Date Out:

Chemical Code: 417300
DP Barcode: D231065, D241004, D248484

ENVIRONMENTAL FATE AND GROUND WATER BRANCH

Review Action

To: Jim Tompkins, PM #25
Reregistration Division (7505C)

From: Kevin Poff, Chemist
Fate & Monitoring Branch/EFED (7507C) Kevin Poff 3/9/99

Thru: Betsy Behl, Chief
Fate & Monitoring Branch/EFED (7507C) Betsy Behl 3/5/99

Attached, please find the FMB review of...

Common Name:	Glyphosate (ANSI)	**Trade name:**	Glygran 80% WDG
Company Name:	Industria Prodotti Chimici S.P.A.		
ID #:	0033660-GT		
Purpose:	To review data to support the terrestrial non-food use of glyphosate.		

Type Product:	Action Code:	EFGWB #(s):	Review Time:
Herbicide	176		30 days

STATUS OF STUDIES IN THIS PACKAGE:

Guideline #	MRID	Status[1]
161-1	00108192	A
161-2	Waiver	A
163-1	00108192	A
162-1	44125717	A
162-3	44125718	A
164-1	44125719	A

STATUS OF DATA REQUIREMENTS ADDRESSED IN THIS PACKAGE:

Guideline #	Status[2]
161-1	S
163-1	S
162-1	S
162-3	S
164-1	S

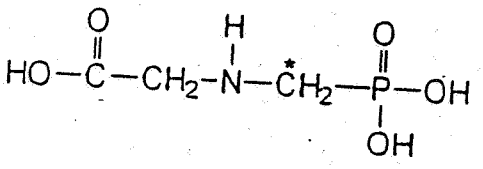
[1]Study Status Codes: A=Acceptable U=Upgradeable C=Ancillary I=Invalid.
[2]Data Requirement Status Codes: S=Satisfied P=Partially satisfied N=Not satisfied R=Reserved W=Waived.

1. CHEMICAL:
Common Name: Glyphosate (ANSI)

Chemical Name: N-(phosphono-methyl) glycine

Type of product: Herbicide

Chemical Structure:



Physical/Chemical Properties:
Molecular Formula: $C_3H_8NO_5P$
CAS RN: 1071-83-6
Molecular weight: 170.8 g/mole
Melting point: 210-212°C (Tec), 215-219°C (Pure)
Solubility: 12.28 g/L in water
UV max (water) 205 nm
Log K_{ow} = 2.78
Vapor pressure: 1.94 X 10^{-7} mm Hg
Dissociation constants: pKa_1 = 2.35
pKa_2 = 5.84
pKa_3 = 10.48

2. TEST MATERIAL:

See attached DER's.

3. STUDY/ACTION TYPE:

To review data to support the non-food use registration of glyphosate acid.

4. STUDY IDENTIFICATION:

(1) MRID No:00108192
Brightwell, B., Malik, J. (1978) Solubility, Volatility, Adsorption and Partition Coefficients, Leaching and Aquatic Metabolism of MON 0573 and MON 0101: Report No. MSL-0207. Final rept. (Unpublished study received Jun-12, 1978 under 524-308; submitted by Monsanto Co., Washington D.C; CDL:234108-A)

(2) MRID No:44125716
DATA WAIVER: Sig. Legnaro Ennio Photodegradation in Water: UV-vis spectra of glyphosate. December 12, 1990. Performed by Instituto di Chimica Industriale, Universite di Padova, Via Marzolo, 9 Padova ITALY. Study Identification No. 287 12/2A, 2/B-2/C-2/D 2/E. Submitted by I.Pi.Ci S.p.A. Via F. Beltrami, 11 20026 Novate Milanese ITALY.

