that the most likely alachlor metabolites that could reach ground-water could be the polar acidic soil metabolites. He states that these substances are not mutagenic, do not bioconcentrate and do not undergo significant metabolic transformations.

This summary identifies and provides chemical structures for seven major and six minor (trace level) metabolites of alachlor. Five soil metabolites of alachlor were identified which have the potential to move in soil and potentially reach ground water. They are pictured on page 7 (Schraa and Bachmann).

SUMMARY:

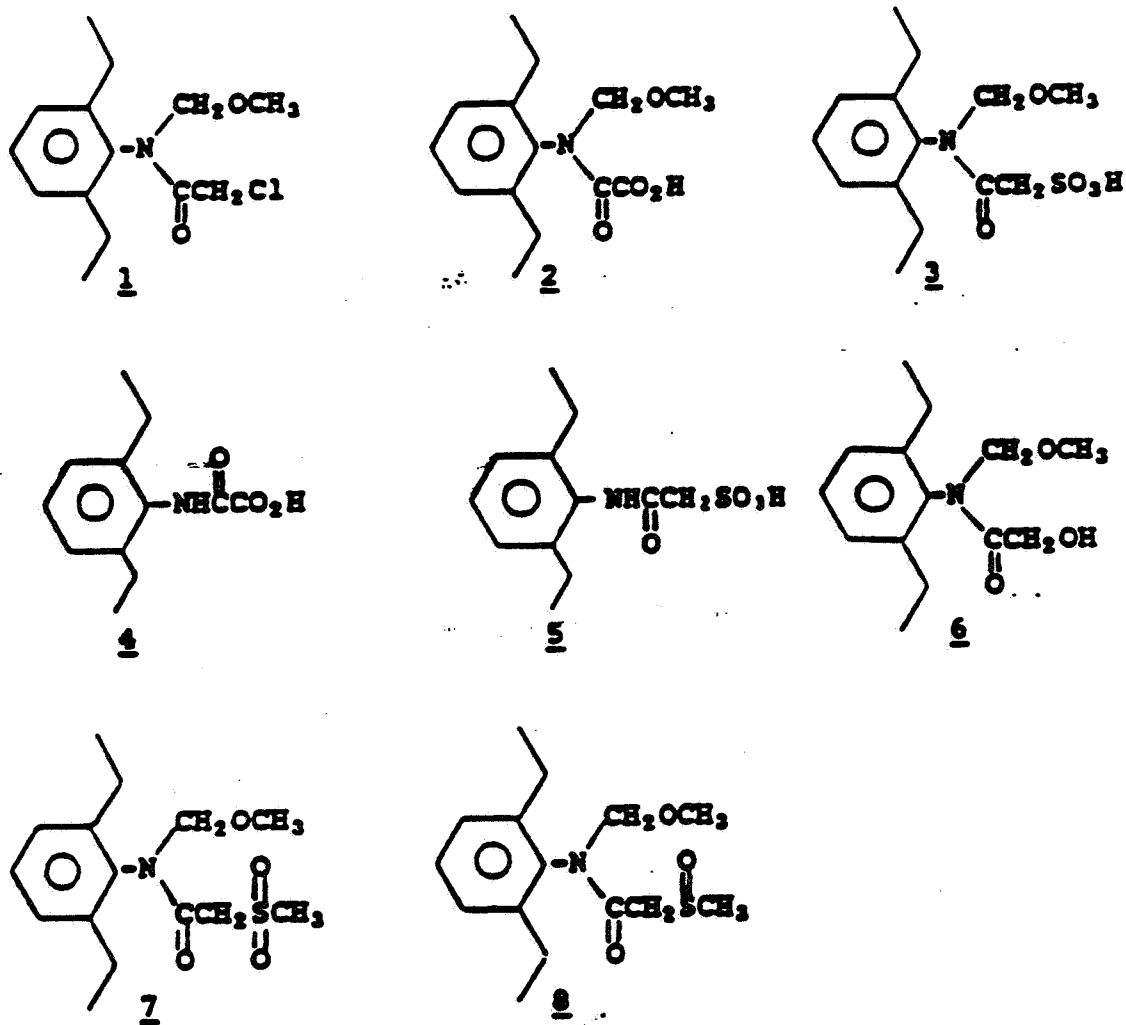
The 1990 Monsanto NAWWS study strongly suggests that the parent compound alachlor is not commonly found in private rural drinking water wells in its use area. However, no major studies have focused on alachlor degradates/metabolites under field conditions.

Because of EPA's limited information on alachlor degradates, their mobility, and toxicology, we recommend that the information presented in this report be reviewed by HED. We would also further request the complete results of the 1991 sampling from Heidelberg College Water Quality Laboratory, preferably in magnetic form (floppy disc) be submitted to the Ground-Water Section for review.

As more studies include ESA and other alachlor degradates as analytes, and as the popularity and usage of immunoassay methods increases, we believe that the frequency of alachlor degradate detections will increase.

Structures of Alachlor and Its Major Soil
Metabolites

7



REFERENCES:

- Ferguson, B.S. to D. Baker. 15 November, 1991. Memorandum discussing laboratory results for ESA testing by ImmunoSystems, Inc. Scarborough, Maine.
- Holden, L.R. and J.A. Graham, 1990. "The National Alachlor Well Water Survey. Project Summary. Volume 1 of 7." St. Louis, MO: Monsanto Agricultural Company.
- ICF Incorp. 1991. "Review of the Monsanto Company National Alachlor Well Water Survey-Phase II Report." EPA Contract No. 68-D8-0006. Fairfax, VA: ICF Incorporated.
- Schraa, G. and A. Bachmann, Nd. "Fate of Alachlor In The Environment-A Substantiated Statement on Agreement/Disagreement with the Assessment Attached." Brussels, Belgium: Monsanto Agricultural Products.