

DP Barcode : D163707
PC Code No. : D157127
EFGWB Out : 114402
12-29-92

TO: Christine Rice, PM52
Thomas Luminello, Jr., PM Team Reviewer
Product Manager #
Special Review and Reregistration Division (H7508W)

FROM: Elizabeth Behl, Section Head
Ground Water Technology Section
Environmental Fate & Ground Water Branch/EFED (H7507C)

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

Attached, please find the EFGWB review of...

Reg./File # : 114402

Common Name : Sodium 5-[(2-chloro-4-trifluoromethyl)-Phenoxy]-2-Nitrobenzoic Acid

Product Name : Blazer®, Tackle®

Company Name : BASF, (Rhone-Poulenc)

Purpose : Review of progress report, protocol, (a)(2) report, and other miscellaneous reports.

Type Product : Herbicide

Action Code : 405, 660 EFGWB #(s): 91-0542 Total Review Time = 13 days

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

161-1	162-4	164-4	166-1
161-2	163-1	164-5	166-2 X P
161-3	163-2	165-1	166-3
161-4	163-3	165-2	167-1
162-1	164-1	165-3	167-2
162-2	164-2	165-4	201-1
162-3	164-3	165-5	202-1

Y = Acceptable (Study satisfied the Guideline)/Concur P = Partial (Study partially satisfied the Guideline, but additional information is still needed)
S = Supplemental (Study provided useful information, but Guideline was not satisfied) N = Unacceptable (Study was rejected)/Non-Concur

x MRID #s 416511, 4145095, 4118332, 418332, 41485

1. CHEMICAL:

Chemical Name: Sodium 5-[2-chloro-4-(trifluoromethyl)-
Phenoxy]-2-Nitrobenzoic Acid
Common Name: Acifluorfen, Sodium salt
Trade Name: Blazer®, Tackle®, Galaxy®, Storm®
Structure: Not applicable

Physical/Chemical Properties:

Molecular Formula	$C_{14}H_7ClF_3NNaO_5$ (sodium salt) $C_{14}H_7ClF_3NO_5$ (acid)
Water Solubility	2.5×10^5 mg/L @ 20 °C
K_d	1.0 ml/g silt loam
K_{oc}	
$\log K_{ow}$	-4.85 (acid) (calculated)
pK_a	2.5

2. TEST MATERIAL

Not Applicable.

3. STUDY/ACTION TYPE:

Review of interim Small-Scale Retrospective Ground-Water Monitoring Studies for acifluorfen-sodium (Blazer® and Tackle®) reports, Ground-Water Vulnerability Analysis for Acifluorfen study sites, well-water analysis summary after eight months.

4. STUDY IDENTIFICATION:

A. Title: Groundwater Vulnerability Analysis for Acifluorfen Application

Authors: S.C. Cooper and J. DeMartinis

Submission For: BASF Corporation
Agricultural Chemicals
P.O. Box 13528
Research Triangle Park, NC 27709-3528

Action: 660 Generic Data Registration
MRID: 416511-00, 416511-01
EFGWB#: 91-0098; reassigned 91-0542
DP Barcode: D157127
Case: 816452
DP Type: 999 Miscellaneous Package
ID#: 114402-007969
Submission: S384414
Identifying No: BASF Doc. # 90/5030 64 pages.

B. Title: A Small-Scale Retrospective Groundwater Monitoring Study and Limited Prospective Field Dissipation Study with Acifluorfen-Sodium, the Active Ingredient Tackle Brand Herbicide and Blazer Brand Herbicide. Rhone-Poulenc Ag Company Protocol No. EC/P-89-0017.

Authors: Russell L. Jones, Ph.D.
Frank A. Norris, Ph.D.

Submission By: BASF
Agricultural Chemicals
P.O. Box 132528
Research Triangle Park, NC 27709-6500

Action: 660 Generic Data Registration
MRID: none
EFGWB#: 90-0544; Reassigned 91-0542
DP Barcode:
Case: 816452
DP Type:
ID#: 114401-03
Submission:
Record No.: 263536
Identifying No: Rhone-Poulenc Protocol No. EC/P-89-0017

C. Title: A Small-Scale Retrospective Groundwater Monitoring Study and Limited Prospective Field Dissipation Study with Acifluorfen-Sodium, the Active Ingredient Tackle Brand Herbicide and Blazer Brand Herbicide. Progress Report

Authors: Frank Norris, Ph.D.

