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TO: Robert Taylor
Product Manager PM 25
Registration Division (H7505C)

FROM: Paul J. Mastradone, Ph.D., Chief *Paul J. Mastradone*
Environmental Chemistry Review Section #1
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 # :007969-OG

Common Name :Quinclorac

Product Name :FACET

Company Name :BASF CORPORATION

Purpose :Additional environmental fate data in response to EFGWB Review dated November 5, 1991

Type Product :Herbicide EFGWB #(s):92-0866 & 92-1053 Review Time:30 days

Action Code :101

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

161-1		162-4	42294102 & 42294103	Y	164-4		166-1	
161-2	42294101	S	163-1	42294105	S	164-5	166-2	
161-3		163-2			165-1	42294108 42294109	Y S	166-3
161-4		163-3			165-2		167-1	
162-1		164-1			165-3		167-2	
162-2		164-2	42294106 & 42294107	Y	165-4		201-1	
162-3	42294104	Y	164-3		165-5		202-1	

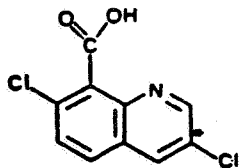
Y = Acceptable (Study satisfied the Guideline)/Concur P = Partial (Study partially satisfied the Guideline, but additional information is still needed)
S = Supplemental (Study provided useful information, but Guideline was not satisfied) N = Unacceptable (Study was rejected)/Non-Concur

1.0 CHEMICAL:

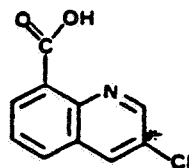
Common Name: Quinclorac, Facet

Chemical Name: 3,7-dichloro-8-quinolinecarboxylic acid

Chemical Structure:



BAS 514 H (quinclorac)



BH 514-1 (degradate)

2.0 TEST MATERIAL:

Studies 1, 2, 3, 4, 5, 6, 9, 10 and 11: Active ingredient

Studies 7 and 8: 50% WP

3.0 STUDY/ACTION TYPE:

- 3.1 Review additional environmental fate data sent by registrant in response to EFGWB's review dated 11/5/91 (EFGWB #s 91-0434, 91-0440, 91-0441 and 91-0756).
- 3.2 Review request for a time extension for the Spray Drift Data Requirements.
- 3.3 Review request for a waiver of the Accumulation in Irrigated Crops data requirement.

4.0 STUDY IDENTIFICATION:

Eswein, R. P. 1991. Freezer storage stability of quinclorac (BAS 514 H) in water: Final report. BASF Registration Document No. 9/5151. Unpublished study performed and submitted by BASF Corp. Agricultural Products, Research Triangle Park, NC. 31 pp. (422941-10)

Eubanks, M. W. 1992. Facet herbicide (quinclorac) aquatic use dissipation-- 1991 study 180-day progress report. BASF Study No. 91002. BASF Report No. ER91037. Unpublished study performed in the field by Jensen Agricultural Consultants, Inc., Washington, LA and Stoneville Associates, Inc., Greenville, MS, and analyzed chemically and submitted by BASF Corp. Research Triangle Park, NC. 334 pp. (422941-06)

Goetz, A.J. and V.W. Winkler. 1991. Photolysis of ¹⁴C-BAS 514 H in rice field water and paddy sediment. BASF Protocol No. 91095. BASF Report No. M9126. BASF Registration Document No. 91/5168. Unpublished study performed and submitted by BASF Corp. Research Triangle Park, NC. 97 pp. (422941-01)

Goetz, A.J. and V.W. Winkler. 1991. Aerobic aquatic metabolism of ¹⁴C-BAS 514 H. BASF Protocol No. M9103. BASF Report No. M9127. BASF Registration Document No. 91/5208. Unpublished study performed and submitted by BASF Corp. Research Triangle Park, NC. 52 pp. (422941-02)

Goetz, A.J. 1992. Further identification analysis of samples generated in an aerobic aquatic metabolism of ¹⁴C-BAS 514 H. BASF Protocol No. 91161. BASF Report No. M9201. BASF Registration Document No. 92/5022. Unpublished study performed and submitted by BASF Corp. Research Triangle Park, NC. 31 pp. (422941-03)

Goetz, A.J. 1992. Anaerobic aquatic metabolism of ¹⁴C-BAS 514 H after 180 days of incubation. BASF Protocol No. M9102. BASF Report No. M9132. BASF Registration Document No. 92/5023. Unpublished study performed and submitted by BASF Corp. Research Triangle Park, NC. 58 pp. (422941-04)