(3) MRID No: 44125717
John Mao, July 3, 1996, Glyphosate Acid-Determination of Soil Metabolism under aerobic conditions. Sponsored by Industria Prodotti Chimici S.P.A. Via F. Beltrami 11-20026 Novate Milan,

Italy. Performed by Springborn Laboratories, Inc. Health and Environmental Sciences, 790 Main Street, Wareham, Massachusetts 02571-1075. SLI Study # 13582.0795.6100.760; #96-5-6508.

(4) MRID No: 44125718
John Mao, September 17, 1996, Glyphosate Acid - Determination of Aquatic Metabolism Under Anaerobic Conditions. Sponsored by Industria Prodotti Chimici S.P.A. Via F. Beltrami 11-20026 Novate Milan, Italy. Performed by Springborn Laboratories, Inc. Health and Environmental Sciences, 790 Main Street, Wareham, Massachusetts 02571-1075. SLI Study #13582.0795.6101.755; #96-6-6536.

(5) MRID No: 44125719 (Interim Report)
Michael W. Hartfield, June 17, 1996, Field Soil Dissipation of Glyphosate Acid. Sponsored by Industria Prodotti Chimici S.P.A. Via F. Beltrami 11-20026 Novate Milan, Italy. Analytical phase performed by EN-CAS Analytical Laboratories 2359 Farrington Point Drive Winston-Salem, NC 27107; Field phase performed by American Agricultural Services, Inc. 404 East Chatham Street, Cary, NC 27511.

(6) MRID No: 44422201 (Final Report)
Michael W. Hartfield, December 2, 1996, Field Soil Dissipation of Glyphosate Acid. Sponsored by Industria Prodotti Chimici S.P.A. Via F. Beltrami 11-20026 Novate Milan, Italy. Analytical phase performed by EN-CAS Analytical Laboratories 2359 Farrington Point Drive Winston-Salem, NC 27107; Field phase performed by American Agricultural Services, Inc. 404 East Chatham Street, Cary, NC 27511.

5. REVIEWED BY:

Kevin L. Poff, Chemist
Fate and Monitoring Branch
Environmental Fate and Effects Division

Date: 3/3/99

6. APPROVED BY:

Betsy Behl, Branch Chief
Fate and Monitoring Branch
Environmental Fate and Effects Division

Date: 3/5/99

7. CONCLUSIONS:

Hydrolysis (161-1) DER 1

1. Study MRID #00108192 is acceptable and completely satisfies the hydrolysis (161-1) data requirement at pH's 3, 6, and 9 (5 and 35 C) for glyphosate acid (which will further be referred to as glyphosate) and its degradate aminomethylphosphonic acid.

2. [^{14}C] glyphosate (94% glyphosate, 5.9% aminomethylphosphonic acid) were stable in sterile buffered water at pH 3, 6 and 9 at 25 and 250 ppm during 35 days of incubation in the dark at 5 and 35 C.

In a separate hydrolysis experiment slight degradation of [^{14}C] glyphosate was observed in two of three sterile, natural waters ranging in pH from 4.23 to 7.30 treated with [^{14}C] glyphosate (94% glyphosate, 5.9% aminomethylphosphonic acid) at 0.1 ppm, and incubated in the dark at 30 C for 35 or 49 days. Aminomethylphosphonic acid was detected at maximum concentration of 25.3 and 17.2% of the applied 35 days posttreatment in the Cattail Swamp (pH 6.2) and Ballard Pond (pH 7.3) waters, respectively. No degradation was observed in the Sphagnum Bog water (pH 4.2). Because glyphosate and aminomethylphosphonic acid do not undergo abiotic hydrolysis it appears the mode of degradation in the natural waters were attributed to water soluble enzymes that the filtration did not omit.

Data Waiver: Photolysis in Water (161-2)

MRID No:44125716

Since the UV/Vis adsorption maximum of Glyphosate (acid) analytical grade and Glyphosate (acid) technical grade "A", "B" and "C" are all < 220 nm, the Fate and Monitoring Branch grants a data waiver for the Aqueous Photolysis (161-2) data requirement. In addition, photolysis studies reviewed on the isopropylamine salt of glyphosate confirm the lack of phototranformation in the environmentally significant wavelengths of 290 to 750 nm.

