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DATE: 2/8/79

To: Product Manager (25) Taylor
TS-767

Through: Dr. Gunter Zweig, Chief
Environmental Fate Branch

Through: Mr. James Conlon, Acting Director
Hazard Evaluation Division, TS-769

From: Review Section No. 1
Environmental Fate Branch

Attached please find the environmental fate review of:

Reg./File No.: 707-RUE,8F2058

Chemical: Oxyfluorfen (2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene)

Type Product: I, D, (H,) F, N, R, S, herbicide

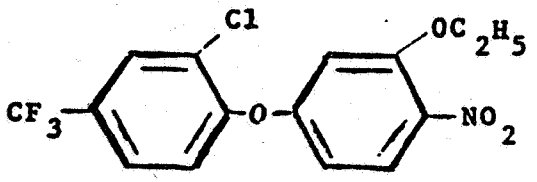
Product Name: GOAL® 2E Herbicide (formerly RH-2915)

Company Name: Rohm and Haas Co.

Submission Purpose: requests registration of new chemical for use on soybeans and corn. Petition of establishment of tolerances on soybeans and corn.

Date in: 5/23/78, 3/16/78 Date Review started: 9/28/78

Date out: 2-8-79



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Studies in EFB review 2/8/79 # 14

Title	Page	Category
Field Air Sampling for RH-2915 Content	3	U
A Hydrolysis Study	4	A
Photodegradation of RH-2915 in Water	4	U
Photodegradation of — in soil	9	U
Photolysis of — in soil	11	A
Photolysis of — on Silica Gel Thin Layer Chromatograph Plates	14	—S
Greenhouse Soil Metabolism of —	16	—S
~~Effects~~ Laboratory Dissipation of — in Soil (Microbe effect) (Effects of Microbes on Pesticide)	19	A
Effects of Pesticides on Microbes	20	A
Activated Sludge Study	22	A
MOBILITY Leaching in 4 soil types	25	A
Laboratory Leaching Study with Aged — Soil	27	A
Adsorption, Desorption and Leaching of Nitrofen & Oxyfluorfen	29	(A)
Adsorptive & Desorptive Behavior of — on Soil	32	A
Field Decline Studies with — in Soil [est. half-life]	38	U
Characterization of Bound & Free Residues from — appl. to Soil	43	U
Fate of — residues in Soil in Pa	49	—S
" " " " " " N.C.	52	-S
— fallow field study	55	U
Soil Residues Decline Study with — & Lasso	58	U
" " " " — & Paraquat	63	U
ACCUMULATION (PLANTS)		
Radioactive Residues in Rotation Crops Grown in Soil treated with — the previous year:	68	—
" " " " " Following — preemerg. applic to peanuts in N.C.	72	—
ACCUMULATION (~~FISH~~)(ANIMALS)		
A Residue & Metabolism Study of — in BG	75	—
" " " " " Channel Catfish Simulated Canal	82	—

U = Unacceptable S = Supplementary
A = Acceptable

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This is the first E.C. review to support the registration of oxfluorfen (new chemical-herbicide) use on corn and soybeans. Previous E.C. reviews for oxyfluorfen (RH-2915) were: 707-EXP with 5G1581, 707-EUP-82 and 83. Renewal with 5G1581, 707-EUP with 6G1690 and 707-EUP-91 with 8G2028.

Other names for the pesticide:
common name: Oxyfluorfen
code name : RH-2915

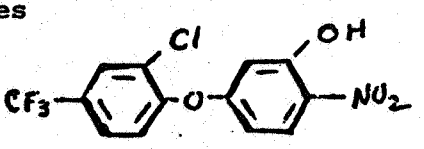
Goal herbicide is formulated as an emulsifiable concentrate with two pounds of active oxyfluorfen per gallon. This formulation contains 23.5% active ingredient.

Chemical and Physical Properties

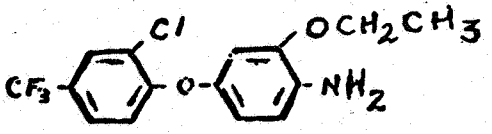
a.	Form:	Crystalline solid at room temperature
b.	Color:	Orange
c.	Odor:	Faint
d.	Melting Point:	84 - 85°C
e.	Vapor Pressure:	2×10^{-6} Torr at 25°C
f.	Boiling Point:	358.7°C (calculated)
g.	Solubility:	<0.1 ppm in water at 25°C Soluble in most organic solvents
h.	Empirical Formula:	$C_{15}H_{11}ClF_3NO_4$
i.	Molecular Weight:	361.72

Degradate/Metabolites: Chemical Structures

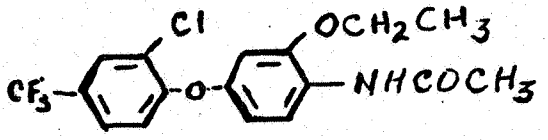
Hydroxy - RH-34670



Amino - RH-35451



Acetamido - RH-35450



The following reports are not environmental chemistry data requirements; therefore, they were not utilized in the environmental chemistry hazard evaluation:

"Field Air Sampling for RH-2915 Content"
Accession No. 096882, Technical Report No. 34H-77-34.

"RH-2915 2-Year Storage Stability Study - Final Report"
Accession No. 096882, Technical Report No. 34H-77-15.

Discussion of Data

Physico Chemical Degradation

"The Hydrolysis of Experimental Herbicide RH-2915 in Water"
Accession No. 094337, Technical Report No. 3923-74-2, Section D-20.

Experimental Design

A solution containing 150 ug of ^{14}-C-RH-2915 labeled in trifluoromethyl group was added to six amber bottles. The solvent (benzene) was evaporated and 100 ml of deionized water buffer of either pH 5, 7 or 9 was added to each bottle. Duplicate samples were prepared for each of the three pH values tested. The samples were incubated at 25°C for 29 days.

Two aliquots were removed from each solution at 1, 2, 4, 7, 14, 21 and 29 days intervals. One aliquot was counted directly by LSC. The other aliquot was extracted with benzene. The aqueous phase was counted, the organic phase was concentrated, spotted on TLC - sheets and co-chromatographed with standard compounds. TLC sheets were cut into segments by R_f increments and the radioactivity of each segment was counted.

After 29 days, over 97% of the radioactivity was present as parent compound for each of the pH values tested. Three other areas on the TLC-sheets contained traces of radioactivity (about 1.4%) but these were also present when fresh RH-2915 was spotted on plates as co-chromatography standard. They corresponded to the R_f values of amino - RH-2915 0.2%, RH-34670-(2-chloro-4-trifluoro-methyl-3'-hydroxy-4'-nitrodiphenylether) about 0.7%, and at the origin about 0.5%.

Conclusion

This hydrolysis study is unacceptable because of the following:

1. The concentration of RH-2915 used in the study was greater than the reported water-solubility of RH-2915. The concentration of RH-2915 used in this study was $\left(\frac{150 \text{ ug}}{100 \text{ ml}}\right)$ approximately 1.5 ppm. The reported water-solubility of RH-2915 is <0.1 ppm. From this we reason that all of the herbicide was not in solution. This is further confirmed by the data in Table II, on page five, which showed that the soluble radiocarbon content of aqueous

buffer solutions increased from 0.61 ppm to 1.57 at pH 5, from 0.77 to 1.30 at pH 7 and from 0.96 to 1.53 at pH 9 for day-1 thru day-28 respectively. The investigator attributed this steady increase in soluble radioactivity to a slow rate of solubilization of RH-2915. Because of the varying solubilization, we cannot determine how much of the chemical is undergoing hydrolysis.