Submission By: Rhone-Poulenc Ag Company
Environmental Chemistry Department
P.O. Box 112014, 2 T. W. Alexander Drive
Research Triangle Park, NC 27709

for: Rhone-Poulenc Ag Company and
BASF Corporation, Agricultural Chemicals

Action: 660 Generic Data Registration
MRID: 4145095-01
EFGWB#: 90-0545; Reassigned 91-0542
DP Barcode:
Case: 816452
DP Type:
ID#: 114401-03
Submission:
Record No.: 263538
Identifying No:

D: Title a.: Interim Reports: A small-scale retrospective groundwater monitoring study and limited prospective field dissipation study with acifluorfen-sodium, the active ingredient of Tackle® Brand Herbicide and Blazer® Brand Herbicide: Interim Report. Blasland and Bouck Engineers. BASF Registration No. 91/5048 122 pages

Authors: S. C. Cooper, Blasland and Bouck Engineers

Action: 660
MRID #: 418332-00,418332-01
EFGWB#: 91-0542
✓ DP Barcode: D163707
Case: 816452
ID#: 114402-007969
Submission: S394757

and Title b.: A small-scale retrospective groundwater monitoring study and limited prospective field dissipation study with acifluorfen-sodium, the active ingredient of Tackle® Brand Herbicide and Blazer® Brand Herbicide: Interim Report. Analysis of Well Water for Residues of Acifluorfen. BASF Corporation, Agricultural Research Center. BASF Registration No. 91/5049 17 pages

Authors: L. A. Sears

Action: 660
MRID #: 418332-02
EFGWB#: 91-0542
✓ DP Barcode: D163707
Case: 816452
ID#: 114402-007969
Submission: S394757

E. Title: Acifluorfen-Sodium: Small-Scale Retrospective Study. Summary of Well Water Analyses Eight Months After Application.

Authors: Laura Sears

Submission By: BASF Corporation
Agricultural Research Center
Research Triangle Park, NC 27709
BASF Corporation, Agricultural Chemicals

BASF Corporation Chemicals Division
Agricultural Chemicals
100 Cherry Hill Road
Parsippany, NJ 07054

Action: 405 Adverse Data
MRID: 414485-01
EFGWB#: 90-0566; Reassigned 91-0542
DP Barcode:
Case: 816452
DP Type:
ID#: 114401-03
Submission: S409882
Record No.: 264088
Identifying No: 11440103

5. REVIEWED BY:

James K. Wolf
Soil Scientist

Signature: James K. Wolf

OPP/EFGWB/Ground Water Section Date: October 20, 1992

6. APPROVED BY:

Elizabeth Behl
Section Head

Signature: E. A. Wolf for EB

OPP/EFGWB/Ground Water Section Date: November 9, 1992

7. CONCLUSIONS:

Five small-scale retrospective/limited prospective ground-water monitoring studies were conducted by the registrant. These studies were located in five states, Indiana, North Carolina, North Dakota, Tennessee, and Virginia. The five study sites were deemed vulnerable to ground water contamination based upon several soil (particle size, lack of restricting layers) and hydrogeologic (depth to ground water) criteria. The North Carolina site was thought to be the most vulnerable. EFGWB generally agreed with the registrants selection criteria, but thought too much emphasis was placed on the texture of the subsoil at the expense of the surface soil texture.

The studies were conducted prior to approval of the final study protocol and several deficiencies identified in previous reviews were not addressed by the registrant. Several sites were selected and studies initiated prior to EFGWB concurrence.

The registrant failed to sample the standing water at the Arkansas site as agreed EFGWB # 90-002, page 10, Arkansas scenario #3. (USEPA, 1990a). Additionally, in

¹ It was later demonstrated that this site was actually in Tennessee. Despite being located on the western side of the Mississippi.

keeping with the spirit of the request to sample standing water at the Arkansas site, if standing water was present at the Indiana site, due to flooding in June 1990, samples should have also been collected and analyzed.

Acifluorfen residues were detected eight months after application in two shallow monitoring wells at the North Carolina retrospective ground-water monitoring site. The registrant re-analyzed the original samples and also re-sampled the monitoring wells. There were no detections observed in these samples. The registrant concluded that the detections had been "false positive" detections.

Specific comments are given in the review of the final report (USEPA, 1992b; EFGWB # 92-0428).

8. RECOMMENDATIONS:

Recommendations are given with review of final report (USEPA, 1992b; EFGWB 92-0428).

9. BACKGROUND:

See Background in the review of the final report for small-scale retrospective ground-water monitoring study (USEPA, 1992b; EFGWB 92-0428).

10. DISCUSSION:

The following reviews are general in scope, because the final report for the small-scale retrospective ground-water study has been submitted and reviewed (USEPA, 1992b).

These comments evaluate how well the study followed the protocol and addressed the primary objectives of the study. Several general comments concerning the submitted studies should be made. First, the studies were conducted without a final and EFGWB approved protocol. Second, mid-way through the studies BASF became the sole registrant, which resulted in a change of the individuals conducting the studies. And finally, the registrant continually modified the protocol, in many instances without EFGWB concurrence.

Study A. Groundwater Vulnerability Analysis for Acifluorfen Application. (MRID #416511-00, #416511-01, originally to be EFGWB 91-0098)

The registrant conducted an analysis to identify geographical areas potentially vulnerable to ground-water contamination from the agricultural uses of herbicides with the active ingredient acifluorfen (Blazer® and Tackle®). Factors considered to have an influence on pesticide

leaching to ground water included: soil type (permeability, particle size, pH, temperature, organic carbon, water content, clay content, CEC), hydrogeology (permeability, particle size, organic carbon, depth to water table), climate, and agronomic practices. Acifluorfen "use by county" was estimated from county acifluorfen sales information.