Mobility - Adsorption/Desorption (163-1) DER 1

1. Study MRID #00108192 is acceptable and satisfies the adsorption/desorption portion of the unaged mobility (163-1) data requirements for glyphosate.

2. [^{14}C] glyphosate (94% glyphosate, 5.9% aminomethylphosphonic acid) was equilibrated for 4 hours at 25 C (soil solution ratio 4:1) and adsorbed to Drummer silty clay loam, Ray silt, Spinks sandy loam, Lintonia sandy loam, and Cattail Swamp sediment with Freundlich K_{ads} values of 62, 90, 70, 22, and 175 respectively. The 1/N values were 0.902, 0.944, 0.951, 0.782 and 1.010 in each of the five soils respectively. The maximum percentages of applied glyphosate desorbed were 5.3, 3.7, 3.6, 11.5, and 0.9% respectively. Soil binding can be related to organic content/clay material as the least adsorption and greatest desorption occurred on the Lintonia sandy soil which contains the least organic matter in this series (0.07%).

Mobility - Aged/Unaged Column Leaching (163-1) DER 1

1. Study MRID #00108192 is acceptable and satisfies the aged/unaged column leaching portion of the mobility (163-1) data requirement for glyphosate.

2. [^{14}C] glyphosate (94% glyphosate, 5.9% aminomethylphosphonic acid) was slightly mobile to relatively immobile with <7% of the applied ^{14}C detected in the leachate from 30-cm silt, sand, clay,

sandy clay loam, silty clay loam, and sandy loam soil columns eluted with 20 inches of water. Aged (30 days) [^{14}C] glyphosate residues were relatively immobile in silt, clay, sandy clay loam soils with <2% of the radioactivity detected in the leachate following elution with 20 inches of water. Both glyphosate and aminomethylphosphonic acid were detected in the leachate of aged and unaged soil columns. The results indicate that glyphosate and aminomethylphosphonic acid will not readily be leached.

Aerobic Soil Metabolism (162-1) DER 2

1. Study MRID #44125717 is acceptable and satisfies the aerobic soil metabolism (162-1) data requirement for glyphosate acid.

2. [^{14}C]Glyphosate at 5.55 ppm, degraded with a registrant calculated first order half-life of 7.5 days (r^2= 0.9875) in a Washington sandy loam soil that was incubated in the dark at approximately 25 C and 75% of the FMC for up to 120 days. The major non-volatile degradate was aminomethylphosphonic acid (AMPA) which comprised a maximum of 32.9% by day 30, then decreased to 18 to 27% of the applied by days 60 and 90 respectively. Extensive mineralization took place as the major degradate was $^{14}CO_2$ at 53% by day 120. Soil bound residues were generally <10 to 11% of the applied with the exception of day 90 and 120.

Anaerobic Aquatic Metabolism (162-3) DER 3

1. Study MRID #44125718 is acceptable and satisfies the anaerobic aquatic metabolism (162-3) data requirement for glyphosate.

2. [C^{14}]glyphosate [N-phosphonomethyl glycine, radiochemical purity 95.9%] at 2.78 ppm, degraded with a first order half-life of 203 days (r^2 = 0.8580) in anaerobic (flooded plus nitrogen atmosphere) Ohio clay loam sediment that was incubated in the dark at 25 ± 1 C for 181 days. In general, parent glyphosate and its major degradate aminomethyl phosphonic acid (AMPA) was associated with the sediment phase and was mineralized. Glyphosate was dosed in the aqueous phase but approximately 85%% of the applied dose was found in the sediment a few hours after dosing (time 0). The only degradate identified in the sediment and water fraction was AMPA. AMPA was at almost 10% of applied at time 0 and increased to a total maximum average of 21.2% of applied by day 181. [^{14}C]CO_2 accounted for approximately 22.4% of the applied by day 181. Material balances ranged from 88.3% to 103% of the applied and averaged 98 ± 6% (n=20) for all samples (Table 6).