"A hydrolysis Study with ^{14}C-RH-2915", Technical Report No. 34H-77-30, Accession No. 096884, Section J-8.

This hydrolysis study was conducted analogous to the hydrolysis study report in Technical Report No. 3923-74-2 above except for the following pertinent parameters:

1. Concentrations of labeled oxyfluorfen ($^{14}CF_3$) in deionized water buffers of pH 4, 7 and 10 were 0.05 ppm and 0.50 ppm.

2. Temperatures of hydrolysis solutions were 25°C and 45°C for 29 days.

Results

TLC analysis of toluene extract of the hydrolyzate (at 0.05 ppm) showed that over 97% of radioactivity was oxyfluorfen for each pH value tested and at each temperature.

Conclusions

1. Oxyfluorfen was stable to hydrolysis at pH 4, 7 and 10 at 25°C and 45°C at a concentration of 0.05 ppm.

2. The hydrolysis study conducted at 0.05 ppm is acceptable and satisfies data requirement for hydrolysis. Hydrolysis study conducted at 0.5 ppm is unacceptable because 0.5 ppm is above the water solubility of oxyfluorfen.

Photodegradation of RH-2915 in Water, Accession No. 095586 Technical Report No. 34H-76-8, Tab 21.

^{14}C-RH-2915 (^{14}C-CF_3 or ^{14}C-NO_2 ring labeled) at 1 ppm in 50% aqueous methanol in a photocell was irradiated with fluorescent sunlamps or fluorescent blacklights for 48 hours. The spectral distribution of the light source was between 300-400 nm with an intensity of approximate 450 $\mu W/cm^2$. Organic volatiles

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were trapped on chromosorb and in ethylene glycol trapping soluion. $^{14}CO_2$ was absorbed in methyl cellosolve: ethanol amine absorbent solution. Aqueous methanol was sampled at 4, 8, 24 and 48 hours. CO_2 traps were also sampled at these times. Chromosorb and ethylene glycol traps were sampled at 48 hours.

Sensitized photolysis studies were conducted in the same way except that the 50% aqueous methanol contained 2% acetone (by volume).

Controls were conducted similarly with the lamps off.

A large scale run to obtain large quantities of products was conducted by using 1 gram of non-labeled RH-2915, 90% methanol/water (v/v) and utilizing a high pressure mercury arc lamp. The products were characterized by GC/MS, after being partitioned by liquid - liquid extraction into acid, neutral and basic photoproducts.

Analytical Procedures

1. Radioanalysis

   All samples were analyzed directly by LSC. Counting cocktail was added to aqueous methanol and CO_2 trapping solution samples and counted directly. Silica gel and Chromosorb samples were amended with methanol; ethylene glycol samples were amended with ethanol before addition of counting cocktail and analyzing directly by LSC.

2. Thin Layer Chromotography

   A. Four solvent systems were used: (A) hexane/benzene 1:3 (v/v), (B) acetone/benzene 1:9 (v/v), (C) methanol/chloroform/water 10:90:0.05 (v/v/v) and (D) benezene/dioxane/formic acid 77:21:1.7 (v/v/v).

      TLC spots of cold standards were visualized under UV light. Radioactive spots were detected by autoradiography and quantitated by removing the radioactive area of silica gel and counted using LSC.

   B. Sample Preparation

      Aqueous methanol samples were acidified and extracted twice with benzene or once with hexane followed benzene extraction. The organic fractions were combined, dried over magnesium sulfate and concentrated to volume. Radioanalysis of all fractions (organic and aqueous), concentrates and residue adsorbed to glassware was done throughout the study. Concentrates were analyzed by TLC/autoradiography.

Accountability of Carbon-14 in Photolysis Runs

Compound	Photolysis Conditions	Percent of Treatment[1] Aqueous Samples	Volatile Traps	Total Accountability[3]
$^{14}CF_3$-RH-2915	Direct	91	2	94
^{14}C-NO_2-RH-2915	Direct	90	3	94
^{14}C-NO_2-RH-2915	Sensitized	85	5	91
$^{14}CF_3$-RH-2915	Dark	96	tr[2]	97

[1] Based on assay of 0 hour aqueous samples (50/300 ml)

[2] tr = trace (less than 0.5%)

[3] This includes residues adsorbed to the apparatus

Material balance after concentrating extracts was approximately 70%.

Carbon-14 Distribution in Individual Samples

Test Compound	Photolysis Conditions	Hours Irradiated	PPM	Percent $^{14}CO_2$	Percent After Partitioning		Percent Adsorbe to Apparatus
					Aqueous	Organic	
$^{14}CF_3$-RH-2915	Direct	0	1.12	0	1	99	
		4	1.11	0	14	86	
		8	1.08	0	23	77	
		24	0.99	1	25	75	
		48	0.96	6	45	45	5
	Dark	0	1.16	-	2	98	
		48	1.10	-	4	91	5
^{14}C-NO_2-RH-2915	Direct	0	1.15	0	1	99	
		4	1.26	tr	11	88	
		8	1.18	1	19	80	
		24	1.10	4	29	67	
		48	0.89	8	33	56	4
	Sensitized	0	0.91	0	1	99	
		4	0.89	1	17	82	
		8	0.88	2	19	79	
		24	0.77	7	42	51	
		48	0.71	11	69	17	3

14C-RH-2915 After 48 Hours Irradiation

Product	Carbon-14 Label and Photolysis Conditions			
	$^{14}CF_3$ Dark	$^{14}CF_3$ Direct	$^{14}C\text{-}NO_2$ Direct	$^{14}C\text{-}NO_2$ Sensitized
pp1	---	2	3	7
RH-2915	96	10	13	7
Polar[a]	4	34	42	2[c]
Water Soluble	---	48	34	72
CO_2	NS[b]	6	8	12

a Polar materials in organic extracts

b NS - Not significant

c This low value may indicate a susceptibility of these photoproducts to sensitized photodegradation.

Half-life of ^{14}C-RH-2915 was approximately 12 hours. Seventeen photoproducts were detected in acidic, neutral or basic fractions from a large scale run with cold RH-2915 (1 gram) in 90% methanol/water utilizing a high pressure mercury lamp.

Conclusion

1. This photolysis in water study is unacceptable for the following reasons:

   (a) The stability of RH-2915 to light in water cannot be assessed from photolysis studies conducted in 50% aqueous methanol. We do not know the influence of methanol on the rate of RH-2915 photolysis. Photolysis rate studies are required to be conducted in distilled or deionized water.

   (b) The large scale photolysis study conducted for the identification of photoproducts cannot be evaluated until a rate study conducted in distilled or deionized water is submitted and evaluated. In distilled or deionized water, 17 photoproducts may not be produced.

   (c) Because of the mixed solvent system (acetone-methanol) used in the photosensitized study, we cannot determine if acetone sensitize the photolysis of RH-2915.

Photodegradation of ^{14}C-RH-2915 on Soil, Accession No. 095586, Technical Report No. 34H-76-4, Tab 21.

