DP Barcode :D180561,D180563
PC Code No. :103601
EFGWB Out : OCT 14 1992

TO: Walter Waldrop
Product Manager PM #71
Special Review and Reregistration Division (H7508W)

FROM: Akiva D. Abramovitch, Ph.D., Head
Environmental Chemistry Review Section #3
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 # :103601

Common Name :Glyphosate, isopropylamine salt

Product Name :Glifonox, Glycel, Lider, Rattler, Rodeo, Roundup, Weedoff.

Purpose :To review supplemental data to a Reregistration package.

Type Product :Herbicide Action Code: 629 EFGWB #(s): 92-1143,1144 Review Time: 3.0 days

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

161-1		162-4	42372503,41723601 Y	164-4		166-1	
161-2		163-1		164-5		166-2	
161-3		163-2		165-1	42372504,41543202 Y	166-3	
161-4		163-3		165-2		167-1	
162-1	42372501,41742901 Y	164-1		165-3	42372505,40541305 Y	167-2	
162-2		164-2	42383201,40881601 Y	165-4		201-1	
162-3	42372502,41723701 Y	164-3		165-5		202-1	

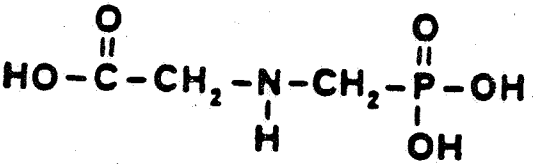
Y = Acceptable (Study satisfied the Guideline)/Concur. P = Partial (Study partially satisfied the Guideline, but additional information is still needed)
S = Supplemental (Study provided useful information, but Guideline was not satisfied) N = Unacceptable (Study was rejected)/Non-Concur

1. CHEMICAL:
Common Name: Glyphosate

Chemical Name: Isopropylamine salt of N-(phosphono-methyl) glycine.

Type of product: Herbicide

Chemical Structure:



Physical/Chemical Properties

Molecular formula:	$C_3H_8NO_5P$.
Molecular weight:	169.1 g/mole.
Physical state:	Zwitterion structure which forms colorless crystals.
Melting point:	200 C.
Bulk density:	0.5 g/cm^3.
Solubility (25 C):	12 g/l water; insoluble in common organic solvents.
Vapor pressure:	1.75 X 10^{-7} mm Hg at 25°C

2. TEST MATERIAL:

N/A

3. STUDY/ACTION TYPE: Review registrants response to a review of an aerobic soil metabolism 162-1, anaerobic aquatic metabolism 162-3, aerobic aquatic metabolism 162-4, confined rotational crop 165-1, accumulation in irrigated crop 165-3, and an aquatic dissipation 164-2 study.

4. STUDY IDENTIFICATION:

(1) MRID No:42372501 Honegger, Joy L. June 24, 1992. Addendum to MSL-10578 MRID#41742901 Aerobic Metabolism of [^{14}C] Glyphosate in Sandy Loam and Silt Loam Soils with Biometer Flask. Submitted by Monsanto Agricultural Company 800 N. Lindbergh Blvd. St. Louis, Missouri 63167.

(2) MRID No:42372502 Honegger, Joy L. June 24, 1992. Addendum to MSL-10577 MRID#41723701 Anaerobic Aquatic Metabolism of [^{14}C] Glyphosate. Submitted by Monsanto Agricultural Company 800 N. Lindbergh Blvd. St. Louis, Missouri 63167.

(3) MRID No:42372503 Honegger, Joy L. June 24, 1992. Addendum to MSL-10576 MRID#41723601 Aerobic Aquatic Metabolism of [^{14}C] Glyphosate. Submitted by Monsanto Agricultural Company 800 N. Lindbergh Blvd. St. Louis, Missouri 63167.

(4) MRID No:42372504 Honegger, Joy L. June 24, 1992. Addendum to MSL-9811 MRID#41543202 AND #41543201 Part II: Quantitation,

2

Characterization, and Identification of Glyphosate and Its Metabolites in Rotational Crops. Submitted by Monsanto Agricultural Company 800 N. Lindbergh Blvd. St. Louis, Missouri 63167.

(5) MRID No:42372505 Honegger, Joy L. June 24, 1992. Addendum to MSL-7633 MRID#40541305 Irrigated Crop Study. Determination of Glyphosate Residues in Crops, Irrigation Water, Sediment and Soil Following Treatment of Irrigation Source with Rodeo Herbicide. Submitted by Monsanto Agricultural Company 800 N. Lindbergh Blvd. St. Louis, Missouri 63167.