Terrestrial Field Dissipation (164-1) DER 4

1. Study's MRID #44125719 and #44422201 are acceptable and satisfy the terrestrial field dissipation (164-1) data requirement for glyphosate.

2. In California, glyphosate dissipated with a calculated first order (r^2 = 0.97) half-life of 2.79 days from the upper 6 inches of

a bareground plot of a sandy loam soil following a broadcast application of glyphosate [glygran 80%WDG; N-(phosphono-methyl) glycine] at 9.04 lb ai/A on 9/08/95. In the 0- to 6- inch soil depth, glyphosate decreased from a maximum peak average of 3.92 ppm at day 0 posttreatment to 2.31 ppm at 1 day, 2.01 ppm at day 3, 1.0 ppm at day 7, 0.1 ppm at day 14 and < 0.05 ppm by day 32. Glyphosate was not detected in the 6-12 or 12-18 inch soil depth. The degradate, AMPA (aminomethylphosphonic acid) dissipated with a calculated first order (r^2 = 0.95) half-life of 48 days. In the 0- to 6- inch soil depth AMPA was present at 0.157 ppm at day 0, decreased to 0.087 ppm at day 1, 0.088 ppm at day 3, reached a maximum (peak average) of 0.478 ppm at day 7, decreased to 0.437 ppm at day 14, increased to 0.468 ppm at day 32, decreased to 0.208 ppm at day 60, then decreased to 0.132 at day 90, 0.111 ppm at day 119 and < 0.05 ppm by day 300. AMPA was not detected in the 6-12 or 12-18 inch soil depth. During the study (9/95-7/96), rainfall plus irrigation totaled 22.89 inches (241% of 10 year average) and air temperatures ranged from 41 to 102 F; soil temperatures were not reported.

In North Carolina glyphosate dissipated with a calculated first order (r^2 = 0.84) half-life of 31.0 days from the upper 6 inches of a bareground plot of a sandy loam soil following a broadcast application of glyphosate [glygran 80%WDG; N-(phosphono-methyl) glycine] at 9.06 lb ai/A lb ai/A on 8/15/95. In the 0- to 6- inch soil depth, glyphosate was variable and decreased from an average of 4.43 ppm at day 0 posttreatment to 4.06 ppm at day 1, 2.61 ppm at day 3, 2.14 ppm at day 7, increased to 2.24 ppm at day 16, decreased to 1.03 ppm at day 31, decreased to 0.473 ppm at day 59, decreased to 0.231 ppm at day 90, then increased to 0.405 ppm at day 120 and was 0.263 ppm at day 281. Glyphosate was detected twice in the 6- to 12- inch soil depth on day 1 at 0.06 ppm and on day 7 at 0.053 ppm. Soil sampling went to the 12-18 inch and 18-24 inch soil depths. The degradate, AMPA (aminomethylphosphonic acid) was too variable to accurately determine a dissipation half-life. In the 0- to 6- inch soil depth AMPA was variable and < 0.05 ppm at day 0, increased to 0.056 ppm at day 1, increased to 0.58 ppm at day 3, decreased to 0.073 ppm at day 7, increased to 0.337 ppm at day 16, decreased to 0.308 ppm at day 31, increased to 0.365 ppm at day 59, decreased to 0.208 ppm at day 90, increased to 0.349 ppm at day 120, then decreased to 0.316 ppm at day 281. AMPA was not detected below the 0- to 6- inch soil depth. Soil sampling went to the 6-12 inch, 12-18 inch and 18-24 inch soil depths. During the study (8/95-5/96), rainfall plus irrigation totaled 40.58 inches (108% of 10 year average) and air temperatures ranged from 31 to 90 F.

8. RECOMMENDATIONS:

Inform the registrant that the data requirements to support the terrestrial non-food use of glyphosate acid are satisfied. If in the future the registrant would request new uses the environmental fate data requirements would change accordingly and further data may be required.