Lawrenceville silt loam (0% sand, 56.1% silt, 42.8% clay, 2.5% organic matter, pH 7.06 and C.EC meq/100g = 11.0) amended with an equal volume of sand was treated at 5 ppm with RH-2915 labeled in either the trifluoromethyl carbon or labeled in the nitrophenyl ring and irradiated for 48 hours with simulated sunlight. The spectral distribution of blacklights and fluorescent lamps was between 280 and 450 nm. Intensity of irradiation 4 cm below the lamps was 250 UW/CM^2 with 90% transmission of incidence light at 310 nm. Soil samples were collected at 0, 4, 20, and 48 hours. Dark control soil samples were collected at 0 and 47 hours only. Chromosorb 102 traps for volatile organics and CO_2 trapping solution were sampled at the same time soil was sampled. Ethylene glycol traps which served as a back up trap in the event of break through of volatiles organic past the chromosorb 102 trap.

Soil samples and chromosorb 102 (after elution with acetone) were analyzed for ^{14}-carbon by combustion. Acetone eluate was concentrated and activity counted using LSC. CO_2 trapping solution and ethylene glycol trapping solution were counted directly using LSC.

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Extractability of Herbicides from Soil

Compound	Soil Sample (Hours)	Percent Distribution Carbon-14 After Extraction		
		Soil Remains	Extract	Concentrate
$^{14}CF_3$-RH-2915	0	NS[1]	100	88
	4	1	99	84
	20	2	98	80
	48	8	92	85
	0 (dark	NS	100	95
	47 (dark)	3	97	71
^{14}C-NO_2-RH-2915	0	NS	100	86
	4	1	99	82
	20	1	99	78
	48	8	92	88
	0 (dark)	NS	100	90
	47 (dark)	5	95	83

[1] NS - Not significant

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No degradation products were detected in soil extract analyzed by TCL. Extracts from chromosorb traps of $^{14}CF_3$-RH-2915 treated soil (irradiated 48 hours) contained 2-chloro-4-trifluoromethyl phenol and traces of $^{14}CO_2$. Based on trapped volatiles, RH-2915 was approximately 0.2% photolyzed on soil surface after 48 hours of simulated sunlight irradiation.

Conclusion

1. $^{14}CF_3$-RH-2915 or ^{14}C-NO_2-RH-2915 on Lawrenceville silt loam under simulated sunlight at 280 - 450 nm was relatively stable for 48 hours; approximately 0.20% photolyzed to 2-chloro-4-trifluoromethyl phenol and trace amounts of $^{14}CO_2$ (volatile products).

2. This study is unacceptable; the time was too short to estimate a half-life or to characterize or identify photolysis product at half-life.

"A Photolysis Study of RH-2915 on Soil" Accession No. 097091, Technical Report No. 34H-78-1, Section J, Tab 1.

Sieved Pasquotank sandy loam (74.0% sand, 19.0% silt, 7.0% clay, 2.70% O.M., CEC 8.25 Meg/100g, Bulk Density, 1.42 g/cc) was moistened, treated with (1.62 ug/10g soil) RH-2915 uniformly ^{14}C-labeled in the nitrophenyl ring and was irradiated continously, 24 hours a day with simulated sunlight for 28 days. The spectral distribution of the fluorescent sunlamps and blacklight tubes positioned 5 cm above the soil surface was between 280 to 500 nm. Intensity of the light sources was 246 u watts cm^2 with 85 and 92% transmission at 300 and 400 nm respectively.

Organic volatiles trapped on chromosorb (styrene-divinylbenzene copolymer beads) were placed in a counting vial, organic were eluted with methanol and counted by LSC. Duplicate aliquots of 2-methoxyethanol: ethanolamine trapping solution mixture containing evolved $^{14}CO_2$ were counted by LSC. Photolyzed soil sample was Soxhlet extracted with methanol. The activity in duplicate aliquots of methanolic extract was counted using LSC. The remainder of the methanolic extract was concentrated for autoradiograph TLC analysis. Triplicate subsamples of dry extracted soil were combusted and activity counted by LSC.

^{14}-Carbon Distribution from RH-2915 Soil Photolysis

Sample	% ^{14}C in Chromosorb Traps (Organic Volatiles)	% ^{14}C in CO_2 Trap	% ^{14}C in MeOH Ext.	% ^{14}C in Combusted Soil	(% ^{14}C Acct'd for) Total ^{14}C[1]
1-Day	NS	0.7	92	5.3	92.9
3-Day	NS	1.0	92	6.8	86.6
7-Day	NS	3.4	85	10.8	79.0
14-Day	NS	4.1	78	17.0	92.9
21-Day	0.06	1.3	82[2]	17.0	72.5[2]
28-Day	0.05	0.6	82	17.0	75.8

[1] Used original MeOH extracted dpm

[2] Used concentrated MeOH extract dpm

TLC Quantitation

Day	% RH-2915	% Polar (Origin)	MeOH Ext. Eff.	% Parent X Ext. Eff.
1	97.5	0.0	92	89.7
3	90.0	5.5	92	83.6
7	92.6	7.4	85	78.7
14	93.3	6.7	78	72.8
21	90.1	9.9	82	73.9
28	84.5	11.6	82	69.3

Results

TLC analysis of extractable ^{14}C-soil residue at 28 days showed that approximately 85% of residue was RH-2915.

Percent of activity at TLC origin (polar material) increased from 5.55% at day-3 to 11.6% at day-28.

Photolytic half-life of RH-2915 was estimated by multiplying the percent parent remaining at each sampling interval by the soil extraction efficiency at each sampling date. A computer fit of the data to first order kinetics indicated a half-life of about 80 days.

Conclusion

1. Approximately 15% of RH-2915 was photolyzed on soil surface in 28 days.

2. Polar material at TLC origin which accounted for about 11.6% of the activity at 28 days was not identified or TLC characterized with R_f values.

3. This study satisfies the rate of photodegradation part of data requirement but it does not satisfy the identification of photolysis products part of data requirement. Since the polar material (11.6%) was increasing at 28 days, this material needs to be identified or characterized with TLC R_f values.

"Photolysis of RH-2915 on Silica Gel Thin Layer Chromatography Plates" - Accession No. 094337, Technical Report No. 3923-74-70. Section D-21.

^{14}C-RH-2915-CF_3 (4.17 ug) and ^{14}C-RH-2915-NO_2 (4.45 ug) spotted on silica gel thin layers were placed on a turntable 7 cm below a bank of fluorescent blacklight and sunlamps and exposed for 0.5, 1, 2, 4, 8, 16, 48 and 72 hours at 20°C. The spectral distribution of the simulated sunlight was between 280 and 400 nm. Average incidence light intensity in this region was 397 u watts cm^2 with approximately 90% transmission at 310 nm. Photodegradation in the presence of anthraquinone (photosensitizer) was measured concurrently (on the same plates) by overspotting 50 ug of anthraquinone with about 5 ug of RH-2915. Control plates treated identically to sample plates were wrapped in foil and exposed 72 hours.

After irradiation, reference compounds were spotted on the plates. The plates were developed using two solvent systems.

TLC spots of standard compounds were visualized under uv light. Raioactive spots were detected by autoradiography and quantified by removing the radioactive area of silica gel and counted using LSC.

Results relative to the characterization and identification of photoproducts were as follows:

RH-2915 photolyzed into at least 13 different products.

The major photolysis product was immobile and remained at the TLC origin in the solvent systems: A - hexane/benzene 1:3 (v/v) and B - acetone/benzene 1:1 (v/v).

One of the major photoproducts was identified as 4-trifluoromethyl-2-chlorophenol.

The phenol identified as a photolysis product is evidence that cleavage of the ether bond occurs, phenolic products have been shown to undergo photolysis.