(6) MRID No:42383201 Goure William F. June 29, 1992. Addendum to MSL-8332 MRID#40881601 Aquatic Dissipation of Glyphosate and AMPA in Water and Soil Sediment Following Applications of Glyphosate in Irrigated Crop and Forestry Uses. Submitted by Monsanto Agricultural Company 800 N. Lindbergh Blvd. St. Louis, Missouri 63167.

5. REVIEWED BY:

Kevin L. Poff, Chemist
Environmental Chemistry Review Section #3
Environmental Fate and Groundwater Branch/EFED

Date: 10/6/92

6. APPROVED BY:

Akiva Abramovitch, Ph.D., Chemist
Environmental Chemistry Review Section #3
Environmental Fate and Groundwater Branch/EFED

Date: 10/15/92

7. CONCLUSIONS:

Aerobic Soil Metabolism

1. The registrant has provided sufficient information to upgrade study MRID #41742901 aerobic soil metabolism from supplemental to acceptable.

2. Glyphosate degraded rapidly with half-lives of < 1 day in sandy loam soil and 1-3 days in silt loam soil respectively that were incubated in the dark at 25°C and 75% of the 0.33 bar moisture. The major nonvolatile degradate was aminomethyl- phosphonic acid and reached a maximum conc. of 26.3-28.7% at 14 days. At 12 months postreatment, $^{14}CO_2$ was the major degradate and totaled ≥ 70.5% of the applied. Taking into account the supplemental data supplied by the registrant, degradation of glyphosate during storage stability gave recalculated half-life values of 1.85 and 2.06 days in the Kickapoo sandy loam and Dupo silt loam respectively.

Anaerobic Aquatic Metabolism

1. The registrant has provided sufficient information to upgrade

study MRID #41723701 anaerobic aquatic metabolism from supplemental to acceptable.

2. [^{14}C]Glyphosate (radiochemical purity 98.8%), at 3.87 ppm, degraded with an observed half-life of 4-7 days (a recalculated half-life provided by the registrant in supplemental information was 8.1 days) in anaerobic (flooded plus nitrogen atmosphere) silty clay loam sediment that was incubated in the dark at 25.4 ± 0.84 C for 1 year; the calculated half-life was 208 days (r = 0.749). Glyphosate decreased from 95.1-95.4% of the applied at day 0 to 47.0-47.6% at 7 days, then was variable ranging from 12.9 to 58.4% between 15 and 90 days, and was 17.8-22.8% at 180-365 days (Table XI). The major nonvolatile degradate was aminomethylphosphonic acid (AMPA). AMPA comprised 3.4-4.2% of the applied at day 0, increased to a maximum 31.6% at 15 days, then ranged from 13.9 to 23.7% up to 365 days. At 1 year posttreatment, evolved $^{14}CO_2$ was the major degradate totaling 35.0% of the applied radioactivity, organic volatiles accounted for 1.2%, and unextractable [^{14}C]residues accounted for 3.9%

Aerobic Aquatic Metabolism

1. The registrant has provided sufficient information to upgrade study MRID #41723601 aerobic aquatic metabolism from supplemental to acceptable.

2. [^{14}C]Glyphosate (radiochemical purity 98.8%), at 4.1 ppm, degraded with an observed half-life of approximately 7 days in flooded silty clay loam sediment that was incubated in the dark at 24.6 ± 0.57 C for 30 days; the calculated half-life was 14.4 days (r = 0.948). Glyphosate decreased from 91.6-94.4% of the applied at day 0 to 46.1-54.4% at 7 days, and was 21.8-22.6% at 30 days (Table VIII). The major nonvolatile degradate was aminomethylphosphonic acid (AMPA). AMPA comprised 3.1-3.4% of the applied at day 0, then increased and remained relatively stable comprising 19.4-25.0% at 7-30 days. At 30 days posttreatment, evolved $^{14}CO_2$ totaled an average 22.8% of the applied radioactivity, organic volatiles accounted for 2.5%, and unextractable [^{14}C]residues accounted for 7.2%

Confined Accumulation - Rotational Crops

1. The registrant has provided sufficient information to upgrade studies MRID #41543201 and MRID# 41543202 confined accumulation in rotational crops from supplemental to acceptable.