Goetz, A.J. 1992. Soil desorption of ¹⁴C-residues produced during a study of the dissipation of ¹⁴C-BAS 514 H in a simulated rice field ecosystem. BASF Protocol No. 92025. BASF Report No. M9202. BASF Registration Document No. 92/5024. Unpublished study performed and submitted by BASF Corp. Research Triangle Park, NC. 36 pp. (422941-05)

Goetz, A.J. and V.W. Winkler. 1992. Dissipation of ¹⁴C-BAS 514 H in a simulated rice field ecosystem after 119 days. BASF Study No. 91064. BASF Report No. M9131. BASF Registration Document No. 91/5046. Unpublished study performed by BASF Corp. Agricultural Products, Research Triangle Park, NC and Wildlife International, Ltd. Auburn, AL. and submitted by BASF Corp. Research Triangle Park, NC. 264 pp. (422941-07)

Nelson, J. M. 1992. Accumulation study of ¹⁴C-BAS 514 H in fall planted confined rotational crops. BASF Protocol No. M8909. BASF Report No. M9125. BASF Registration Document No. 92/5044. Unpublished study performed and submitted by BASF Corp. Agricultural Products, Research Triangle Park, NC. 107 pp. (422941-09)

Nelson, T.R. 1992. Overview of quinclorac environmental fate data submitted to EAP on April 22, 1992. BASF Registration Document No. 92/5042. Unpublished data summary report submitted by BASF Corporation, Research Triangle Park, NC. 22 pp. (No MRID Number)

Stewart, J. M. 1991. Methodology and validation data for the determination of quinclorac and metabolite BH 514-1 in soil (BASF Method Number A9001 and A9002). BASF Registration Document No. 9/5050. Unpublished study performed and submitted by BASF Corp. Agricultural Products, Research Triangle Park, NC. 78 pp. (422941-11)

Winkler, V. and J. M. Nelson. 1991. Accumulation study of ¹⁴C-BAS 514 H in annual confined rotational crops. BASF Protocol No. M8910. BASF Report No. M9123. BASF Registration Document No. 91/5170. Unpublished

study performed and submitted by BASF Corp. Agricultural Products,
Research Triangle Park, NC. 104 pp. (422941-08)

5.0 REVIEWED BY: Richard J. Mahler, Hydrologist
Environmental Chemistry Review Section 1, EFGWB, EFED

SIGNATURE:

Richard J. Mahler

DATE: SEP 17 1992

6.0 APPROVED BY: Paul J. Mastradone, Chief
Environmental Chemistry Review Section 1, EFGWB, EFED

SIGNATURE:

Paul J. Mastradone

DATE: SEP 17 1992

7.0 CONCLUSION: The laboratory data indicate that quinclorac is a very stable compound that does not degrade appreciably and is mobile. However, aquatic field studies indicate that the compound is less stable than the laboratory data indicates and is probably not mobile under normal use conditions. The use of quinclorac on rice fields probably presents the least ground water contamination and/or surface runoff risk as compared to terrestrial field uses.

7.1.1 The following studies have met the requirements of 40 CFR part 158.290 and the guidance of Subdivision N:

✓ 161-1--HYDROLYSIS

✓ 161-2--PHOTODEGRADATION IN WATER

✓ 161-3--PHOTODEGRADATION ON SOIL

162-1--AEROBIC SOIL METABOLISM

162-3--ANAEROBIC AQUATIC METABOLISM

162-4--AEROBIC AQUATIC METABOLISM

✓ 163-1--LEACHING AND ADSORPTION/DESORPTION

164-2--AQUATIC FIELD DISSIPATION

165-4--ACCUMULATION IN FISH.

165-1--CONFINED ACCUMULATION IN ROTATIONAL CROPS.

The following study is not required at the present time because proposed label language modifications will direct against the use of treated rice flood waters for irrigation purposes:

165-3--ACCUMULATION IN IRRIGATED CROPS.

The following studies are not required at the present time for the full registration of quinclorac on aquatic food (rice) use sites because the registrant will satisfy these data requirements through the Spray Drift Task Force:

201-1--DROPLET SIZE SPECTRUM

202-1--DRIFT-FIELD EVALUATION.

Based on the confined rotational data submitted, EFGWB concludes that a rotational interval of 309 days after application will result in concentrations of parent quinclorac from 0.001 to 0.110 ppm in rotational crops.

7.1.2 ENVIRONMENTAL FATE, LEACHING AND SURFACE RUNOFF FATE ASSESSMENTS

Based on its behavior, the dissipation of quinclorac in aquatic and terrestrial environments is substantially different.