The registrant defined a "vulnerable area" as having:

- 1) soils having a sand, sandy loam, or loamy sand texture,
- 2) a permeable unsaturated zone (no restrictive layers, and
- 3) a water table within 30 feet of the land surface. Other documentation submitted by the registrant indicated that emphasis was placed upon subsurface soil texture, where USEPA (1990a) indicated that the EFGWB was also concerned about the surface layer(s).

Site Vulnerability

The hydrogeologic vulnerability analysis was conducted using acifluorfen sales data to determine use per county, the DBAPE soil database to identify vulnerable soils by series and county, and county DRASTIC varscores. Thirteen soil series representing 53 counties in 13 states were identified to be potentially vulnerable based upon surface soil properties, and acifluorfen use. DRASTIC scores further reduced the number of sites to 29 counties (varscores less than 148 were not considered). Further scrutiny of water table depths and subsoil conditions further reduced the potential number of counties to 24.

The registrant concluded that 17 of the 24 counties had water tables deeper than the NC site, and that 10 of the 17 had some restricting layers. The registrant then infers that "Because the retrospective study has shown no detectable residues in ground water, even at the extremely vulnerable North Carolina site, it is concluded that these 17 are not at risk relative to acifluorfen leaching". The remaining seven counties were judged by the registrant to contain areas of equivalent vulnerability to the NC site. Therefore, because of the absence of detections at the NC site, the registrants reasoned that it was unlikely that acifluorfen would reach ground water in any of these seven counties. The EFGWB does not concur with this reasoning, as it neglects factors such as soil temperature, precipitation duration, intensity, frequency, and distribution.

Comparison of Study Sites

Five small-scale retrospective/limited prospective ground-water monitoring studies were conducted by the registrant. The studies were located in five states,

Indiana (IN), North Carolina (NC), North Dakota (ND), Tennessee (TN), and Virginia (VA). The NC study site was considered by the registrant to be the most vulnerable. The registrant also considered the NC site to be more vulnerable than the prospective study site in Wisconsin (WI) (USEPA, 1989a). Although, the average surface soil textures (0 to 2 feet) were similar, [90-95% sand, 5% clay (the clay content does get as high as 13 percent in the 1 to 3' depth increment) at the NC site, and 93-95% sand, 4% clay at the WI site], the depth to ground water was 18 feet at the WI site, but only 5 feet at NC. The state, county, depth to water, soil series, percent slope and sand, permeability, and DRASTIC varscores were summarize by the authors (on their Table 1, page 25).

The EFGWB considers the WI site to be the most vulnerable of the sites, but concurs that because of the shallow water table the NC is highly vulnerable. Several soils and environmental conditions appear to have an influence on the leachability of acifluorfen to ground water. The three factors which appeared to have the greatest influence on the acifluorfen residues leaching to the ground water at the Wisconsin site compared to the other five sites studied in the retrospective sites were: 1) high uniform sand content (93 to 97%) from the soils surface to 3.9 to 4.8 m below the surface, 2) application of irrigation water, 3) relatively lower soil temperatures.

The first apparent factor to influence the potential of acifluorfen to be leached to ground water is the low clay and silt contents of the soil. The Wisconsin site had the lowest clay (4%) and silt (1 - 3%) and highest sand (93 to 97%) throughout the total depths (3.9 - 4.8 m) of any of the cores, used for site characterization. The five retrospective sites had comparable sand-silt-clay compositions in the subsoil (> 3 feet - VA, > 2-4 feet - TN, > 3 feet - NC, > 2-4 feet - IN, and > 2 feet - ND, but in surface soils. The soil characterization data from the NC site had the highest sand contents throughout the total core lengths of the five retrospective sites. Particle size distributions above these depths generally contain more than 10% clay and more than 18% silt. For example, the Tennessee site contained less than 45% sand in the upper 2 feet of all four cores used in site characterization. Also the textural changes at some of the sites, because of layering of finer textured soils overlying coarse textured soils can also act as a restricting layer under unsaturated conditions.

² In some reports this sites is identified as the Arkansas site. Tennessee is correct.

The Wisconsin site was the only study location to receive supplemental irrigation water. The soils would then be kept wetter than at the other sites by the regularly scheduled irrigations. Because of the low water holding capacity and wetter conditions of this soil, leaching could be enhanced by irrigation. At the other sites leaching would be influenced by rainfall distributions, amounts, and intensity, and evapotranspiration.

The climatological conditions would also influence the rate of pesticide dissipation. The field dissipation half-lives ranged from around 6 days to 66 days. The warmer climates generally had shorter half-lives and colder climates had longer half-lives. The field dissipation half-life reported for the Wisconsin site was ≈ 15 days, whereas for the North Dakota site with somewhat similar climatic conditions the field dissipation half-life was around 56 to 66 days. The WI field dissipation half-life may be less than the North Dakota site, because the leaching component of dissipation was enhanced through the addition of irrigation water.