2. ^{14}C-Glyphosate residues accumulated in lettuce, carrots, and barley planted 30, 119, and 364 days after sandy loam soil was treated with glyphosate at 3.71 lb ai/A. Accumulation decreased as the length of the rotation increased. In crops planted at 30 days posttreatment, [^{14}C]residues at harvest were 0.097 ppm in lettuce, 0.051 and 0.037 ppm in carrot tops and roots, respectively, and 0.188 and 0.175 ppm in barley grain and straw, respectively. In

immature lettuce harvested at 40 and 60 days postplanting, [^{14}C]residues were 0.108 and 0.048 ppm, respectively (Table 7). In crops planted at 119 days posttreatment, [^{14}C]residues at harvest were 0.037 ppm in lettuce, 0.028 and 0.017 ppm in carrot tops and roots, respectively, and 0.078 and 0.056 ppm in barley grain and straw, respectively. In immature lettuce harvested at 28 and 48 days postplanting, [^{14}C]residues were 0.059 and 0.055 ppm, respectively (Table 7). In crops planted at 364 days posttreatment, [^{14}C]residues at harvest were 0.028 ppm in lettuce, 0.018 and 0.0096 ppm in carrot tops and roots, respectively, and 0.047 and 0.061 ppm in barley grain and straw, respectively. In immature lettuce harvested at 35 and 61 days postplanting, [^{14}C]residues were 0.057 and 0.043 ppm, respectively; in barley forage harvested at 48 days postplanting, [^{14}C]residues were 0.056 ppm.

Accumulation in Irrigated Crops

1. The registrant has provided sufficient information to upgrade study MRID #40541305 accumulation in irrigated crops from supplemental to acceptable.

2. Alfalfa, corn (grain and forage), grass (fescue or sudan) and lettuce were irrigated five to eight times during the 1987 growing season with glyphosate treated water containing a maximum of 21.3 ppm (on treatment day then fell to 0.46 ppm by 1 day after treatment) of glyphosate. Residues in the sediment beneath the treated water reached a maximum of 3.5 ppm at 14 days after treatment. Residues of glyphosate in the sprinkler water at the pond site were the highest 7 days after treatment at 0.12 ppm. One lettuce sample from the MO location (the pond site) at 29 days after treatment (of water source) and 5 irrigation events was found to contain 0.06 ppm glyphosate.

Aquatic Field Dissipation

1. The registrant has provided sufficient information to upgrade study MRID #40881601 aquatic dissipation study from supplemental to acceptable.

Data from the forestry dissipation study MRID #41552801 and the accumulation in irrigated crops study MRID #40541305 will be used in conjunction with the aquatic dissipation study MRID #40881601 to completely satisfy the 164-2 data requirement.

2. Glyphosate dissipated from the water with a registrant calculated half-life of 7.5 days and 120 days from the sediment of the farm pond in MO. Half-lives could not be calculated from the Corvalis OR, Cuthbert GA, and Chassell MI sites due to recharging events taking place from leaf drop, (MRID #40881601).

The irrigated crops study results demonstrate that when used under normal agricultural practices according to label directions for the control of aquatic weeds in irrigation sources, glyphosate and AMPA residues in irrigated soil are less than 0.05 ppm (see

attached supplemental information, (MRID #40541305).

In Michigan, Georgia and Oregon pond and stream water, the maximum glyphosate concentrations were measured immediately posttreatment and dissipated rapidly. Glyphosate accumulated in the pond sediment, and to a lesser extent in the stream sediments; glyphosate was present in pond sediment at ≥1 ppm in Michigan and Oregon at approximately 1 year posttreatment, (MRID #41552801

ENVIRONMENTAL FATE AND GROUND WATER ASSESSMENT

Glyphosate and its major degradate aminomethylphosphonic acid (AMPA) are stable to hydrolysis at pH 3, 6, and 9 from 5 to 35°C. Glyphosate is also stable to photodegradation in water and on soil. Acceptable adsorption/desorption data indicate that the compound adsorbs strongly to soils which would minimize its potential to contaminate ground water. Supplemental data from the aerobic soil metabolism 162-1 indicate that glyphosate degrades with a half-life of < 1 day (a new 162-1 study will be submitted by 3/94), and AMPA comprised 16.0-16.5% of the applied at day 0, was 26.3-28.7% at 14 days, decreased to 11.0-14.8% by 2 months, and was 1.5-2.2% at 9-12 months. There are no acceptable field dissipation studies 164-1, but glyphosate and AMPA in forest dissipation studies did leach into the underlying soil (below forest litter layer) but not below a depth of 6 inches and dissipated with half-lives of <1 day at the Michigan and Georgia sites and <14 days at the Oregon site. In pond and stream water, the maximum glyphosate concentrations were measured immediately posttreatment and dissipated rapidly. Glyphosate accumulated in the pond sediment, and, to a lesser extent, in the stream sediments; glyphosate was present in pond sediment at ≥1 ppm in Michigan and Oregon at approximately 1 year posttreatment.