Conclusion

1. Photolysis on silica gel is not currently a physico chemical degradation data requirement; however, the study contains useful information. On silica gel one of the major photoproducts was identified as 4-trifluoromethyl-2-chlorophenol.

Metabolism

Greenhouse Soil Metabolism Study of RH-2915
Technical Report No. 3923-74-64 in Accession No. 094336 (Tab 16)

This aerobic/anaerobic soil metabolism study of RH-2915, 2-Chloro-1-(3-Ethoxy-4-Nitrophenoxy)-4 Trifluoromethylbenzene, utilized a Nixonton sandy loam and a Drummer silty loam, having the following properties:

	Nixonton	Drummer
% Organic Matter	2.59	3.83
pH	5.5	5.5
% Sand	71.0	13.0
% Silt	22.0	65.0
% Clay	7.0	22.0
Cation Exchange Capacity (Meq/100g)	7.0	10.1
Field Moisture Capacity (% at 1/3 Bar)	12.5	15.6

Soils were treated with radiolabeled RH-2915 (either in the CF_3 group or in the NO 2 Phenyl ring) at a level of either 1 ppm or 10 ppm, transferred to glass jars and incubated at 21-32°C. Samples were withdrawn for analysis on days 15, 32, 60, 90, 120, 182, 270 and 393. At 32 days a portion of the soil was transferred to wide-mouth jars, thoroughly purged with nitrogen and sealed under slight positive pressure. Samples were taken at 30 and 60 days.

Triplicate subsamples were analysed as follows: following Soxhlet extraction with methanol, extracts were concentrated and spotted on TLC plates. After development with either acetone: benzene or hexane:benzene (25:75 v/v) and visualization by autoradiography, spots were counted by scraping and LSC. Soil was subjected to conventional combustion and LSC.

The following data were reported:

Aerobic Soils - Total ^{14}C Residues (ppm RH-2915)

	Sandy Loam		Silt Loam	
Day	CF_3 Label	Ring Label	CF_3 Label	Ring Label
0	1.05	0.95	1.05	1.07
120	0.87	0.88	0.88	0.80
270	0.64	0.75	0.85	0.79
393	0.57	0.61	0.78	0.87

Anaerobic Soils - Total ^{14}C Residues (ppm RH-2915)

Day	CF_3 Label	NO_2 Ring Label
0	1.00	0.98
30	0.87	1.06
60	0.98	0.93

Aerobic Soils - Extraction of ^{14}C- Recovery %

	Sandy Loam Soil		Silty Loam Soil	
Day	CF_3 Label	NO_2 Ring	CF_3 Label	NO_2 Ring
15	91	106	98	102
120	63	59	96	100
182	74	59	86	84
270	49	38	77	85
393	25	22	61	59

In the Aerobic study, total radiocarbon in the Nixonton soil decreased to about 60% of applied after 393 days. In Drummer soil, CF_3- labeled parent decreased to about 80% of applied and NO_2-ring-labeled decreased to about 87% of applied after 393 days. No degradates were detected detected through the 120th day. At 182 days, only one metabolite was quantitated (12.1%), but it was not identified, since its R_f did not match that of any of the standards cochromatographed. Small quantities of other degradates were detected, but not identified.

In the anaerobic study, virtually no degradation was measured after 60 days (2-7%), and no degradates were identified.

Conclusions

1. Degradation of RH-2915 was more rapid under aerobic than under anaerobic conditions.

2. No degradates were detected under aerobic conditions through the 120th day.

3. In the aerobic study, the first half-life was not reached by the 393rd day (about 40% of the applied was degraded in the Sandy loam and about 18% in the Silty loam.

4. At 182 days, ~~one~~ two degradative products ~~was~~ were detected and quantitated (12.1%), but ~~was~~ not identified since ~~its~~ their R_f values did not match any of the standards cochromatographed.

5. Under anaerobic conditions, approximately 2-7% of the applied was degraded after 60 days.

6. Under aerobic conditions, degradation of the parent compound was similar in both soil types tested.

7. Diagrams of TLC plates were not submitted.

8. Degradates were not identified.

Effect of Microbes on Pesticides

Acc# 094336 Section J Tab 12. Laboratory Dissipation Study of RH-2915 in Soil. J.D. Fisher Tech Report No. 3923-74-6.

Materials and Methods

RH-2915 was labeled either in the trifluoromethyl or uniformely nitrophenyl ring positions. A biometer flask sequence was set-up using the method of Bartha. A Nixonton Sandy Loam [pH 5.5.,sand 71%, silt 22%, clay 7%, O.M. 2.59%, CEC 7.00mc/100g, moisture 1/3 bar 12.52%] was added to biometer flasks and either sterilized using autoclaving techniques, left untreated, and treated with RH-2915 at a concentration of 10ppm. Samples were taken at intermittent intervals up to 35 days. Samples were assayed for $^{14}CO_2$, total CO_2 (respiration) and metabolite production using Soxhlet extraction with methanol. The extracts were evaporated to near dryness, combined, and analyzed by TLC.

Results/Conclusions

No biodegradation was observed for the non-sterile soil when compared to the sterile soil for 35 days as measured by $^{14}CO_2$ production and/or tlc plates.

No metabolites were found to occur from the non-sterile flash at any sampling interval.

No difference in total CO_2 production could be observed from the control and treated flasks.

The temperature of incubation was not given and this should be obtained from the applicant to be better able to relate this phenomenon observed. It does not invalidate the study, nor deny registration.

It should be noted that the soil used was of a pH that would favor the fungul populations and this could be the difference in the results observed from the activated sludge study in which amino-RH-2915 was identified. Since the activated sludge study would involve bacterial populations, this compound may be metabolized.

It should be noted that the soil used had been fallow for 5 years and this could have impacted on the results.

This is an acceptable effect of microbes on pesticide study and fulfills the data requirement.

Effect of Pesticides on Microbes

AGC# 096884 Section J Tab 10 Evaluation of RH-2915 against Environmentally-Important Microorganisms P.K. Cooke

Materials and Methods

A two-fold broth serial dilution assay was performed. One ml of a 10x pesticide solution (in 50% acetone/water) was added to 9ml of appropriate liquid medium, mixed and 5ml of this mixture was added to 5ml of growth media. This procedure was followed until concentrations ranged from less than 1 to 1,000 ppm. For anaerobic microorganisms evaluated a layer of sterile mineral oil was used as an overlay. The temperature of incubation varied with the individual organisms tested but ranged from 20-30°C, except for Ps. aeruginosa which was held at 37°C. Growth or no growth was reported by either + or 0. Organisms used for the evaluation were: Azotobacter vinelandii, Bacillus subtilis, Clostridium pasteurianum , Nostoc sp, Cellulomonas sp., Pseudomonas aeruginosa, Pseudomonas fluorescens, Streptomyces albus, Aspergillus foetidus, and Chaetomium globosum. Media that was used for culture were: Allen's nutrient broth, trypticase soy, mildew/sucrose/cellulose medium, ATCC med. #12, and AC medium.

Results/Conclusions

RH-2915 did not inhibit the growth of Azotobacter, Ps. aeruginosa, Ps. fluorescens, A.foetidus, and/or Chaetomium at concentrations from less than one to 1,000 ppm. RH-2915 was inhibitory to B. subtilis, Cellulomonas, Streptomyces and Nostoc at 1,000 ppm concentrations. RH-2915 was inhibitory at 500ppm to Cl. pasterianum. All controls exhibited positive growth in their respective tubes.