In aquatic systems:

The compound applied to non-flooded rice fields is loosely bound to soil ($K_d = 0.05-0.516$), which upon flooding is released to the flood water. Based on the supplemental data provided, it appears that the half-lives of quinclorac depend on whether it is applied to soil and then flooded (27-70 days), or directly into floodwater (7-19 days). Once released into flood water, or applied directly to flood water, it is rapidly to moderately rapidly secondarily photodegraded to multiple compounds (none of which exceed 10%) and CO_2 .

Although the low K_d values indicate potential high mobility, the aquatic field dissipation data indicated little mobility below the 12 inch soil depth.

It does not appear that surface runoff of quinclorac is a major concern in rice culture.

In terrestrial systems:

The compound is similarly loosely sorbed by the soil upon application; however, it is likely that very little is available for secondary photolysis. It has a moderately rapid to moderately long aerobic half-life (18-166 days).

It may be mobile, since several instances of quinclorac detection below 12 inches were noted in the field studies.

There may be surface runoff concerns, since the K_d is low, solubility is relatively high and the chemical is near the soil surface.

Leaching assessment:

From the data submitted related to field dissipation studies, it appears that quinclorac does not leach in soil, under normal use conditions; since, in general, quinclorac was not detected below the 12 inch soil depth. In those instances where quinclorac was detected below 12 inches, the registrant attributed this to contamination; however, given the low K_d values reported for quinclorac, it is feasible that leaching below 12 inches may occur.

Detailed Environmental Fate Assessment for Aquatic Uses:

The acceptable as well as supplemental laboratory data indicate that the compound is stable to hydrolysis, photolysis in sterile water, as well as aerobic and anaerobic metabolism. The leaching data indicated that the compound is mobile. Furthermore, crop rotation restrictions listed on the rice label of 3 months for small grain crops and 10 months for all other crops also imply that quinclorac is persistent.

Conversely, a non-guideline supplementary study shows quinclorac to degrade photolytically in the presence of non-sterile rice paddy water and sediment with half-lives of 5.3 and 15.7 days. Similarly, the submitted aquatic field dissipation studies indicate that quinclorac is less persistent than the laboratory studies would indicate, with little reported mobility in soil.

The disparate behavior between laboratory and aquatic field dissipation studies can partly be explained by considering the data from the guideline and the supplemental non-guideline photolysis studies. In the guideline photolysis study, after 697 hours of irradiation in buffered pH 7 sterile water, quinclorac comprised 92% of the recovered radioactivity, indicating stability.

However, the photolytic half-lives of quinclorac added to non-sterile natural river water and solutions, H_2O_2 and humic acid sensitized waters, and to rice paddy water and aqueous buffered solutions containing humic acid or rose bengal, and to rice paddy water and sediment varied from 1 to 38 days.

In general when the make up of the aqueous solutions closely approximated natural conditions, such as the rice paddy waters, the half-lives were usually <20 days. The data indicate and EFGWB agrees that there are natural photosensitizers (including humic acids, tryptophan, tyrosine, riboflavin and H_2O_2 , NO_3 , NO_2 ozone and other

compounds) in natural water (such as rice paddies), which can enhance aqueous photodegradation, that are not present in sterilized water.

EFGWB concludes that this is a plausible theory since the registrants have submitted non-guideline data and literature reviews which show quinclorac and other zenobiotics to degrade more rapidly in naturally occurring waters, including rice paddy water and sediment, and those treated with soil humic materials and other naturally occurring substances than in sterilized waters. Study 1 (MRID 422941-01), in this submission, is especially pertinent for demonstrating the importance of natural photosensitizers to quinclorac degradation in the presence of light. In this study, soil and rice paddy water were obtained from a typical rice growing area, treated with quinclorac (with and without the ingredients used to make the wettable powder formulation) and exposed to light intermittently for 30 days. At the end of 30 days, the half-lives of quinclorac were 5.3 and 15.7 days, respectively, for the treatments with and without formulation ingredients. About 8 and 21% of the applied material, respectively, for quinclorac treatments with and without formulation ingredients were converted to CO_2 by the end of the experiment. The registrant noted that the formulated material accelerated the production of CO_2 , probably due to components of the formulation material that are known to act as photosensitizers. Furthermore, it should be mentioned that with both treatments (with and without formulation) between 75 to 90% of the CO_2 evolved occurred during the first 15 days and then the rate decreased. This decrease in the rate of photolysis (as measured by CO_2 production) shows as the needed photosensitizers are depleted, the rate of photolysis also decreases.