8. RECOMMENDATIONS:

Inform the registrant that the Aerobic Soil Metabolism (162-1), Anaerobic Aquatic Metabolism (162-3), Aerobic Aquatic Metabolism (162-4), Confined Accumulation - Rotational Crops (165-1), Accumulation in Irrigated Crops (165-3), and the Aquatic Field Dissipation (164-2) data requirements are now completely satisfied.

The current status of environmental fate data requirements to support terrestrial food crop (field, vegetable, and tree fruit and nut crops), aquatic food crop (cranberries and rice), greenhouse nonfood crop, terrestrial nonfood crop (ornamental including turf), terrestrial nonfood (fallow and fence rows, highways and roadsides, railroad rights-of-way), aquatic non-food, domestic outdoor, and forestry (including Christmas tree plantations) sites is as follows:

Satisfied:

-Hydrolysis (161-1): File or reg # 524-308, 6/30/78; Stable at pH 3, 6, 9 at 5 and 35°C.

-Photodegradation in Water (161-2): EFGWB #90-0745, 92-0032, 90-0753,91-0356,92-0011,91-0506; Stable in pH 5, 7, and 9 buffered solutions under natural sunlight.

-Photodegradation on Soil (161-3): EFGWB # 90374, 6/28/90; Stable.

-Aerobic Soil Metabolism (162-1): This review, EFGWB #92-1143,1144 and (EFGWB #90-0745, 92-0032, 90-0753,91-0356,92-0011,91-0506); half-life values of 1.85 and 2.06 days in the Kickapoo sandy loam and Dupo silt loam respectively were reported. AMPA was the major degradate.

-Anaerobic Aquatic Metabolism (162-3): This review, EFGWB #92-1143,1144 and (EFGWB #90-0745, 92-0032, 90-0753,91-0356,92-0011,91-0506); half-life reported was 8.1 days in anaerobic (flooded plus nitrogen atmosphere) silty clay loam sediment. AMPA was the major degradate.

-Aerobic aquatic metabolism (162-4): This review, EFGWB #92-1143,1144 and (EFGWB #90-0745, 92-0032, 90-0753,91-0356,92-0011,91-0506); half-life of reported was 7 days in flooded silty clay loam sediment that was incubated in the dark at 24.6 $\pm$ 0.57 C for 30 days. AMPA was the major degradate.

-Leaching/ Adsorption/Desorption (163-1): EFGWB # 70727-29 (data taken from Dynamac review 6/7/85) (aged batch equilibrium) K_d values of 62, 90, 70, 22, and 175 were reported for Drummer silty clay loam, Ray silt, Spinks sandy loam, Lintonia sandy loam, and Cattail Swamp sediment respectively. After leaching 7 soils with 20" of water the recovered radioactivity in the soils was 93-100% of the applied.

-Aquatic Field Dissipation (164-2): This review, EFGWB #92-1143,1144 and (EFGWB #:92-0228, and #91-0763); MRID #40881601, Glyphosate dissipated from the water (irrigation source) with a registrant calculated half-life of 7.5 days and 120 days from the sediment of the farm pond in MO. MRID #41552801, In Michigan, Georgia and Oregon pond and stream water, the maximum glyphosate concentrations were measured immediately posttreatment and dissipated rapidly. Glyphosate accumulated in the pond sediment, and to a lesser extent in the stream sediments; glyphosate was present in pond sediment at $\geq$1 ppm in Michigan and Oregon at approximately 1 year posttreatment.

-Forestry Dissipation (164-3): EFGWB # 91-0763; aerially applied at 3.75 lb/A to forested sites in Michigan, Oregon, and Georgia, glyphosate averaged 652-1273 ppm in tree foliage immediately posttreatment, then declined rapidly with half-lives of <1 day at the Michigan and Georgia sites and <14 days at the Oregon site.

The forestry dissipation study results demonstrate that when used under normal silviculture practices according to label directions, the maximum combined glyphosate and AMPA residue level in soil is less than 5 ppm. Glyphosate and AMPA residues in soil

dissipate with time. The average half-life for the dissipation of glyphosate was 100 days, and ranged from 35 to 158 days. The average half-life for the dissipation of AMPA was 118 days, and ranged from 71 days to 165 days.