This method although essentially qualitative, did not indicate a point where a more quantitative method would be required(enumeration not the population approach itself). This is indicated from the results observed that only from 500ppm and higher were any significant results obtained. It is highly doubtful that any accumulation in the field would be obtained at these concentrations. The directions for use call for ppm to be applied once per year and other factors such as photodecomposition, wind, rain, and soil enzymes will tend to mitigate this chemical, and not allowing the residues to build to critical levels.

These results do not conflict with the activated sludge study were bulking was observed. The plate counts in the activated sludge study did not show an effect, with the bulking caused by a stimulation of growth of these types of organisms by RH-2915. The results indicate that the compound may be used co-metabolically.

Data from the effect of microbes on pesticides study indicate that total CO_2 evolution is not impaired and supports the above results.

For reference we need to know how the applicant identified growth (i.e. colorimetric, turbulence, etc.)

This study is an acceptable population approach effect of pesticides on microbes study and fulfills the data requirement.

Activated Sludge

ACC#097091 Section J Tab-2 pg. 103-193. Activated Sludge Study with RH 2915 Lab. No. 7E-7455 1977

Materials and Methods

RH 2915 (2-chloro-1(3-ethoxy-4-nitrophenyl)-4-trifluoromethyl benzene) labeled in one of two positions: 1. trifluoromethyl - $^{14}CF_3$. 2. uniformely ^{14}C-nitrophenyl ring; were added at increasing increments from 0-200ppm into separate semi-continuous fill-draw activated sludge vessels. The sludge used was a composite of activated sludge from a treatment plant receiving industrial and municipal detritus material, plus synthetic sludge composed of nutrient broth, beef extract, dipotassium hydrogen phosphate and ammonium sulfate. The sludge composite was added to their respective vessels at 23 hr. intervals with a BOD/micro-organisms ratio of 0.3 and held at a constant 21-26°C temperature, with air bubbled through the system during this incubation. The air was indisposed after 23 hours, the sludge was allowed to settle for 1/2 hr. and samples were taken of the effluent and sludge. Approximately one-tenth of the solids were returned to the vessel and the process repeated again, using a higher concentration of RH-2915. Samples were monitored for $^{14}CO_2$, microbial characterization of enumeration (differential and selective media consisting of TGA, EAA, and RB agar plates), and extraction and characterization of the solids via Soxhlet reflux with methanol with subsequent TLC and LSC analysis.

Results/Conclusions

RH 2915 did not effect the number of colonies developing on the TGA or RB media. No growth was observed on the EAA media and is not expected since actinomycetes are not normal organisms associated with activated sludge.

MLSS (mixed liquor suspended solids) are not effected until the 5-9 cycle interval, which corresponds to 10-60ppm levels introduced and/or 15.7-171/ppm cumulative (due to the recycling of part of the solids back into the system, which is characteristic of activated sludge processes) at which time the sludge showed a marked decrease in the D.O. (control 7-8ppm, both labels of RH 2915 0.1 ppm.) and an increase in the MLSS (control 2-3g/l, both labels of RH 2915 3-4g/l). The author indicated that the sludge also had a predominance of filamentous micro-organisms in the system, making settling of the sludge difficult and causing subsequent termination of the experiment.

Total activity via combusion showed that 93-98% of the activity remains in the solids, while 2-3% was found in the effluent. Total recovery was 100%. This was true for both labels of RH 2915. Characterization of this activity indicated that 80% was parent material for the nitrophenyl label; 75.9% was parent for the trifluoromethyl label; 20.5% was amino RH 2915 for the nitrophenyl label and 16.8% for the trifluormethyl label and 2.7 and 6% remained at the origin for the nitrophenyl and trifluormethyl labels respectively. The effluent was not characterized as the solids, but can be assumed to have the same general pattern.

Vigorous aeration of sewage results in the formation of a floc; the finely suspended and colloidal matter of sewage forms aggregates designated as floccules. If this floc is permitted to settle and then added to fresh sewage that is again vigorously aerated, flocculation occurs in a shorter time than before. By repetition of this processes, a stage is reached where complete flocculation of the fresh sewage occurs very quickly. These particles of activated sludge contain large numbers of very actively metabolizing bacteria, together with yeasts, molds, and protozoa. This combination of microbial growth is very effective in the oxidation of organic compounds. Poor settlement of activated-sludge adversely affects the performance of a sewage-treatment plant. The principal reason for poor settling(bulking) is the growth of filamentous micro-organisms, either free-floating in the mixed liquor or protruding from the flocs. Organisms associated with this phenomenon are Sphaerotilus, Leucothrix, Lineola, Pelonema, Spirulina, Achronema, Pepoploca, Vitreoscilla, Thiothrix, Streptothrix, with some not identified but characterized such as gram-negative sheath forming bacteria.

From the data presented it can not be discerned as to what organisms are involved in the phenomenon observed, however, an effect is observed (bulking) and a subsequent decrease in the effluent quality or total inhibition of the activated sludge system may occur. Most of the parent and its metabolites stays in the sludge(solids) and 3% will be discharged into the receiving aquatic habitats.

This study is an acceptable activated sludge metabolism study and fulfills the data requirement.

Recommendations

The following information will have to be obtained from the applicant in order to more completely evaluate the potential concentrations that a municipal sewage treatment plant may receive.

1. The geographical locations for the manufacture of Goal.
2. Local municipality regulations in the manufacturing use area in regards to pre-treatment before discharge to a receiving treatment plant.
3. What is the local load(i.e.ppm) that will be received by the receiving plant.

Ecological effects should be informed that 3% of the load(consisting of 80% parent Goal and 20% amino-Goal) will be discharged by the plant to the receiving aquatic habitat--the significance of this and the need for indirect discharge data requirements should be addressed.

The significance of the effects observed should be referred to appropriate personnel in the Effluent Guidelines Div. and Enforcement Div. for the appraisal.

P.M. Note: the above do not apply if the chemical is manufactured outside the United States.

Mobility

Leaching Study with ^{14}C-RH-2915 in Four Soil Types Accession No. 094336, Technical Report No. 3923-74-67, Tap 14.

Four soils: Drummer silt loam, Hagertown clay loam, Lakeland sand and Pasquotank sandy loam were treated at the equivalent field rate of 1 lb/A (1 ppm) with RH 2915 labeled either in CF_3 group or nitrophenyl ring. 100 grams of each treated soil was layered over 12- inch columns of untreated soil of the same type. The equivalent of 20 inches of water was applied to each column over a 40 hr. period. Leachates were collected and radioanalyzed.

Physical Properties of Soils

Soil	Organic Matter (%)	pH	Mechanical Analysis (%) Sand	Silt	Clay	Cation Exchange Capacity (meq/100g)	Field Moisture Capacity[1]
Silt Loam	3.83	5.5	13	65	22	10.1	15.6
Clay Loam	1.89	6.9	28	34	38	7.2	13.5
Sand	0.95	5.0	98	0	2	1.7	7.1
Sandy Loam	2.70	5.5	74	19	7	8.25	13.5

1. Expressed as 1/3 bar moisture percent.

Radioanalysis of samples

Soil from each column was divided into 2 and 3 inch sections. Triplicate subsamples from each section were combusted, evolved $^{14}CO_2$ was trapped in ethanolamine: methyl cellosolve. After addition of scintillator solution to qliquots of trapping solution, activity was counted using

Scintillator solution was added to duplicate aliquots of the leachates and activity counted directly using LSC.