There were no acifluorfen detections reported in IN, NC³, ND, TN, or VA, after a twelve month period following the 1989 (first) application. Monitoring activities were still being conducted at the IN and ND sites, at the time that this report was submitted. Acifluorfen residues had also been detected in ground water at the prospective site in Waushara County, WI, thus demonstrating the potential to leach to ground water.

Preferential Flow

The registrant suggests that ~~solute~~ the transport mechanism operating at the five retrospective study sites was the convective-dispersive transport type. Previously, the registrant suggested that macropore flow was the transport mechanism active at the Wisconsin study site (Norris, 1989; USEPA, 1989a). While the data submitted (Norris, 1989) does not preclude this route of transport, water movement through the vadose zone appears to be by conventional means (saturated/unsaturated) flow. Eleven of the 16 suction lysimeters had multiple acifluorfen residue detections. Also, many of the lysimeters within a cluster had several residue detections occurring on the same sampling date. If macropore flow had been the primary or only mode of solute transport, the suction lysimeters would

³ Detections of acifluorfen residues in at this site were stated to have been "a false positive" by the registrant.

not have been as effective in collecting water samples with acifluorfen residues.

Suction lysimeter (and tensiometers) will only maintain suction down to about 60 to 80 centibars, thus, indicating a somewhat wet soil (0 centibars is a saturated soil and 1500 centibars is often used as an estimate of the suction at wilting point). Once the suction drops below (soil dries out) the 60 to 80 centibars the suction will break, and no additional sample will be collected. It is unlikely that the suction lysimeters would have been able to collect residues, had macropores been involved. A lysimeter in contact with a macropore would only maintain suction when the macropore was full or nearly full of water, when the macropore empties out, suction would be broken.

Study Summary: The information submitted by the registrant, appears to generally support the judgement that the retrospective study sites were "hydrogeologically vulnerable" to ground-water contamination. Detailed information was not submitted (in this document) to support their contention concerning preferential flow. Data were not supplied in this document to demonstrate the occurrence of preferential flow at the Wisconsin site, nor preclude it at any of the other sites. Other factors such as frequency, duration, and intensity of precipitation, during the study period, and a more detailed investigations of the hydrogeologic conditions occurring at each site ^{are} necessary to fully assess the vulnerability of each site.

Several limitations have previously been noted in earlier reviews. EFGWB, as noted in previous reviews (USEPA, 1990a), does not concur with the registrant focusing on the texture of the subsoil (sandy) and not taking into account the texture of the surface soil. The Branch believes that the soil texture and organic matter content of the surface layers are also important (perhaps the most important), as these layers represent the most active (biologically and chemically) portion of the soil.

Although the registrant indicates that restricting layers were observed at several of the sites not selected, the sites selected by the registrant may also exhibit soil properties which restrict water flow. Many individuals consider only clay layers, compacted zones, caliche, hard pans, etc. as "the layer or layers" which restrict water flow. However, because much of the water flow and corresponding solute transport occurs as unsaturated flow, abrupt changes in soil texture can also greatly influence water movement and solute transport. For example, a finer textured soil overlying a coarser texture may also act as a barrier to unsaturated water flow. Several of the soil

cores at the Soil core S-3 from the Tennessee site illustrate this phenomenon very nicely (Table 1). The particle size of clay and silt is much less than sand; therefore, clay and silt are able to hold water more tightly than sand. Even though the sand has a greater saturated hydraulic conductivity than either the silt and clay, the low matric potential at the wetting front prevents the large, highly conductive pores associated with the sand from filling. The water content at the finer/coarser interface will continue to increase, until the matric potential increases, allowing the larger pores of the sand to fill with water.

Therefore, because several of the sites selected by the registrant exhibit the conditions where finer textured soil material overlies coarser textured soil material vertical water flow may become restricted.

Table 1. Soil particle size distribution
Soil core S-3; Tennessee Study Site

Depth (feet)	Sand (%)	Silt (%)	Clay (%)
0-1	30	52	18
1-2	24	54	22
2-4	78	18	4
4-6	94	2	4
6-8	94	2	4
8-9	94	2	4

Study B: Final Protocol: A small-scale retrospective groundwater monitoring study and limited prospective field dissipation study with acifluorfen-sodium, the active ingredient (Protocol is dated February 23, 1989, originally to be EFGWB # 90-0544).

The Final Protocol document was given only a cursory review, as the final report has been submitted by the registrant. The lack of specific comments should not be assumed to indicate an acceptance or completeness of the submitted protocol. Comments on the protocol document should be considered for the acifluorfen study, and future ground-water monitoring studies as well. New guidelines for ground-water monitoring studies are currently being developed by the Ground Water Section, and exist in draft form. They should be available in the near future. It would be of considerable benefit for the registrant prior to conducting any future studies to meet with the Ground Water Section to obtain guidance before conducting ground water studies. These comments also refer to a "retrospective type study" more information will be required for a "prospective type study". The specific SOP's (Standard Operating Procedures) were only superficially reviewed.