Furthermore, the dissipation of quinclorac in the newly submitted aqueous field dissipation studies with rice can generally be explained by the enhanced photolysis that occurs in the flood water. For example, in both studies when quinclorac was applied directly to flood water, almost 90% had dissipated by 30 days, suggesting dissipation by photolysis; however, when applied directly to soil it required 90 days for the same 90% dissipation. If quinclorac is applied directly to the soil and then flooded, the material in the soil needs to desorb in order to become available for aqueous photolysis, the alleged main route of quinclorac dissipation in rice fields.

Although none of the studies submitted individually describes completely the aqueous fate of quinclorac, all the studies together, plus the research cited in the literature reviews can be used to speculate on the fate:

1. In the presence of photosensitizers such as, humic acids, tryptophan, tyrosine, riboflavin and H_2O_2 , which can be found in natural waters (i.e., rice paddy flood water), oxygen is reduced to form superoxide anions which can react with hydrogen to form H_2O_2 . The peroxide photochemically decomposes in sunlight to form hydroxyl free radicals ($\text{HO}\cdot$) which, with NO_3 , NO_2 and ozone can oxidize quinclorac to 7-chloroquinoline carboxylic acid, 2-

hydroxy-3,7-dichloro quinoline carboxylic acid, 3,7-dichloroquinoline and 2-hydroxy-3,7-dichloroquinoline.

2. The above compounds can undergo further photolytic degradation to 3-chloronicotinic acid and 2-ethyl-5-chloroaniline and other small carbon fragments. These compounds can then bind with or become incorporated into the soil or humic material of the soil as a part of natural soil components (i.e., carbon pool of the soil), and/or can degrade to CO₂, the major terminal product.

Detailed Environmental Fate Assessment for Terrestrial Uses:

EFGWB notes that in five terrestrial field dissipation studies performed in GA, CA, MO, NJ and OR the half-lives of quinclorac applied at a 2.0 lb ai/A rate were, respectively, 18, 36, 44, 50 and 166 days, again generally indicating a moderately rapid to slow dissipation rate. However, the authors did not speculate on a route of dissipation for the terrestrial field studies.

Photodegradation is probably not a major route of degradation under terrestrial field conditions, since the data indicate that quinclorac when applied to soil in the laboratory is relatively stable (half-life 122-162 days) to photolysis. However, soil photolysis may have some importance in quinclorac degradation since the half-life in the dark controls were 382-529 days, suggesting light enhanced degradation. EFGWB notes that for soil photodegradation to be important in field situations, quinclorac molecules would have to migrate from the lower soil depths to the soil surface for photodegradation to occur. EFGWB also notes that in these soil photolysis studies, the statistical estimation of the half-lives are of limited value because the calculations involve extrapolation considerably beyond the experimental time limits (30 days) of the study; therefore, the half-lives given are only rough approximations.

The registrant has suggested that the reasons for the difference in results between laboratory (aerobic soil metabolism) and terrestrial field studies are probably the result of changes in microbial population or susceptibility of certain microbes to artificial situations that occur in the laboratory under aerobic conditions. This seems to be an acceptable theory since the laboratory data show that fresh soil, either alone or added to stored soil, increases degradation of quinclorac as compared to stored soil.

For example, in one study when stored soil was incubated with quinclorac in the dark, <0.1% ¹⁴C₂ was produced after 365 days. Conversely, when another stored soil was amended with a "fresh lysimeter soil", and incubated with quinclorac, about 10% ¹⁴C₂ was produced after 138 days. The half-life was estimated to be between 89 and 138 days.

Similar, another study measured ¹⁴C₂ production for 28 days after ¹⁴C-quinclorac was added to freshly collected soil from North Carolina. It

was shown that 5% of the applied radiolabel was released as $^{14}\text{CO}_2$ in 28 days.

In another study, degradation was assessed using carrots (a plant sensitive to about 4 ppb quinclorac in soil) as a biological indicator plant. In fresh clay loam, sandy loam, loam and organic soils collected fresh from fields, loss of herbicidal activity against carrots (as measured by % plant damage) was observed and quinclorac half-lives were estimated to be 30 to 90 days. EFGWB notes that when the fresh clay loam soil was steam sterilized or air dried to 20% field moisture capacity, sieved, moisture brought to 40 % and stored for 4 months at 20°C , no significant loss of herbicidal activity against carrots was noted for-up to 8 months.

However, one of the main concerns with these studies is that the registrant did not compare the same soils, stored or fresh, in order to conclusively show that there is something in fresh soils that is not in stored soils. Furthermore, EFGWB notes the non-guideline studies submitted indicate that even when fresh soil is used and degradation is increased as compared to stored soil, quinclorac can still be considered moderately stable to aerobic metabolism (i.e., half-life >30 days). These laboratory half-lives, however, are entirely consistent with the observed half-lives noted in the terrestrial field studies; therefore, it can be concluded that aerobic degradation of quinclorac to CO_2 in terrestrial situations has merit.