-Accumulation in Confined Rotational Crops (165-1): MRID #41543201 and MRID #41543202 (EFGWB #90-0745, 92-0032, 90-0753,91-0356,92-0011,91-0506) ^{14}C-Glyphosate residues **(expressed as fresh weight)** accumulated in lettuce, carrots, and barley planted 30, 119, and 364 days after sandy loam soil was treated with glyphosate at 3.71 lb ai/A. Accumulation decreased as the length of the rotation increased. In crops planted at 30 days posttreatment, [^{14}C]residues at harvest were 0.097 ppm in lettuce, 0.051 and 0.037 ppm in carrot tops and roots, respectively, and 0.188 and 0.175 ppm in barley grain and straw, respectively. In immature lettuce harvested at 40 and 60 days postplanting, [^{14}C]residues were 0.108 and 0.048 ppm, respectively (Table 7). In crops planted at 119 days posttreatment, [^{14}C]residues at harvest were 0.037 ppm in lettuce, 0.028 and 0.017 ppm in carrot tops and roots, respectively, and 0.078 and 0.056 ppm in barley grain and straw, respectively. In immature lettuce harvested at 28 and 48 days postplanting, [^{14}C]residues were 0.059 and 0.055 ppm, respectively (Table 7). In crops planted at 364 days posttreatment, [^{14}C]residues at harvest were 0.028 ppm in lettuce, 0.018 and 0.0096 ppm in carrot tops and roots, respectively, and 0.047 and 0.061 ppm in barley grain and straw, respectively. In immature lettuce harvested at 35 and 61 days postplanting, [^{14}C]residues were 0.057 and 0.043 ppm, respectively; in barley forage harvested at 48 days postplanting, [^{14}C]residues were 0.056 ppm.

-Accumulation in Irrigated Crops (165-3) MRID #40541305 (EFGWB #90-0745, 92-0032, 90-0753,91-0356,92-0011,91-0506); Alfalfa, corn (grain and forage), grass (fescue or sudan) and lettuce were irrigated five to eight times during the 1987 growing season with glyphosate treated water containing a maximum of 21.3 ppm (on treatment day then fell to 0.46 ppm by 1 day after treatment) of glyphosate. Residues in the sediment beneath the treated water reached a maximum of 3.5 ppm at 14 days after treatment. Residues of glyphosate in the sprinkler water at the pond site were the highest 7 days after treatment at 0.12 ppm. One lettuce sample from the MO location (the pond site) at 29 days after treatment (of water source) and 5 irrigation events was found to contain 0.06 ppm glyphosate.

-Bioaccumulation in Fish (165-4): (EFGWB #90-0745, 92-0032, 90-0753,91-0356,92-0011,91-0506); Maximum bioconcentration factors were 0.38X for edible tissues, 0.63X for nonedible tissues, and 0.52X for whole fish.

Waived:

-Laboratory Volatility (163-2) EFGWB #92-0707
-Field Volatility (163-3) EFGWB #92-0707

Not Satisfied:

-Terrestrial Field Dissipation (164-1)
-Droplet Spect. (201-1)
-Field Spray Drift Evaluation (202-1)

Reserved:

-Long Term Terrestrial Field Dissipation (164-5)
-Field Rotational Crops (165-2)
-Aquatic Nontarget Organisms (165-5)

9. BACKGROUND :

Glyphosate is a non-selective, non-residual, postemergence herbicide registered for use to control annual weeds, herbaceous and woody perennial, aquatic weeds, and annual and perennial grasses in food and non-food crop sites. It may be applied (in spring, summer, or fall) as a direct application in established crops; as a recirculating or wiper application to control weeds that are taller than the crop; or as a broadcast spray before planting, before emergence of the crop, or to achieve total vegetation kill for turf renovation or site preparation. In some states in the U.S., aerial application is permitted. Glyphosate is applied with a non-ionic surfactant. Single active ingredient formulations include emulsifiable concentrate, soluble concentrate, and ready-to-use. Glyphosate may be tank mixed with alachlor, simazine, linduron, metribuzin, and metolachlor.

10. DISCUSSION OF INDIVIDUAL STUDIES:

A) AEROBIC SOIL METABOLISM (MRID #41742901 AND SUPP. #42372501)

The registrants response to the deficiencies in MRID #41742901 are as follows: (study deficiencies are in italics)

In the day 0 soil extracts, parent glyphosate comprised only 44.5-50.6% of the applied radiocarbon in the sandy loam soil and 64.3-82.2% in the silt loam soil.

Storage stability data indicate that some degradation of glyphosate occurred between sampling and quantitative analysis which would decrease time 0 sampling concentrations of glyphosate. Also, CO_2 was not trapped on Day 0 which could account for some of the material loss. In addition, 2 to 8 hours elapsed between time of inoculation of the soil and soil extraction or freezing for Day 0 sampling time at which time glyphosate degraded.