Experimental Design. Protocol, page 3 of 12

Deficiencies have been previously identified in other reviews (USEPA, 1990a,b,c). A minimum of three well-clusters rather than two are required in ground-water monitoring studies. Additionally an upgradient well is also often necessary. The length of the study will depend upon the environmental chemistry of the pesticide and its degradates, i.e., the more persistent the pesticide residues, the longer the study will last. Sampling intervals will also need to reflect the environmental chemistry of the pesticide, and the specific site being evaluated. The half-life appears to be fairly rapid, sampling intervals may need to be much more frequent, i.e., weekly, bi-weekly, daily, etc. Additionally, prior use will generally be more than one or two years as stated on page 3 of 12.

Site Location, Protocol, page 5 of 12.

Much of the information listed in the protocol to be included was not included. Ideally a portion of a USGS 7.5 minute quadrangle map (a good quality reproduction) should be included with the study to clearly identify, state, county, township, latitude and longitude, and Township and Range numbers. These maps can also go along way in aiding in the identification of nearby structures, streams, ditch and other water bodies, etc. The geology and climate of study areas should also be described.

Site Characteristics, Protocol page 5 of 12.

Of the six items listed only number #3 was adequately fulfilled, although some data was missing for several of the sites. Slope direction and inclination should be defined as should location within the landscape (crest, backslope, footslope) and shape of landscape element (linear, concave, or convex).

Soil Conservation Service (SCS) soil mapping unit descriptions, SCS soil profile descriptions for the soils series in the mapping unit at the study site(s) should be included (major soils plus inclusions, and competing series). Soil profiles should be characterized according to SCS criteria (USDA-SCS. 1951).

The ground-water depth, direction of flow, gradient, and aquifer characteristics such as hydraulic conductivity should be measured. Ground water contour maps should be provided. Seasonal variation in ground water should be evaluated. External factors (wells, ditches, wetlands) which may influence the aquifer should also be evaluated.

Meteorological Conditions and Records, Protocol 6 of 12.

The importance of collecting data on site can not be over emphasized. On site collection of meteorological data is required for prospective studies. It is also highly recommended that at least on site precipitation be measured during the growing season (i.e., spring, summer, fall), for retrospective studies, as rainfall distribution (amounts, intensity, and duration) can be quite variable, due to localized thunder storms, during this period.

Data Required on Each Set of Samples Taken, page 6 of 12.

Soil, Protocol, page 6 of 12.

The Ground Water Section does not generally approve of compositing samples, as no information concerning spatially variability can be obtained. (see next comment)

Sampling, Protocol, page 7 of 12.

A. Soil Sampling.

Item 2. Sampling Intervals: The sampling interval and duration of sampling will depend upon the environmental fate characteristics of the pesticide and its degradates, and the detection limits of the analytical procedures. Rapidly decomposing residues may require a shorter time interval between samplings. Persistent residues will require a longer term study.

Item 5. Number of Core Samples: It is unclear whether all 16 cores will be composited or whether only the four cores from each quadrant will be composited. Based

upon the results submitted in the progress report (MRID # 414095-01), the number of cores ranged from one to 4. Therefore, it is unclear whether a total of 16 cores were collected with 4 cores from each quadrant of the study plot being composited, or whether all sixteen cores were composited into 1 core.

- Item 6. Core Depth Increments: Core depth increments should not exceed 0.15 m for the upper 0.9 meters and 0.3 m for the remaining samples. Sampling increment lengths will also depend on soil variability, and detection limit for pesticide and degradates of interest.

Soil Sample Processing, Protocol, page 8 of 12.

Water and soil samples were analyzed using methods previously approved by the Agency. The limit of detection was 1 µg/L for water and 10 µg/L for soil. The field water contents of the soil samples at the time of collection for residue analysis should be reported.

Study C: Progress Report: A small-scale retrospective ground-water monitoring study and limited prospective field dissipation study with acifluorfen-sodium, the active ingredient (Progress report is dated February 23, 1990). (MRID # 414095-01, originally to be EFGWB # 90-0545)

The progress report consisted of two sections; first, the retrospective and the limited prospective studies, and second selected study protocols. Because the Final Report has been submitted, this progress report was reviewed for general information, and to evaluate the registrants responses to previous EFGWB reviews.

The objective of the retrospective study was to monitor for acifluorfen-sodium residues in soil and ground water at five sites. The sites selected were to be vulnerable to vertical solute movement, and have a normal acifluorfen-sodium use history (2 of last 3-years, or 3 of the last 5-years). Additionally, a limited prospective study was to be conducted at each site, to obtain information concerning the dissipation, and leaching patterns of acifluorfen residues in the soil. Studies were conducted in Tennessee⁴, Indiana, North Carolina, North Dakota, and Virginia.