ENVIRONMENTAL FATE AND GROUND WATER ASSESSMENT:

a. Abiotic degradation is not an important degradation process.

[^{14}C] glyphosate (94% glyphosate, 5.9% aminomethylphosphonic acid) were stable in sterile buffered water at pH 3, 6 and 9 at 25 and 250 ppm during 35 days of incubation in the dark at 5 and 35 C.

b. Photodegradation in Water in not an important degradation process.

Since the UV/Vis adsorption maximum of Glyphosate (acid) analytical grade and Glyphosate (acid) technical grade "A", "B" and "C" are all < 220 nm, the Fate and Monitoring Branch grants a data waiver for the Aqueous Photolysis (161-2) data requirement. In addition, photolysis studies reviewed on the isopropylamine salt of glyphosate confirm the lack of phototranformation in the environmentally significant wavelengths of 290 to 750 nm.

c. Biodegradation under aerobic conditions is an important degradation process for glyphosate:

Aerobic soil metabolism was investigated in a sandy loam (1.2% OM) in the dark at 25 C at 5.5 ppm (9.0 lb ai/A). The calculated first order half-life was 7.5 days (r^2= 0.9875). The major non-volatile degradate was aminomethylphosphonic acid (AMPA)
which comprised a maximum of 32.9% by day 30, then decreased to 18 to 27% of the applied by days 60 and 90 respectively. Extensive mineralization took place as the major degradate was $^{14}CO_2$ at 53% by day 120.

d. Glyphosate and its degradate AMPA do not appear to be mobile based on batch equilibrium and soil column leaching.

In batch equilibrium studies Freundlich K_{ads} values of 62, 90, 70, 22, and 175 were reported respectively for a Drummer silty clay loam, Ray silt, Spinks sandy loam, Lintonia sandy loam, and Cattail Swamp sediment. Aged (30 days) [^{14}C] glyphosate residues were relatively immobile in silt, clay, sandy clay loam soils with <2% of the radioactivity detected in the leachate following elution with 20 inches of water. The results indicate that glyphosate and aminomethylphosphonic acid will not readily be leached.

e. Bareground Terrestrial Field Dissipation Studies indicate glyphosate and AMPA are not mobile in a field environment:

In California, glyphosate dissipated with a calculated first order (r^2 = 0.97) half-life of 2.79 days from the upper 6 inches of a bareground plot of a sandy loam soil. Glyphosate was not detected in the 6-12 or 12-18 inch soil depth. The degradate, AMPA (aminomethylphosphonic acid) dissipated with a calculated first order (r^2 = 0.95) half-life of 48 days. AMPA was not detected in the 6-12 or 12-18 inch soil depth. In North Carolina glyphosate dissipated with a calculated first order (r^2 = 0.84) half-life of

31.0 days from the upper 6 inches of a bareground plot of a sandy loam soil. Glyphosate was detected twice in the 6- to 12- inch soil depth on day 1 at 0.06 ppm and on day 7 at 0.053 ppm. Soil sampling went to the 12-18 inch and 18-24 inch soil depths. The degradate, AMPA (aminomethylphosphonic acid) was too variable to accurately determine a dissipation half-life. AMPA was not detected below the 0- to 6- inch soil depth.

f. Glyphosate does not appear to have the potential to accumulate in fish (moderate water solubility, low octanol/water partition coefficient [log K_{ow} = 2.78]).

g. Based on the low vapor pressure of glyphosate (1.94 X 10^{-7} mm Hg @25 C), direct volatilization from soils will not be an important dissipation mechanism.

ENVIRONMENTAL FATE AND GROUND WATER ASSESSMENT:

The data indicate that chemical and photochemical decomposition is not a significant pathway of degradation of glyphosate in soil and water. However, glyphosate is readily degraded by aerobic soil microbes to aminomethylphosphonic acid (AMPA), which is degraded to CO_2, although at a slower rate than parent glyphosate.