Freezer storage stability data were not provided.

As mentioned above, the storage stability data indicate that some degradation of glyphosate occurred during storage and handling

of Day 0, 1 and 3 samples. By Day 7 glyphosate levels were stabilized in storage and were comparable to samples stored for periods up to 1 year. Because of this degradation a new aerobic metabolism half-life and degradation curve was calculated for each soil to take these storage stability effects into consideration. The initial half-life calculations were 0.6 and 1.1 days for Kickapoo sandy loam and Dupo silt loam respectively compared to values of 1.85 and 2.06 days when taking storage stability effects into consideration.

Three degradates that comprised up to 3.5% of the applied (0.140 ppm), 3.6% (0.144 ppm), and 0.6% (0.024 ppm) were not identified.

The three unknowns present in the Dupo silt loam (0.06, 0.04, and 0.004 ppm) and the Kickapoo sandy loam soil (0.09, 0.06, and 0.009 ppm) were observed in all samples, including the sterile samples, at the same concentrations throughout the study. Because of the detection of these products in the sterile soils as well as the viable soils indicate that the unknowns may not be the product of microbial metabolism but some other mechanism such as radiolysis. The same unknowns were present in the aerobic aquatic and anaerobic aquatic metabolism studies. The unknowns coeluted with impurities in a ^{14}C AMPA standard which they are small molecules derived from AMPA degradation. Using electrospray mass spectrometry a preliminary identification of one of the degradation products was made as hydroxymethylphosphonic acid, m/z 113.

B) ANAEROBIC AQUATIC METABOLISM MRID #41723701 AND SUPP. #42372502)

<u>The registrants response to the deficiencies in MRID #41723701 are as follows:</u> (study deficiencies are in italics)

An accurate assessment of the dissipation pattern of glyphosate and the formation and dissipation of its degradates could not be made because the concentrations of glyphosate and its degradate AMPA were too variable between 15 and 90 days posttreatment.

A new nonlinear model (Gustafson, D.I. and Holden, L.R.) was used to generate a new dissipation curve for glyphosate in an anaerobic environment which fits the data points better than using the pseudo first order linear model in mrid #41723701. The new dissipation curve predicts the half-life of glyphosate to be 8.1 days compared to a half-life 4-7 days in mrid #41723701.

Freezer storage stability data were not provided.

Supplemental data submitted by the registrant in this data package (attached) has shown that glyphosate was stable in the sediment extracts during the storage interval (9-11 months) of this study.

Two degradates that comprised up to 1.4% of the applied (0.05 ppm) and 6.2% (0.24 ppm) were not identified.

The unknowns that were not identified were not from microbial degradation but were generated via another mechanism, ie. radiolysis and were more than likely impurities associated with a ^{14}C AMPA standard (see registrants response above concerning the unknowns in the aerobic soil metabolism study).

C) AEROBIC AQUATIC METABOLISM (MRID #41723601 AND SUPP. #42372503)

The registrants response to the deficiencies in MRID #41723601 are as follows: (study deficiencies are in italics)

Two degradates that comprised up to 2.0% of the applied (0.08 ppm) and 2.8% (0.11 ppm) were not identified.

The unknowns that were not identified were not from microbial degradation but were generated via another mechanism, ie. radiolysis and were more than likely impurities associated with a ^{14}C AMPA standard (see registrants response above concerning the unknowns in the aerobic soil metabolism study).

D) CONFINED ACC. ROT. CROPS (MRID #41543202, #41543201 AND SUPP. #42372504)

The registrants response to the deficiencies in MRID #41543202, #41543201 are as follows: (study deficiencies are in italics)

Freezer storage stability data on glyphosate and its degradates in the plant and soil substrates must be provided.

Supplemental data submitted in this data package by the registrant (attached) has shown that glyphosate and AMPA was stable in the crop and soil matrices during the storage interval (7-9 months) of this study.

The test substance was incompletely characterized.

[^{14}C]Glyphosate (22.53 mCi/mole, radiochemical purity 96.5%) and [^{12}C]glyphosate, chemical purity 99% was dissolved in deionized water by the addition of isopropylamine. MON 0818 surfactant was then added to produce a concentrated aqueous solution that was applied at an application rate of 3.71 lbs/acre. The specific activity of the glyphosate in the spray solution was 1.31 mCi/mmole, the chemical purity was 99% and the radiochemical purity was 96.5%.