None of the individual aerobic metabolism and field dissipation studies submitted individually describes completely the aerobic fate of quinclorac; however, all the studies together, plus the research cited in the literature reviews can be used to speculate on the fate:

1. Quinclorac is initially metabolized to the primary degradate, BH514-1. This compound can then undergo further degradation to 5-chloro-2-hydroxy-nicotinic acid, which in turn is metabolized to 5-chloro-2,6-dihydroxy-nicotinic acid, 2-hydroxy-3-chloro-8-quinoline carboxylic acid, 7-chloro-8-quinoline carboxylic acid and 8-quinoline carboxylic acid and other small carbon fragments.
2. These compounds can then bind with or become incorporated into the soil or humic material of the soil as a part of natural soil components (i.e., carbon pool of the soil), and/or can degrade to CO_2 , a major terminal product.

Detailed Leaching Assessment:

From the data submitted related to field dissipation studies, it appears that quinclorac does not leach in soil, under normal use conditions. In general, quinclorac was not detected below the 12 inch soil depth. In those conditions where quinclorac was detected below 12 inches, the registrant attributed this to contamination. However, given the low K_d values reported for quinclorac, it is feasible that leaching below 12 inches occurs. Furthermore, in a study similar to the aforementioned

study, using carrots as biological indicator, there were significant differences in the soil leaching of freshly applied active ingredients in comparison to aged residues. Whereas, freshly applied residues leached in soil columns to at least 16 inches, residues aged 4 weeks did not leach below the 12 inch soil depth.

A field study, using about 0.22 and 1.0 lb ai/A of quinclorac and carrots as a biological indicator of quinclorac activity, was performed in 1986 (spring and autumn application) and 1987 (spring application). Soil samples were collected to a 1 meter (40 inches) depth at about 0, 2, 3, 5 and 6 months. In general, the major portion of the quinclorac residues from the Spring application were found at a depth no greater than 15 inches, while none of the pesticide leached below 20 inches. In the autumn applied treatment, the high rate resulted in a small amount of quinclorac residues leaching to the bottom of the sampling depth (40 inches), although the major biological activity occurred in the 0-24 inch depth.

It was also noted that after 3 months, in the lower rate of the spring and autumn applied treatments, no biological activity was noted in relation to damage to carrot plants. However, with the higher rate, biological activity was noted for up to 161 days and 196 days, respectively, in the spring and autumn applied treatments, indicating quinclorac's persistence.

It appears that quinclorac has a low potential to leach under normal field use situations. However, if a sizeable amount of precipitation occurs immediately after an application of quinclorac, leaching to lower levels in the soil is a distinct possibility, especially in sandy soils.

The only studies that have directly addressed the potential mobility of quinclorac and its degradates are the adsorption/desorption studies (Study 9, MRID 41063562 and Study 10, MRID 41063563, reviewed 12/3/90). In these studies, as mentioned previously, quinclorac was rated as having the potential to be very mobile; while the degradate, BAS 514-1, has the potential to be mobile to very mobile. The field studies submitted, aquatic and terrestrial, indicate little mobility of quinclorac residues in soil below the 12 inch depth.

The use of quinclorac on rice culture probably presents the least ground water contamination risk as compared to terrestrial field use. Soils used for rice culture are of very limited permeability. In fact, this probably is the main characteristic used in selecting a soil in which to grow rice, since rice production in soils which do not maintain a flood are not economically feasible under the present financial conditions. However, if economic conditions improve, the use of quinclorac on these soils that do not readily maintain a flood is possible, and movement of quinclorac through the soil may become important.

Detailed Surface Runoff Assessment:

It also appears that this chemical probably has a high potential to undergo dissolved runoff to near surface water, since the K_d is low, solubility is relatively high (64 ppm) and the chemical is near the soil surface. However, due to the nature of rice culture (i.e., levees surrounding the rice crop) which would retard runoff, movement of quinclorac residues by surface runoff would not be expected. Except under unusual circumstances, such as, excess precipitation immediately following an application of quinclorac, or the need to drain the fields to correct zinc deficiency on rice seedlings, it does not appear that surface runoff of quinclorac is a major concern in rice culture. However, movement of quinclorac residues by surface runoff may be a significant mode of dissipation under terrestrial use conditions.

SUMMARY OF STUDIES REVIEWED TO DATE

Hydrolysis: Fifty ppm [3-¹⁴C]Quinclorac was hydrolytically stable in aqueous buffered pH 5, 7, and 9 solutions. After 737 hours, quinclorac comprised $\geq 98\%$ of the applied in the three buffer solutions and was the only [¹⁴C]compound detected.