Three study sites were approved by the EFGWB, North Carolina, Virginia, Indiana (had tentative approval),

⁴ Report stated site was in Tennessee.

whereas the Tennessee and North Dakota studies were initiated prior to EFGWB approval (USEPA, 1990a). The Tennessee, Indiana, and Virginia sites had higher than desirable clay and/or silt contents in the surface sampling increments, 0 to 0.3 m and 0.3 to 0.6 m), respectively, only the North Carolina site had low clay and silt contents for these increments. EFGWB, as noted in previous reviews (USEPA, 1990a), does not concur with the registrant focusing on the texture of the subsoil (sandy) and not taking into account the texture of the surface soil. EFGWB believes that the soil texture and organic matter content of the surface layers are also important (perhaps the most important), as these layers represent the most active (biologically and chemically) portion of the soil. Several of the sites only had one year of previous use of acifluorfen.

Several items addressed in previous reviews have been addressed in total or in part by the registrant in this Progress Report, but many items still need to be addressed.

A third cluster of monitoring wells has been installed at all the sites, except the one North Dakota. (The third well cluster was added at North Dakota). The SCS soil series has only been identified at two sites, Arkansas, Indiana, and North Carolina remain. The soil series may be incorrectly identified, should it be designated the Arveson rather than Averson? This should be checked.

The following items from the EFGWB # 90-0002, remain to be addressed:

Site characterization of the monitoring sites, with information on the local hydrology, including direction of ground water flow, map of the water table surface, and the location of relevant surface water features (EFGWB # 90-002, Recommendation 3).

Soil sampling increments were still too large (EFGWB # 90-002, Recommendation 4). Confusion still exist concerning the number of cores collected, as this varies from one to four.

The registrant was to continue monitoring at monthly intervals (EFGWB #90-0422). (This requirement appears to have been met).

ADDITIONAL COMMENTS

- a. The methods of soil analysis used for characterization should be referenced.

- b. Site specific soil profile descriptions, SCS profile description for each series, mapping unit description and profile descriptions for other series in the mapping unit should be included.

Study Summary: Acifluorfen residues in soils and ground water were monitored at five study sites, located in five states. Acifluorfen levels decreased with time in surface increments, and demonstrated some evidence of leaching. Acifluorfen residues (1 to 2 $\mu\text{g/L}$) were reported in ground water at the retrospective site in North Carolina.

Study D:

Title a.: Interim Reports: A small-scale retrospective groundwater monitoring study and limited prospective field dissipation study with acifluorfen-sodium, the active ingredient of Tackle® Brand Herbicide and Blazer® Brand Herbicide: Interim Report. Blasland and Bouck Engineers. (Dated April 1, 1991) BASF Registration No. 91/5048 (MRID # 418332-01; EFGWB # 91-0542) 122 Pages.

This interim report presents data obtained from the Indiana and North Dakota small scale retrospective and limited prospective ground-water monitoring studies. Both sites were treated with a second application (1990) of acifluorfen per EPA recommendations. Acifluorfen was applied at a rate of 0.25 lb ai./acre in June and July of 1990 for the ND and IN sites, respectively. Monitoring activities were to be conducted for an additional 12 months after this application. The interim report includes ground water and soil monitoring data from the two sites during the period of June 1990 through January 1991.

The study objective was to monitor the vertical movement of acifluorfen (leaching pattern) through the soil and occurrence in ground water at the two sites. Monitoring at the other three retrospective sites (TN, NC, and VA) were discontinued in 1990. The ground water monitoring at these three sites continued until the 12 month anniversary of the 1989 application (USEPA, 1990a). The report makes reference to an interim report dated September 28, 1990, no record of this report was found in the EFGWB.

2.3.2 Ground-Water Sampling, page 16 of 122.

Water-levels were measured and water samples collected immediately after application, and then at monthly intervals. There were no detections of acifluorfen residues greater than the detection limit of 1.0 $\mu\text{g/L}$, in any of the wells sampled. Several wells were not sampled because they were either went dry, had an insufficient sampled volume, or the well was frozen. Monitoring

activities were to continue for an additional six months at both sites.

Appendix A, Study Protocol.

The study protocol underwent considerable change over the course of the study which is reflected in the Protocol Amendments. Some of these changes were without EPA consent or concurrence.

Title b.: A small-scale retrospective ground-water monitoring study and limited prospective field dissipation study with acifluorfen-sodium, the active ingredient of Tackle® Brand Herbicide and Blazer® Brand Herbicide: Interim Report. Analysis of Well Water for Residues of Acifluorfen. BASF Corporation, Agricultural Research Center. BASF Registration No. 91/5049 (MRID # 418332-01; EFGWB # 91-0542) 17 pages

The report describes the analytical methods, quantification, recoveries, and laboratory results from the first 6 months of monitoring after a June or July 1990 application of acifluorfen at study sites in Indiana and North Dakota. The limit of quantification in water is 1.0 µg/L. There were no detections of acifluorfen in any of the water samples collected from the Indiana and North Dakota sites during the sampling period.

E. Title: Acifluorfen-Sodium: Small-Scale Retrospective Study. Summary of Well Water Analyses Eight Months After Application. (MRID # 414485-00, 414485-01; EFGWB # 90-0566).
17 page

Previous reviews recommended that monitoring continued at the retrospective sites (USEPA, 1990a,b). The Agency was informed on February 26, 1990 that acifluorfen residues of 1 $\mu\text{g/L}$ (well #C2W1) and 2 $\mu\text{g/L}$ (well# C3W1) were detected in two shallow water wells at the North Carolina small-scale retrospective study site, seven months after the 1989 (last) application of acifluorfen. (USEPA, 1990c). These concentrations were reportedly similar to levels of acifluorfen residues detected in the prospective study in Wisconsin.