E) ACC. IN IRRIGATED CROPS (MRID #42372505 AND SUPP. #40541305)

The registrants response to the deficiencies in MRID #42372505 are as follows: (study deficiencies are in italics)

11

The registrant must explain the disparity between the accumulation in the confined rotational crop (165-1) and the apparent lack of accumulation in the irrigated crops (165-3); also, the rapid decline in glyphosate concentration in the pond water from Day 0 to Day 1 was not explained.

The lack of accumulation in the irrigated crops 165-3 study is the result of the very low levels of exposure of the irrigated crops to glyphosate levels. Also, the lower limits of method validation (0.05 ppm) found in the confined accumulation in rotational crops could not be achieved in the accumulation in irrigated crops due to using non-radiolabeled glyphosate.

The rapid decline of glyphosate concentrations in pond water can be attributed to: a) dilution of glyphosate and; b) removal of glyphosate from the pond water due to adsorption onto the pond sediment.

F) AQUATIC FIELD DISSIPATION (MRID #40881601 AND SUPP. #42383201)

The registrants response to the deficiencies in MRID #40881601 are as follows: (study deficiencies are in italics)

Soil "cores" were not taken to define the adsorption of glyphosate to various soil constituents over time and to provide information on the dissipation of glyphosate in sediment/soil. Soil sampling should have been done to a depth of at least 15 cm; sediment sampling should have been done to a depth of at least 5 cm.

The aquatic dissipation site was being used concomitantly in the forestry dissipation study and the irrigated crops study. The soil core data was not included in this report but is present in MRID #41552801 forestry dissipation study and MRID #40541305 irrigated crops study (see attached supplemental information)

A protocol was present but there was no detailed description of materials and methods in the experimental section of the report.

See attached information (page 11 of MRID #42383201).

11. COMPLETION OF ONE-LINER:

Attached.

12. CBI INDEX:

Not Applicable.

12

glyphosate metabolism 6-MEIO's

Page ___ is not included in this copy.

Pages 13 through 102 are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product inert impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _____.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
GLYPHOSATE
Last Update on September 23, 1992
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

LOGOUT	Reviewer:	Section Head:	Date: October 8, 1992

For HH

Common Name:GLYPHOSATE
Smiles Code:
PC Code # :103601 CAS #:1071-83-6 Caswell #:

Chem. Name :N-(PHOSPHONOMETHYL)GLYCINE

Action Type:Herbicide

Trade Names:GLYPHOSATE ISOPROPYLAMINE SALT; ROUNDUP; GLIFONOX
(Formul'tn): AQU. SOLN.; MAY BE FORMULATED WITH ALACHLOR OR ACIFLUORFEN
Physical State: COLORLESS CRYSTALS

Use :CONTROL OF MANY ANNUAL AND PERENNIAL GRASSES AND BROADLEAF
Patterns :WEEDS PLUS MANY TREE AND WOODY BRUSH SPECIES IN CROPLAND
(% Usage) :AND NONCROP SITES.
:

Empirical Form: $C_3H_8NO_5P$
Molecular Wgt.: 169.10 Vapor Pressure: 7.50E -8 Torr
Melting Point : 200 °C Boiling Point: NA °C
Log Kow : pKa: @ °C
Henry's : 2.00E-11 Atm. M3/Mol (Measured) 1.39E-12 (calc'd)

Solubility in ...				Comments
Water	1.20E 4	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)
[ ] pH 5.0:
[ ] pH 7.0:
[V] pH 9.0:STABLE
[V] pH 3.0:STABLE
[V] pH 6.0:STABLE
[ ] pH :

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
GLYPHOSATE
Last Update on September 23, 1992
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Photolysis (161-2, -3, -4)
[V] Water:Stable at pH 5,7,9 sunlight, 14.7-28.6 C (calc.half-life
[ ] : >410 days)
[ ] :
[ ] :

[V] Soil :90.2 day half-life in sandy loam, irradiated, 96.3 non-irr.
[ ] Air :

Aerobic Soil Metabolism (162-1)
[V] T 1/2= < 1 day SdLm
[V] T 1/2= 1-3 day SiLm
[ ]
[ ]
[ ]
[ ]
[ ]

Anaerobic Soil Metabolism (162-2)
[ ] See anaerobic aquatic metabolism.
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Anaerobic Aquatic Metabolism (162-3)
[S] AT pH 4.2, T1/2 = 5 WEEKS
[S] " " 6.3, " = 7 WEEKS
[V] T 1/2= 8.1 days in silty clay loam sediment, major degradate was
[ ] AMPA.
[ ]
[ ]
[ ]

Aerobic Aquatic Metabolism (162-4)
[S] IN pH 6.2 NATURAL WATER, 51-
[ ] 61% REMAINED AFTER 63 DAYS.
[V] T 1/2= 7 days SiClLm, AMPA was the major degradate.
[ ]
[ ]
[ ]
[ ]