Aqueous Photolysis: [3-¹⁴C]Quinclorac (radiochemical purity 99.6%), at 54 ppm, degraded slightly (<10% of the applied) in a sterile aqueous pH 7 buffer solution that was irradiated for 697 hours using a xenon arc lamp at 25 C. After 697 hours of irradiation, quinclorac comprised 92% of the recovered radioactivity, an unidentified degradate comprised 1.6%, and 2.7% remained near the origin of the TLC plate.

Conversely, the photolytic half-lives of non-radiolabeled quinclorac in non-sterile natural river water and solutions containing activated sewage sludge were, respectively, 5 and 10 days. The authors concluded that photolysis was the main route of degradation in these two studies; however, they did not speculate as to what the degradates were.

Aerobic soil metabolism: [2,3,4-¹⁴C]Quinclorac, at 0.5 ppm, degraded slowly with a half-life of >1 year in two silt loam soils that were incubated aerobically in the dark at 23 °C. Quinclorac was the only [¹⁴C]compound detected in the extracts, with the exception of trace amounts of 3-chloro-8-quinolinecarboxylic acid (BH 514-1) recovered from the ionically-bound residue fraction.

In another aerobic metabolism study, using 2,3,4-¹⁴C-quinclorac applied to a sandy loam soil, after 28 days of incubation, the cumulative amount of ¹⁴CO₂ was equal to 5.11% of the initially applied radioactivity.

Anaerobic aquatic metabolism: [2,3,4-¹⁴C]Quinclorac, at 0.5 or 5 ppm, degraded with a half-life of >1 year in flooded silty clay loam and silty clay soils that were incubated under anaerobic conditions in the dark at 23 °C for 365 days. In all samples, quinclorac composed 100% of the extractable radioactivity.

¹⁴C-quinclorac applied at 1.5 ppm to soils from MS and LA were incubated at 25°C in the dark under anaerobic conditions and samples were taken periodically for 180 days. About 2% of the radioactivity was bound to the soil and about 90% of the parent quinclorac was still present after 180 days. Trace amounts of degradates (totaling 7% of the applied material) consisting of up to 8 components were observed but not identified. These results are consistent with previous studies.

Aerobic aquatic metabolism: [2,3,4-¹⁴C]Quinclorac at 0.5 ppm, degraded with a half-life of >1 year in flooded silty clay and silty clay loam soils that were incubated in aerated flasks in the dark at 23 °C for 360 days. At the end of the study, 74.5-79.7% of the applied radioactivity was extractable and most of this was undegraded quinclorac. No significant degradation of quinclorac occurred in flooded silty clay loam soil treated a 5 ppm. It was determined that 5.4 to 8.8% of the applied radioactivity was evolved as ¹⁴CO₂ during the study.

In contrast, in the flooded silty clay soil treated at 5 ppm, quinclorac degraded with an estimated half-life of 4.7 months. One degradate, 3-chloro-8-quinolinecarboxylic acid (BH 514-1) comprised 55.7% of the initial radioactivity after 6 months incubation and 30.8% after 12 months. Evolved ¹⁴CO₂ was not determined in this instance. Three other unidentified compounds were isolated in quantities ranging from 5.0 to 7.6% of the applied radioactivity.

¹⁴C-quinclorac applied at 1.5 ppm to soils from MS and LA were incubated at 25°C in the dark under aerobic conditions and samples were taken periodically for 30 days. About 1% of the radioactivity was bound to the soil and >93% of the parent quinclorac was still present after 30 days. These results are consistent with previous studies.

Mobility: Based on batch equilibrium (adsorption/desorption) studies, [¹⁴C]quinclorac was determined to be very mobile in sand, sandy loam, loam, clay loam, and silty clay soils. Freundlich K_d values were <0.05 for the sand soil, 0.067 for the sandy loam soil, 0.258 for the loam soil, 0.597 for the clay loam soil, and 0.516 for the silty clay soil. K_{oc} values ranged from 13 for the sandy loam soil to 54 for the clay loam soil. In general, adsorption increased with increasing soil organic matter content, CEC, and clay content.

Adsorption/desorption studies with [¹⁴C]3-chloro-8-quinolinecarboxylic acid (BH-514-1), the primary degradate of quinclorac, was determined to be mobile to very mobile in sand, sandy loam, loam, clay loam, and silty clay soils. Freundlich K_d values were 1.56 for the sand soil, 1.97 for the sandy loam soil, 11.4 for the loam soil, 13.3 for the clay loam soil, and 30.2 for the silty clay soil. K_{oc} values ranged from 860 for the sandy loam soil to 2080 for the silty clay soil. In general, adsorption increased with increasing soil organic matter content, CEC, and clay content.