Radioactive Residues

as ppm RH-2915

	Silt Loam	Clay Loam	Sand	Sandy Loam
0-2"	1.50	1.86	0.91	2.11
2-4"	NDR	0.013	0.31	NDR
4-6"	NDR	NDR	0.08	NDR
6-9"	NDR	NDR	0.004	NDR
9-12"	NDR	NDR	NDR	NDR
Leachate	NDR	NDR	NDR	NDR

NDR - Less than 0.003 ppm

Conclusions

1. RH-2915 did not leach below four inches in any soils except sand, where traces were found at 9 inches.
2. This study is in agreement with the ^{14}C-field study where RH-2915 leached very little, and most of the radioactivity was found in the 0-1 inch soil layer.
3. This study is in agreement with adsorption/desorption studies in which RH 2915 was strongly adsorbed to soil, thereby limiting leaching.
4. This is an acceptable rapid leaching study and fulfills data requirement for mobility (rapid leaching).

"Laboratory Leaching Study with Aged RH 2915 Soil"; Accession No. 094336, Technical Report No. 3923-74-23, Tab 13.

Nixonton sandy loam was treated at 1 ppm with ^{14}C-RH 2915 labeled in either the CF_3 group or the nitrophenyl ring and placed in the greenhouse. After 32 days aging, 100 grams of aged soil was layered over duplicate 12-inch columns of untreated Nixonton sandy loam. An equivalent of 1/2 inch of water (ca. 185 ml) was added to the columns daily for 45 days.

Physical Properties of Nixonton Sandy Loam

Mechanical Analysis	Organic Matter	Cation Exchange Capacity	ph	Field Moisture Capac
Sand - 71%	2.59%	7 meq/100 g	5.5	12.5% @ 1/3 Bar Suctic

The leachates were collected daily and radioassayed. After 45 days, the soil was extruded from each column divided into 2-inch segments for the top 6 inches and 3-inch segments for the bottom 6 inches. Each soil segment was radioassayed.

Analytical Procedures

1. Leachates: Scintillator solution was added to duplicate aliquots of the leachate and counted directly using LSC.

2. Soil Segments: Triplicate subsamples from each soil segment were combusted evolved $^{14}CO_2$ was trapped in ethanoloamine: methyl cellosolve, and activity in trapping solution was counted using LSC.

3. Extraction and characterization of RH 2915 in Aged Soil: Aged soil samples were Soxhlet extracted with methanol. After concentrating the methanolic extract, the residue was dissolved in methanol and cochromatographed on silica gel thin layer against parent and conceivable RH 2915 degradation utilizing two TLC solvent systems:

   A = Hexane: benzene 1:3 (v/v)

   B = Acetone: benzene 1:3 (v/v)

Average Residues of Soil Column Sections
% of Applied ^{14}C

	CF_3 Label	NO_2-Ring Label
0-2"	82.97	82.25
2-4"	2.42	0
4-6"	0.35	0
6-12"	0	0
Total Recovered	85.74	82.25

Results

Approximately 83 and 82% of applied $^{14}CF_3$ and ^{14}C-nitrophenyl ring labeled RH 2915 respectively were found in the top 0-2 inch soil segments by combusion analysis. Less than 3% of ^{14}C- residue was detected in lower soil segments.

Approximately 1.85 and 1.35% of applied $^{14}CF_3$ and ^{14}C-nitrophenyl ring labeled RH 2915 respectively were found in the leachates after 45 days.

Methanol extract of aged soil contained 69 and 62% of $^{14}CF_3$ and ^{14}C-nitrophenyl ring labeled RH 2915 aged soil residue respectively; TLC analysis of methanol extractable ^{14}C-residue was shown to be all parent compound.

Approximately 15% of applied ^{14}C was unaccounted for with either ^{14}C-labeled RH 2915. Loss of the applied radioactivity was attributed to volatilization.

Conclusion

1. More than 82% of $^{14}CF_3$ or nitrophenyl labeled RH 2915 was retained in the upper 0-2 inches of Nixonton sandy loam and since only 1.35% CF_3 labeled or 1.85% of ring labeled RH 2915 was found in the leachates, RH 2915 is considered to be slightly mobile in sandy loam soil.

2. Leaching to at least 12 inches is indicated by the presence of either $^{14}CF_3$ or nitrophenyl ring labeled RH 2915 residue in leachates.

3. This study satisfies RH 2915 aged soil leaching data requirement for all uses requiring aged soil leaching data.

"Adsorption, Desorption and Leaching of Nitrofen and Oxyfluorfen"
Accession No. 096882. Section J, Tab 12. Open Literature Publication:
Weed Science, Vol. 25. Page 97, Issue 2 (March), 1977.

Adsorption

^{14}C-labeled technical oxyfluorfen (spec. act. 2.61 m Ci/g) randomly labeled in the nitrophenyl ring was used. Three concentrations, 2,4 and 6 M x 10^{-7} were used. The adsorbents used were: muck soil (19.2% clay, 56.0% silt, 30.2% sand, 56.0% organic matter, 97.0 meg/100g CEC and ph 6.1); Georgia kaolinite and Wyoming bentonite both 100% clay, washed first with either HCL or $CaCe_2$, then washed free of chloride ions with distilled water and freeze dried. Since acid washed clay contain large amounts of exchangeable aluminum, they are referred to as H-Al-clays.

Duplicate 0.2 g samples of adsorbent in a flask were treated with 10 ml of the aqueous herbicide solutions (10 ml=720 ug, 140 ug and 2170 ug of oxyfluorfen for the respective concentrations used). The flask were shaken for 4 hours in a gyrotary shaker containing water kept at 25±1°C. After equilibration the contents of the flasks were centrifuge and duplicate aliquots of the supernatants were analyzed using LSC. The difference in radioactivity between the standards and the treatments were considered to be adsorption.

Adsorption of oxyfluorfen on muck was greater than 95% of initial concentration. H-Al-Bentonite adsorbed more than 90% of the initial oxyfluorfen concentration. H-Al-Kaolinite adsorbed between 35 to 50% of the initial oxyfluorfen concentration. The ph did not seem to have an effect on the adsorption of oxyfluorfen.

Desorption

Desorption was determined by resuspending the adsorbents, at one initial concentration (6 x 10^{-7} M oxyfluorfen) in distilled water and shaking these at 25 ± 1°C for 1 hour. Content of tubes were centrifuged and aliquots of the supernatants analyzed by LSC. The extraction procedure and radioassay of supernatants were repeated 4 times.

Ten percent or less of oxyfluorfen was desorbed from muck, H-Al-2ndH-Ca-bentonite after 4 extractions.

Leaching

Physical and chemical characteristics of the soils used

Soil type	ph	Organic matter (%)	Clay (%)	Silt (%)	Sand (%)	CEC (meg/100g)
Ockley silt loam	6.7	2.1	14	72	14	14
Bloomfield fine sand	7.2	0.2	3	7	90	3

Plastic columns (inside diameter 7.5 cm) were packed with air dried Ockley silt loam or Bloomfield fine sand soil to a depth of 5 cm. The columns were saturated with water and the excess water allowed to drain out. Oxyfluorfen (0.4 m Ci + 153 mg) was added to the columns. After 2 hr., the columns were eluted with 240 ml of water (equivalent to 2.15" of the soil surface). The leachate was collected and the radioactivity determined.