In general, the available field and laboratory data indicate glyphosate and AMPA adsorbs strongly to soil and would not be expected to move vertically below the 6 inch soil layer. Based on unaged batch equilibrium studies glyphosate is expected to have a low potential to leach to ground water with $Kd_{(ads)}$ values ranging from 62 to 175. The degradate AMPA also appears to lack mobility characteristics as aged (30 days) [^{14}C] glyphosate residues were relatively immobile in silt, clay, sandy clay loam soils with <2% of the radioactivity detected in the leachate following elution with 20 inches of water.

Glyphosate does have the potential to contaminate surface waters from erosion via transport of residues adsorbed to soil particles suspended in runoff water. If glyphosate were to reach surface water it would be resistant to hydrolysis and aqueous photolysis, but would more than likely remain associated with the sediment phase.

Based on the low vapor pressure of glyphosate, volatilization from soils will not be an important dissipation mechanism. The low octanol/water coefficient suggests that glyphosate will have a low tendency to accumulate in fish.

9. BACKGROUND : This data was submitted to support the non-food use registration for glyphosate (ANSI). Glyphosate is a non-selective and systemic postemergent herbicide for weed control on commercial, industrial and residential sites. It provides systemic control of broadleaf weeds, grasses, woody brush and trees. The formulation (GLYGRAN) is only as a WDG 80% ai. Its for broadcast

applications at the rate of 0.9 to 1.35 lbs GLYGRAN WDG per acre (0.72 to 1.08 lb ai/A). Glygran is recommended for noncrop or nonplanted areas such as right-of-ways, including railroads, dividers and medians: pipelines, public utility lines, including pumping stations, transformer stations and substations; around electric yards, fence lines and parkways. Also, around ornamental plantings and trees, walkways, patios; along driveways and around golf courses; parking areas, industrial sites, parks, playgrounds, petroleum farms, fence posts, schools, signposts, storage areas, and Christmas tree plantations.

10. DISCUSSION:
See attached DERS.

11. COMPLETION OF ONE-LINER:
Attached.

12. CBI INDEX:
Not Applicable.

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
GLYPHOSATE (ACID)
Last Update on February 24, 1999
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

LOGOUT	Reviewer:	Section Head:	Date:

Common Name:GLYPHOSATE (ACID)
Smiles Code:
PC Code # :417300 CAS #:1071-83-6 Caswell #:

Chem. Name :N-(phosphonomethyl)glycine

Action Type:Herbicide

Trade Names:Glygran
(Formul'tn):80 WDG
Physical State: White solid

Use Patterns (% Usage) :Terrestrial Non-food only; rights of ways, railroads,utility :lines,pipelines,pumping stations,fence lines,substations, :walkways, patios,parking areas,golf courses, industrial site :schools, signposts, storage areas, dividers and medians.

Empirical Form: $C_3H_8NO_5P$
Molecular Wgt.: 170.80 Vapor Pressure: 1.94E -7 Torr
Melting Point : 215-219 °C Boiling Point: °C
Log Kow : 2.78 pKa: @ °C
Henry's : E Atm. M3/Mol (Measured) 3.63E-12 (calc'd)

Solubility in ...					Comments
Water	12.00E 3	ppm	@	°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 at 5 and 35C
[V] pH 3.0:stable at 5 and 35C
[V] pH 6.0:stable at 5 and 35C
[ ] pH . :

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Photolysis (161-2, -3, -4)
[ ] Water:waived; technical grade glyphosate acid adsorption spectrum
[ ] :indicated a maximum at <220nm and the isopropylamine salt
[ ] :appeared to be photolytically stable.
[ ] :

[ ] Soil :
[ ] Air :