Terrestrial field dissipation: In five field dissipation studies located in Oregon, Georgia, New Jersey, Missouri and California, quinclorac was

applied at a maximum of 2.0 lb ai/A. The resulting dissipation half-lives were reported to be 18, 36, 44, 50 and 166 days with coefficients of determination (R^2) ranging from 0.70 to 0.94. The authors did not speculate on the route of quinclorac degradation. In general, quinclorac was not detected below the 12 inch soil depth. However, in those cases where quinclorac was detected below 12 inches, the authors attributed this to contamination. EFGWB notes that, given the low K_d values reported for quinclorac, it is feasible that leaching below 12 inches occurred.

In a confined field dissipation study, $3\text{-}^{14}\text{C}$ -quinclorac applied to a soil at rates of 0.5 and 1.0 ppm, dissipated with half-lives of 42 and 50 days in a loam and sandy loam soil, respectively.

Aquatic field dissipation: A confined field aquatic dissipation study was initiated using a small plot of silty clay soil planted to rice and treated under nonflood conditions with labeled and unlabeled quinclorac for a total application of 0.75 lb ai/A. A permanent flood was established 7 days after treatment. Quinclorac residues were reported to dissipate from the floodwater with an estimated half-life of approximately 21 days.

In three aquatic field dissipation studies performed in three states, quinclorac was applied at a rate of 0.5 lb ai/A to flooded (California, Mississippi and Texas) and nonflooded (Mississippi and Texas) plots. The resulting dissipation half-lives were reported to vary from 7.1 to 9.6 days in the flood water of plots treated when flooded; conversely, when quinclorac was applied to nonflooded soil, the half-lives in soil were 36 days in MS and 70 days in TX.

^{14}C -quinclorac applied at a rate of 0.5 lb ai/A to soil contained in large outdoor containers, had a half-life of about 60 days when the treatment was applied to soil and then flooded 5 days later; while the half-life in the treatment that was applied to the flood water was about 43 days. In both experiments, essentially all of the radioactivity in the flood water was parent quinclorac. This suggests that quinclorac can desorb from the soil (when soil applied and then flooded) thereby allowing photolytic degradation of quinclorac to occur.

When the flood water was removed 91 days after flooding, levels of quinclorac had decreased to approximately 2 and 5% of the applied quinclorac for the treatments applied to soil (0.009 ppm) or into the flood water (0.22 ppm), respectively. While soil samples collected 119 days after treatment revealed that about 0.047 and 0.044 ppm was parent quinclorac for the treatments applied to soil and then flooded 5 days later or into the flood water, respectively. The remainder of the soil radioactivity (0.139 and 0.140 ppm) was associated with humic components (average = 15%) of the soil, bound (average = 20%) to soil components or are a complex mixture of polar components (average = 26%), none of which were identified since their individual concentrations were <0.01 ppm.

In two other aquatic field dissipation studies quinclorac was applied at a rate of 0.5 lb ai/A to fields in MS and LA either before flooding or after flooding. Quinclorac dissipated with half-lives of 27 and 39 days when

applied directly to soil and then flooded 5 days later. When quinclorac was applied directly to the flood water the half-lives were 10 and 19 days. In both cases, when quinclorac was applied directly to flood water, almost 90% had dissipated by 30 days; however, when applied directly to soil about 90% had dissipated by 90 days. This shows that quinclorac dissipates more rapidly when applied to flood water.

Confined accumulation: Application rates of 0.5 and 1.0 lb ai/A ¹⁴C-quinclorac were made to 4' x 8' plots of soil in which corn was growing and then 309 days later rotational crops (beets, chard and wheat) were planted. The concentration of parent quinclorac was between 0.001 to 0.025 ppm and <0.001 to 0.110 ppm in the crops treated with 0.5 and 1.0 lb ai/A, respectively; while the concentration of the methyl ester metabolite was <0.007 ppm, regardless of application rate. No other radioactive residues were identified that exceeded 10% TRR or 0.01 ppm. Concentration of parent quinclorac in the soil, at the time the crops were harvested, from the low and high treatments were, respectively, 0.01 and 0.024 ppm.