Less than 2% of the applied radioactivity was found in the leachates for both soil types.

Conclusions:
Adsorption/Desorption

1. Adsorption/desorption of oxyfluorfen on and from muck, bentonite and kaolinite adsorbents is not a data requirement for this proposed user because these adsorbents are not representative of the proposed use sites. However, the study contains useful information for the follow reasons:

   (a) ph did not appear to influence the adsorption/desorption of oxyfluorfen on and from organic matter (muck) or clay (bentonite and kaolinite).

   (b) Organic matter (muck) and clay content influence both adsorption/desorption of oxyfluorfen.

Leaching

1. Approximately 98% of oxyfluorfen was retained on a 5 cm (depth) column of either Ockley silt loam or Bloomfield fine sand after elution with the equivalent of 2.15 " soil surface of water.

2. Leaching to 5 cm was indicated by the presence of about 2% oxyfluorfen in the leachate; leaching to lower depths is expected to be minimal due to the strong adsorption of oxyflourfen to soil.

3. This study partially satisfies the clay requirement for mobility; the rapid leaching part of the data requirement for mobility is satisfied by this study. Aged leaching was not addressed in this study.

"The Adsorptive and Desorptive Behavior of RH 2915 on Soil"

Accession No. 096884, Technical Report No. 34H-7727

A. Adsorption:

Duplicate 2.5 gram samples of each of 5 soils contained in a centrifuged tube were treated with either 15 ml or 25 ml of an aqueous solution of 0.01 $NCaSO_4$ containing 0.130, 0.034 or 0.011 ug/ml of CF_3 labeled RH 2915. The tubes were shaken for 24 hours at 25 $\pm$ 1°C to establish adsorption equilibrium. After equilibration the tubes were centrifuged and volume recorded. Duplicate aliquots were counted using LSC. Adsorption was determined by the difference in herbicide concentration between the initial and final equilibrium solutions.

Physical Properties of Soils

Soil Type	pH	% Organic Matter	Cation Exchange Capacity	Bulk Density g/cc	Mechanical Analysis(%) Sand	Silt	Clay
Pasquotank Sandy Loam	4.5	2.70	8.25	1.42	74	19	7
Cecil Clay	4.6	0.44	6.9	1.50	32	14	54
Lakeland Sand	4.9	0.95	1.7	----	98	0	2
Lawrenceville Silt Loam	6.4	2.70	9.0	1.49	16	66	18
Solomon Loam	7.3	15.10	49.9	1.16	24	44	32

B. Desorption:

A portion of soil was removed from each tube for radioassay by combustion. The remaining soil at each concentration level was resuspended in a Super-

Mixer, the tubes were shaken on a water bath at 25 ± 1°C. Each sample was given three desorptive extractions; the first desorptive extraction was equilibrated 16 hours, and the second and third extraction were each equilibrated five hours. Duplicate aliquots of equilibrated supernatants were counted using LSC. A soil fraction was combusted to determined the amount of adsorbed herbicide. The amount of the herbicide remaining adsorpted at each extraction was calculated from the difference between the successive residual concentration on the soil and that released in the respective equilibrium solution.

C. Calculation of Constants 1/n and K:

Adsorption and desorption isotherms were determined using the Freundlich relationship log x/m = log K + 1/n (log C) where x/m - ug herbicide adsorbed of the adsorbent, C = equilibrium solution concentration, K = value of x/m @ C = 1, and 1/n = slope of the isotherm. The K values were determined (by computer) as the antilog of the vertical axis intercept point for each linear curve. A Q value was also calculated which expressed the magnitude of pesticide adsorbed per unit of organic matter.

Results

Adsorption:

Soil Type	% Organic Matter	pH	% Adsorption of RH-2915 Concentration (ppm) 0.130	0.034	0.011
Solomon Loam	15.10	7.3	99.2	95.2	100.0
Pasquotank Sandy Loam	2.70	4.5	99.2	94.7	99.0
Lawrenceville Silt Loam	2.70	6.4	97.6	92.9	96.5
Cecil Clay	0.44	4.6	80.7	79.4	79.2
Lakeland Sand	0.95	4.9	73.8	65.1	74.0

RH-2915 was strongly adsorbed, the trend in decreasing order of adsorption by the different soils being: Solomon Pasquotank, Lawrencevill,e Cecil, Lakeland. The higher the organic matter the greater the adsorption.

The adsorption data show that there is an apparent relationship between organic matter content and RH 2915 adsorption. No apparent relationship between adsorption and pH, cation exchange capacity or clay contents was shown for the 5 soil used in this study.

Desorption:

% Desorption of RH-2915

ppm: Desorption Extraction (Rinse)	0.1			0.03			0.01		
	1	2	3	1	2	3	1	2	3
Solomon Loam	0.54	0.48	0.27	1.1	0.0	0.0	0.0	0.0	0.0
Pasquotank Sandy Loam	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
Lawrenceville Silt Loam	1.2	0.92	1.1	2.4	0.88	1.8	0.0	0.0	0.0
Cecil Clay	14.3	8.3	5.3	9.5	4.3	5.5	8.0	4.0	2.8
Lakeland Sand	18.7	11.4	5.5	17.5	8.0	5.4	13.4	5.2	3.6

In general, desorption of RH-2915 by the 5 different soils was in the reverse order of adsorption, indicative of the strong binding by the high organic matter soil.

Calculated Values for K, 1/n and Q:

Soil Type	Organic Matter %	RH-2915 Adsorption K[1]	1/n[2]	Q[3]	Desorption K[1]	1/n[2]	Q[3]
Solomon Loam	15.10	---	---	---	---	---	---
Pasquotank Sandy Loam	2.70	---	---	---	---	---	---
Lawrenceville Silt Loam	2.70	---	---	---	---	---	---
Cecil Clay	0.44	15.49	1.09	3520	48.98	0.77	11,13
Lakeland Sand	0.95	9.95	1.06	1047	36.31	0.79	382

[1] K determined as the antilog of the corresponding value of log x/m when log C_e = 0 (from Figures 1 through 4) x /m = amount of adsorbed pesticide (x) per unit amount of adsorbent (m) C_e = equilibrium solution concentration of the pesticide.

[2] $1/n = \text{slope} \quad \frac{\log C_2 - \log C_1}{\log x/m^2 - \log x/m_1}$

[3] $Q = \frac{K \times 100}{\% \text{ Soil Organic Matter}}$

RH 2915 was so strongly adsorbed that constants K and 1/n were calculated only for Cecil clay oand Lakeland sand, soil lowest in organic matter. The log of x/m and the log of C_e /equilibrium concentration (1st desorptive extraction only)/ was used to obtain the Freundlich isotherms in Figures 3 and 4 from which K and 1/n was determined.

The higher the K value, the greater the adsorptive properties of that soil/

pesticide combination. The constant N is a measure of the non-linearity of the adsorption process. Q is a value expressing the magnitude of pesticide adsorbed per unit of organic matter.

Conclusion:

1. Organic matter content of soil influenced both adsorption and desorption of RH 2915. RH 2915 was strongly adsorbed by each of the 5 soil types studied. Adsorption increased markedly with increasing organic matter contents. Desorption of RH 2915 by the 5 different soil type was in reverse order of adsorption relative to organic matter content.
2. This study is acceptable and satisfies mobility data requirement for adsorption/desorption.