Additional ground-water samples were collected for analysis from three of the retrospective sites eight months after the application of acifluorfen. Sites sampled were located in Indiana, North Carolina, and Virginia. The Tennessee and North Dakota sites were not sampled due to flooding in Tennessee and frozen ground in North Dakota. There were no detections of acifluorfen residues in any of these ground-water samples. The registrant failed to sample the standing water at the Tennessee site as agreed EFGWB # 90-002, page 10, Tennessee scenario #3. (USEPA, 1990a).

The North Carolina wells were re-sampled on March 6, 1990 and re-analyzed; no acifluorfen residues were detected in any of the wells. The two samples collected at seven months which had detections were also re-analyzed using a column reportedly having a greater degree of resolution. There were no detections, during the re-analysis, using a method with a 1.0 $\mu\text{g/L}$ detection limit. The earlier detections were classified by the registrant as "false positive", as the peak on chromatograph was not the acifluorfen peak.

The Branch does not concur that the only explanation for the detections seven months after application at the North Carolina site were related to the analytical methods. Although, the explanation and demonstration put forth by BASF does appear plausible. Several points of clarification should be added.

1. The original seventh month samples from wells C2W1 and C3W1 extracts were stored at room temperature in amber vials with Polyseal® caps (page 280 of 415 Final report MRID

⁵ Arkansas site was legally in Tennessee.

#21522-01: USEPA, 1992b, EFGWB 92-0428). Thus the samples may have changed.

2. Although the BASF utilized the same technique (the original OV-17 column method) as Rhone-Poulenc, because of different suppliers, results may not be comparable.

3. Since, the procedural % (81 to 129%) recovery and storage sample % (66 to 139%) recovery are somewhat variable, and the concentrations are close to detection limit, the method may have missed the acifluorfen content in the sample. Additionally, it would seem that the registrant should have used some other analytical method, during the re-evaluation process to validate the results.

4. Since this method converts the acifluorfen to acifluorfen-methyl rather than acifluorfen acid or salt, perhaps the conversion was not complete.

Therefore, the detections of acifluorfen residues at the North Carolina site should not entirely be overlooked.

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Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
ACIFLUORFEN, SODIUM SALT

Last Update on March 27, 1992

[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

LOGOUT	Reviewer: JW	Section Head: DW RWB	Date: 11/10/92
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Common Name: ACIFLUORFEN, SODIUM SALT

PC Code # : 114402

CAS #: 62476-59-9

Caswell #:

Chem. Name : 5-[2-CHLORO-4-(TRIFLUOROMETHYL)-PHENOXY]-2-NITRO-
BENZOIC ACID, SODIUM SALT

Action Type: Herbicide

Trade Names: TACKLE; BLAZER

(Formul'tn): 2 LC

Physical State:

Use : BROADLEAF WEEDS/GRASSES IN SOYBEANS
Patterns :
(% Usage) :
:

Empirical Form: $C_{14}H_6O_5F_3Na$

Molecular Wgt.: 383.70

Vapor Pressure: $7.50E-8$ Torr

Melting Point: $163-4$ °C

Boiling Point: °C

Log Kow :

pKa: 2.50 @ °C

Henry's :

E Atm. M3/Mol (Measured) $1.51E-13$ (calc'd)

Solubility in ...

Comments

Water	2.50E	5	ppm	@20.0	°C
Acetone	E		ppm	@	°C
Acetonitrile	E		ppm	@	°C
Benzene	E		ppm	@	°C
Chloroform	E		ppm	@	°C
Ethanol	E		ppm	@	°C
Methanol	E		ppm	@	°C
Toluene	E		ppm	@	°C
Xylene	E		ppm	@	°C
	E		ppm	@	°C
	E		ppm	@	°C

Hydrolysis (161-1)

[V] pH 5.0:>56 DAYS

[V] pH 7.0:>56 DAYS

[V] pH 9.0:>56 DAYS

[V] pH 3.0:>28 DAYS EVEN AT 40 C

[] pH :

[] pH :

22

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Photolysis (161-2, -3, -4)

[S] Water:92 HRS CONTINUOUS EXPOSURE

[] :TO UV @ 40-45 C

[] :

[] :

[] Soil :57 DAYS pH4

[] Air :

Aerobic Soil Metabolism (162-1)

[V] 1 MONTH SaLm

[V] 2-6 MONTHS SiLm

[V] APPROX. 170 DAYS IN LOAM

[V] 59 DAYS IN MISSISSIPPI SiLm

[S] 6 DAYS IN NEW JERSEY LmSd

[U] 14 days

[]

Anaerobic Soil Metabolism (162-2)

[]

[]

[]

[]

[S] <28 DAYS IN N.J. LmSd

[]