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
GLYPHOSATE
Last Update on September 23, 1992
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Soil Partition Coefficient (Kd) (163-1)

[V]	DRUMMER SiClLm	62
[V]	RAY SILT	90
[V]	SPINKS SdLm	70
[V]	LINTONIA SdLm	22
[ ]		
[ ]		

Soil Rf Factors (163-1)
[V] AFTER LEACHING 7 SOILS WITH
[ ] 20" WATER, THE RECOVERED
[ ] RADIOACT. IN THE SOILS WAS
[ ] 93-100% OF THAT APPLIED.
[ ]
[ ]

Laboratory Volatility (163-2)
[ ] Waived
[ ]

Field Volatility (163-3)
[ ] Waived
[ ]

Terrestrial Field Dissipation (164-1)
[S] IN LmSd AND SiClLm SOILS, T1/2= <1.5 AND 3 WEEKS.
[S] AFTER APPL OF UP TO 8 LBS AIA, DISSIPATION FROM UPPER 6" OF
[ ] FEW SOILS HAD T1/2= < 64 DAYS; IN SdLm T1/2=194-301 DAYS.
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Aquatic Dissipation (164-2)
[V] t1/2= 7.5 days from irrigation source, t1/2= 120 days from
[ ] sediment; In MI,GA and OR pond + stream water max conc. were
[ ] measured imm. following app. and decreased rapidly. In pond
[ ] sediment gly. was at ~1.00 ppm at 1 yr. post treatment.
[ ]
[ ]

Forestry Dissipation (164-3)
[V] half-lives of <1 day, MI and GA sites, <14 days in OR. Glyphos.
[ ] or AMPA did not leach in the soil below 6 inches.

Long-Term Soil Dissipation (164-5)
[ ]
[ ]

Accumulation in Rotational Crops, Confined (165-1)
[V] 0.028 to 0.108 ppm, lettuce;0.018 to 0.051 ppm carrot tops,0/0096
[ ] to 0.037 ppm(roots) at 3.71 lbs.ai/A,30,119,364 days after treat.

Accumulation in Rotational Crops, Field (165-2)
[ ]
[ ]

Accumulation in Irrigated Crops (165-3)
[V] At 21.3ppm int.conc. then 0.46 at 1 day posttreatment alfalfa,
[ ] corn, grass did not acc. residues. Lettuce was at 0.06 ppm gly.

Bioaccumulation in Fish (165-4)
[V] Max conc. in bluegillsunfish, exposed to 12 ppm for 35 days, 0.38
[ ] X edible tissue, 0.63X nonedible tissue, 0.52X for whole fish

Bioaccumulation in Non-Target Organisms (165-5)
[ ]
[ ]

Ground Water Monitoring, Prospective (166-1)
[ ]
[ ]
[ ]
[ ]

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

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

Ground Water Monitoring, Miscellaneous Data (158.75)
[ ]
[ ]
[ ]

Field Runoff (167-1)
[ ]
[ ]
[ ]
[ ]

Surface Water Monitoring (167-2)
[ ]
[ ]
[ ]
[ ]

Spray Drift, Droplet Spectrum (201-1)
[ ]
[ ]
[ ]
[ ]

Spray Drift, Field Evaluation (202-1)
[ ]
[ ]
[ ]
[ ]

Degradation Products

Aminomethylphosphonic acid (max conc of .21 ppm at day 31 in sandy loam soil in Iowa). In aerobic aquatic studies, this acid increased with time, amounting in one case to 23% of the applied radioactivity.
Aminomethylphosphonic acid (AMPA),Aerobic Soil, 26 to 28% of applid at 14 days;CO2 > 70.5% of applied at 12 months
(AMPA), Anaerobic Aquatic, 31% of applied at 15 days then 14 to 24% up to 365 days;CO2 at 35% of applied at 1 year
(AMPA), Aerobic Aquatic, 19-25% of applied from 7 to 30 days; CO2 23% of applied at 30 days

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
GLYPHOSATE
Last Update on September 23, 1992
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Comments

Glyphosate dissipated in pond water with T1/2 of 14-21 days; none detectable after 129 days. Sediment conc. increased from 190 ppb at day 7 to 680 ppb at day 127.
Residues in 4-wk old soybeans grown in aged water extracted soils treated at 4 ppm ranged from .76 to 4.12 ppb; residues in the soil during the growing period ranged from .64 to 3.72 ppm.

References: WSSA 83, EFGWB Reviews
Writer : PJH,KLP