In another confined accumulation study, pre- and postemergence applications of ¹⁴C-quinclorac (0.45 and 0.47 lb ai/A) were applied to sorghum plants, growing in a 4 x 8 x 4 container outdoors, and then 132 days after the preemergence application, rotational crops (mustard, turnips and barley) were planted in the container. The concentration of parent quinclorac in the soil at the time of planting was about 0.048 ppm. The concentration of parent quinclorac in the various crops was between 0.010 to 0.129 ppm, while the concentration of the methyl ester was between <0.001 to 0.009 ppm. No other radioactive residues were identified that exceeded 10% TRR or 0.01 ppm. At the time of harvest, the concentration of parent quinclorac in the soil was about 0.006 ppm.

Fish accumulation: [¹⁴C]Quinclorac residues did not accumulate in channel catfish exposed to 1 ppm [¹⁴C]quinclorac in a flow-through system for 28 days. During the depuration period, [¹⁴C]residues were not detected (<0.013 ppm) in the aquarium water.

7.1.3 Because BASF is a member of the Spray Drift Task Force, EFGWB will not require droplet size spectrum or drift field evaluation data on Facet at this time. The registrant may satisfy these data requirements through the Spray Drift Task Force which is scheduled to submit its final report in December 1994. This assumes, however, that neither EEB, TOX, nor any other entity within OPP requires these data in advance of the Task Force's final report.

7.1.4 The registrant is proposing label language ("Do not use water from rice cultivation after a FACET application to irrigate any crops") which they believe will prohibit the use of treated rice paddy water for irrigation purposes. They also believe that the demonstrated rapid dissipation of quinclorac from rice paddy water should be sufficient to waive the requirement for this study. EFGWB does not have any objection to granting a waiver from the Accumulation in Irrigated Crops requirement.

8.0 RECOMMENDATIONS: Inform the registrants of EFGWB's specific reply to the status of the new studies submitted for review, to their request for a time extension for the Spray Drift Data Requirements and to their request for a waiver of the Accumulation in Irrigated Crops Study.

9.0 BACKGROUND:

9.1 In the EFGWB Science Chapter for the Quinclorac New Chemical Registration Standard dated December 3, 1990, the registrant submitted environmental fate studies in support of the registration of quinclorac. Because of the discrepancies between laboratory (which indicated persistence) and field data (which indicated moderately rapid dissipation), EFGWB at that time was not able to assess the environmental fate of quinclorac.

In reply to the EFGWB Science Chapter, the registrant presented their response. EFGWB carefully evaluated BASF's response to original comments and the new studies/data (See EFGWB's review dated November 7, 1991, of BASF response to the EFGWB science chapter). However, because of the discrepancy that still existed between field and laboratory studies (as well as some internal inconsistencies within studies), it still was not possible for EFGWB to assess the final environmental fate as well as, ground water and surface runoff fate of quinclorac at that time.

In response to EFGWB's review of November 7, 1991, the registrant submitted 11 new environmental fate studies (the subject of this review), plus an overview of the relationships between these new studies and previously submitted data. The new studies, acceptable and supplemental, in combination with data previously reviewed now provide EFGWB with a data base sufficient to assess the dissipation, and ground water and surface runoff fate of quinclorac when used in aquatic environments, such as for a rice crop.

9.2 The registrant has requested a time extension for the Spray Drift Data Requirements to coincide with the data submission schedule of the Spray Drift Task Force.

9.3 BASF is requesting a waiver from the Accumulation in Irrigated Crops study since they propose the following label language which they believe will prohibit use of treated rice paddy water for irrigation purposes:

Do not use water from rice cultivation after a FACET application to irrigate any crops.

10.0 DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

10.1 See attached Data Evaluation Reports for individual studies.

10.2 Stewart, J. M. 1991. Methodology and validation data for the determination of quinclorac and metabolite BH 514-1 in soil (BASF Method Number A9001 and A9002). BASF Registration Document No. 9/5050.

Unpublished study performed and submitted by BASF Corp. Agricultural Products, Research Triangle Park, NC. 78 pp. (422941-11).

Control soil samples from WI and FL were fortified with 0.01, 0.05 and 0.5 ppm BAS 514 H and BH 514-1. The fortified samples were analyzed by BASF Methods A9001 and A9002 to determine the recoveries of quinclorac and its metabolite in soil. The average recovery for quinclorac was 79±12% in WI soil and 79±8% in FL soil. The average recovery for BH 514-1 in WI soil was 81±6% and 76±8% in FL soil. The study demonstrates the validity of the two methods for the determination of quinclorac and its metabolite, BH 514-1 residues in soil.

11.0 COMPLETION OF ONE-LINER: Updated to include the data from acceptable and supplemental studies reviewed within the framework of this action.

12.0 CBI APPENDIX: No claim of confidentiality was made for any information contained in this submission on the basis of its falling within the scope of FIFRA Section 10 (d)(1)(A), (B), or (C).