[]

Anaerobic Aquatic Metabolism (162-3)

[]

[]

[]

[]

[]

[]

[]

Aerobic Aquatic Metabolism (162-4)

[]

[]

[]

[]

[]

[]

[]

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Soil Partition Coefficient (Kd) (163-1)

[S] Kd, NEW JERSEY SiLm = 1.0

[]
[]
[]
[]
[]

Soil Rf Factors (163-1)

[] >.83 SiLm 3.8 %OM
[] >.83 SiLm 2.7 %OM
[] >.83 SaLm 2.1 %OM
[] >.83 Sa 0.95%OM
[] >.83 ClLm 1.9 %OM

[]

Laboratory Volatility (163-2)

[V] <1% VOLATILIZED UNDER AEROBIC CONDITIONS IN 3 MONTHS

[]

Field Volatility (163-3)

[]
[]

Terrestrial Field Dissipation (164-1)

[S] IN IRRIGATED WISCONSIN SAND SOIL, T_{1/2}= 0.5 MONTH; WITHIN
[] 2 MONTHS, TOTAL RESIDUE DECLINED TO NEAR DETECTION LIMIT.
[S] IN SiLm IN MISSISSIPPI, T_{1/2}= ABOUT 59 DAYS; THOUGH RAIN-
[] FALL FOR 3 MONTHS WAS 14.9", THERE WAS NO LEACHING BELOW
[] 3" IN THE SOIL.
[S] T_{1/2} = 10 to 22 days, Tennessee; silt loam
[S] T_{1/2} = 7 to 38 days, Indiana; sandy loam; leached to 12"
[S] T_{1/2} = 5 to 7 days, N.Carolina; loamy sand
[S] T_{1/2} = 55 to 66 days, N.Dakota; sandy loam; leached to 24"
[S] T_{1/2} = 8 to 16 days, Virginia; sandy loam

Aquatic Dissipation (164-2)

[] 1 DAY (SITE NOT GIVEN)
[]
[]
[]
[]
[]
[]

Forestry Dissipation (164-3)

[]
[]

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Long-Term Soil Dissipation (164-5)

[]
[]

Accumulation in Rotational Crops, Confined (165-1)

[S] ACCUM. OF C14 IN ROTATIONAL CROPS PLANTED 1 MONTH
[] AFTER SOIL TREATMENT WAS BETWEEN <.02 AND 1.05 PPM

Accumulation in Rotational Crops, Field (165-2)

[]
[]

Accumulation in Irrigated Crops (165-3)

[]
[]

Bioaccumulation in Fish (165-4)

[] BLUEGILL SUNFISH: AT END OF 30 DAY EXPOSURE TO 3.4 MG/L,
[] BCF= 1.1, 0.3, AND 1.9 X FOR WHOLE, FILLET, AND VISCERA

Bioaccumulation in Non-Target Organisms (165-5)

[]
[]

Ground Water Monitoring, Prospective (166-1)

[V] Acifluorfen residues found in WI, 1 to 46 ug/L(efgwb# 89-0701, see
[] efgwb #90-701
[]
[]

Ground Water Monitoring, Small Scale Retrospective (166-2)

[S] 5 retrospective studies: IN, NC, ND, TN, VA: false positive detections
[] in NC: residues very persistent at ND, persistent at IN
[] leaching of residues to 18 to 24 inches (efgwb92-0428)
[]

Ground Water Monitoring, Large Scale Retrospective (166-3)

[]
[]
[]
[]

Ground Water Monitoring, Miscellaneous Data (158.75)

[]
[]
[]

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Field Runoff (167-1)

[]
[]
[]
[]

Surface Water Monitoring (167-2)

[]
[]
[]
[]

Spray Drift, Droplet Spectrum (201-1)

[]
[]
[]
[]

Spray Drift, Field Evaluation (202-1)

[]
[]
[]
[]

Degradation Products

In aerobic soil test, major residue was parent compound, accounting for >40% after 6 months.

Major metabolite in anaerobic soil test was the acetamide of the amino analog of acifluorfen.

In photodegradation study, numerous degradates were formed, but none more than 10% of the original.

Koc = 113 estimate (U)

Prospective study MRID 411728-01 (efgwb 89-0701 see 90-0701)

Retrospective study MRID 421522-01 (efgwb 92-0428)

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Comments

Dissociates in H₂O to free acifluorfen acid (stable).
Photodegrades in H₂O (t_{1/2}=2wks) and on soil (t_{1/2}=57d); cleavage of diphenyl ether bond is principal route in sunlight.
Aerobic degradation t_{1/2}=1-6 mo; anaerobic degradation t_{1/2}=1wk.
Little effect on soil microbes. Free acid readily leaches; other degradation products do not leach. No field leaching was evident below 6" soil depth. Degradation in the field t_{1/2}=2-7 wks.
Highly mobile: After appl of 682 lb. AIA, amt leached from columns with 10" water = 79-93% of that applied.

References: FARM CHEM. HDBK.; EPA REVIEWS
Writer : RJH; JKW