Aerobic Soil Metabolism (162-1)
[V] Glyphosate at 5.55 ppm degraded with a first order t1/2 of 7.5
[ ] days in a Washington sandy loam incubated in the dark at 25C.
[ ] The major non-volatile degradate is aminomethylphosphonic acid
[ ] (AMPA) which comprised a maximum of 32.9% by day 30 then decreasd
[ ] to 18 to 27% by days 60 and 90 respectively. Extensive minerali
[ ] -zation took place as 14CO2 was 53% by day 120.
[ ]

Anaerobic Soil Metabolism (162-2)
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Anaerobic Aquatic Metabolism (162-3)
[V] At 2.78 ppm in an Ohio clay loam sediment glyphosate (acid)
[ ] degraded with a first order half-life of 203 days. In general,
[ ] parent glyphosate and its major degradate (AMPA) was associated
[ ] with the sediment phase and was mineralized. Glyphosate was
[ ] dosed in the aqueous phase but appox. 85% of applied was found in
[ ] the sediment at time 0. AMPA was 10% of applied at time 0 and
[ ] reached a maximum of 21.2% by day 181.CO2 was 22.4% by day 181.

Aerobic Aquatic Metabolism (162-4)
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

11

Soil Partition Coefficient (Kd) (163-1)
[V] Drummer silty clay loam: 3.4%OM, Kads=62
[ ] Ray silt: 1.2%OM, Kads=90
[ ] Spinks sandy loam: 2.4%OM, Kads=70
[ ] Lintonia sandy loam: 0.7%OM, Kads=22
[ ] Cattail swamp sediment:1.5%OM,Kads=175
[ ]

Soil Rf Factors (163-1)
[V] Unaged glyphosate was slightly mobile to relatively immobile with
[ ] a maximum of 7% found in the leachate of 3 separate soils.
[V] Aged glyphosate (30 days) residues were relatively immobile in
[ ] silt, clay and sandy clay loam soils with <2% of radioactivity
[ ] found in the leachate.
[ ]

Laboratory Volatility (163-2)
[ ]
[ ]

Field Volatility (163-3)
[ ]
[ ]

Terrestrial Field Dissipation (164-1)
[V] In CA glyphosate dissipated with a first order half-life of 2.79
[ ] days in a bareground plot applied at 9.04 lb ai/A. Residues
[ ] remained in the 0- to 6- inch soil layer. AMPA dissipated with a
[ ] half-life of 48 days and also was confined to the 0- to -6 inch.
[ ]
[V] In NC glyphosate dissipated with a first order half-life of 31
[ ] days in a bareground plot applied at 9.06 lb ai/A. Residues
[ ] remained in the 0- to 6- inch soil layer. AMPA was too variable
[ ] to accurately determine a half-life but remained in the 0- to 6-
[ ] inch soil layer.

Aquatic Dissipation (164-2)
[ ]
[ ]
[ ]
[ ]
[ ]
[ ]

Forestry Dissipation (164-3)
[ ]
[ ]

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

Accumulation in Rotational Crops, Confined (165-1)
[ ]
[ ]

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

Accumulation in Irrigated Crops (165-3)
[ ]
[ ]

Bioaccumulation in Fish (165-4)
[ ]
[ ]

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

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

Ground Water Monitoring, Small Scale Retrospective (166-2)
[ ]
[ ]
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Ground Water Monitoring, Large Scale Retrospective (166-3)
[ ]
[ ]
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Ground Water Monitoring, Miscellaneous Data (158.75)
[ ]
[ ]
[ ]

Field Runoff (167-1)
[ ]
[ ]
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Surface Water Monitoring (167-2)
[ ]
[ ]
[ ]
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Spray Drift, Droplet Spectrum (201-1)
[ ]
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Spray Drift, Field Evaluation (202-1)
[ ]
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Degradation Products

Biodegradation is the major mode of degradation. Aminomethyl phosphonic acid (AMPA) is the major degradate. Both glyphosate and AMPA have strong adsorptive characteristics.

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GLYPHOSATE (ACID)
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Comments

Dissociation constants pK1=2.35, pK2=5.84, pK3=10.48

References: Reviews
Writer : KLP