Field Dissipation

"Field Decline Studies with RH-2915 in Soil", Technical Report No. 34 H-77-29, Accession No. 096883, (Tab 19) (This study also contains Tank Mix data)

Soil from 5 regions were treated with RH-2915 and periodically analyzed for residues to estimate half-life of RH-2915 under field conditions. Treatment rates and soil analytical characterization were as follows:

Soil Type	pH	%O.M.	% Sand	% Silt	% Clay	CEC meg/100g	Treatment lb. ai/a
Silty Loam	5.9	1.1	18	60	22	7.1	0.38, 0.75
Sandy Loam	5.2	1.1	90	4	6	2.9	0.38, 0.75
Clay Loam	7.1	2.8	42	22	29*	10.4	0.33
Sandy Loam	3.8	2.7	82	10	8	10.5	0.5, 1.0, 2.0
Sandy Loam	4.2	2.0	90	4	6	4.3	1.00

* remainder is "Coarse Fraction"

Analysis

Soil samples were extracted with methanol in a Waving Blendor. After filtration of the extract, the volume was adjusted and an aliquot digested with aluminum metal in refluxing aqueous NaOH to carry out 2 reactions: (1) reduction of nitro compounds (RH-2915 and isomers 5-CF_3-RH-2915 and 6-NO_2-RH-2915) to the corresponding amines and (2) hydrolysis of any amides (acetamido-RH-2915) to corresponding amines. The reaction products were steamed distilled into hexane in a Bleidner apparatus. The extract was treated with heptafluorobutyric anhydride to convert residues to their acylated derivatives. The derivatized residue was cleanedup by Florisil column chromatography and quantitated by GLC with an EC detector.

Results:

The residue levels determined were plotted against their corresponding treatment-to-sampling intervals and the best exponential decline curve fitted to the data points using a computer program GRAPH. The computer-estimated half-lives are shown below:

TABLE I

RH-2915 Half-Lives Estimated from field Experiments

State	Region[1]	Soil Type	Sample Depth	Treatment (lb ai/A)	Half-Lives (days)
PA	S	Silty Loam	0-2 Inches	0.38	60.8
				0.75	56.3
GA	P	Sandy Loam	0-2 Inches	0.38	59.3
				0.75	52.8
IN	M	Clay Loam	0-3 Inches	0.33	64.2
SC	T	Sandy Loam	0-3 Inches	1.00	60.8
				2.00	56.0
NC	T	Sandy Loam	0-3 Inches	1.00	71.8

[1] USDA Land Resource Region

A field dissipation study was performed to estimate RH-2915 half-life when applied to soil as a tank mixture with : Lasso, Surflan, Paraquat or MSMA. All treatment were surface applications of 2.0 lb ai/A of Goal to discrete samples (6" depth) of the soil type indicated. All samples were allowed to field-age at Rohm and Haas Experimental Farm, Newton, Pa., for up to 127 days. The following data were reported:

Soil Type	% O.M.	% Sand	% Silt	% Clay	CEC meg/100g	other herbicide	days est. half-life
Silt Loam*	2.70	16.0	66.00	18.0	9.0	none	32.0-70.7
						Lasso	95.4
						Paraquat	50.1
						Surflan	35.6
						MSMA	71.0
Sandy Loam*	2.70	74.0	19.0	7.0	8.25	none	68.2-68.8
						Paraquat	48.6
						Surflan	64.1
						Paraquat	48.6

* Lawrenceville Silty Loam and Pasquotank Sandy Loam (Same Soil Used in Adsorption/Desorption Study).

Conclusions

I. Field Dissipation Studies

1. The field dissipation studies are unacceptable because they are incomplete; the following deficiences are noted:

(a) Degradation products were neither determined nor characterized; therefore, residue decline curves for the formation and decline of metabolites comprising more than 10% of the initial application or 0.01 ppm whichever is greater can not be constructed. Decline curves show the duration of residues in soil that are used in assessment of potential uptake of residues by rotational crops.

(b) No raw data were submitted.

II. Tank Mixes (2-Components)

1. The tank mix studies are unacceptable because they are incomplete; no data were submitted for the following:

(a) Lasso dissipation in soil when applied alone was not determined.

(b) (a) above also applied to Paraquat and Surflan.

2. On silt loam, RH 2915 half-life (32.0-70.7 days when applied alone) increased to 94 days when applied as a tank with Lasso.

3. On silt loam RH 2915 half-life did not increase-when applied as a a tank mix with either Paraquat or Surflan.

4. On sandy loam, RH 2915 half-life did not increase when applied as a tank mix with either Surfaln or Paraquat.

5. RH 2915 half-life on sand loam, tank mixed with Lasso was determined.

III. Tank Mixes (3-Components)

1. Soil dissipation data were not submitted for RH-2915 when applied as a tank mixture with Lasso and Paraquat or Surflan and Paraquat (3-components).

"Characterization of Bound and Free Residues from ^{14}C-RH-2915 Application to Soil, Technical Report 34-H-76-27, Accession No. 096885"

Trifluoromethyl labeled or nitrophenyl ring labeled RH-2915 formulated as an emulsiable concentrate was used in this study.

Two Duncannon silt loam soil plots at Newton, Pa. were treated with either trifluoromethyl ^{14}C or nitrophenyl ring ^{14}C labeled RH-2915 at a rate of 1/4 lb/A on May 29, 1975. The soil remained fallow following treatment. Plots were weeded only as needed. Zero to 1 inch soil samples were taken 82 and 364 day following the application. On May 26, 1976, the same plots were treated again at 1/4 lb/A. The treatment was incorporated to a depth of 3 inches. Zero to 3 inches samples were taken 67 days after the second application. All samples were stored in a freezer until analyzed.

Physical Properties of Duncannon Silt Loam

Mechanical Analysis	Percent
Coarse Fragments	1.1
Sand	0.0
Silt	56.1
Clay	42.8
pH	7.06
Cation Exchange Capacity (meg/100g)	11.0
Organic Matter	2.5

The soil samples (70-100g) were first Shoxhlet extracted with benzene. The benzene-extracted soils were Soxhlet extracted with methanol. The solvent extracted soils were placed in Erlenmeyer flasks on a skaker and extracted with water. After shaking, the samples were centrifuged, supernatant was decanted and the soil air dried in a hood. Ten grams of the air dried water extracted soils were further extracted by shaking in Erlenmeyer flasks with 0.5 N NaOH solution. The mixture was centrigued, supernatant was decanted, and the soil (humin) washed and centrifuged twice with the NaOH solution and three times with water. The washes were combined with the NaOH supernatant. The remaining humin was analyzed by combustion/LSC analysis.

Chromatography of ^{14}C-Soil Extracts

The benzene, methanol and water extracts were evaporated to dryness on watch glasses. ^{14}C-residues from benzene extracts were dissolved in benzene and in methanol from the methanol and water extracts. Aliquots of ^{14}C-residues from all of the extracts were analyzed by TLC using two systems: (1) hexane/benzene and (2) acetone/benzene. Spots were visualized by radioautographs and quantitated by removing ^{14}C-silica gel spots from TLC plates and counted by LSC. Identification of metabolites was cochromato graphy with standards.

TABLE I

Material Balance of Extractable and Bound RH-2915 Residues in Soil

RH-2915 ^{14}C Label Site	Soil Samples TSI[1]	Treatment Year	% ^{14}C Remaining in Humin	% ^{14}C Extracted from Soil[2]	Material Balance %
CF_3	82	1975	20.3	69.8	90.1
CF_3	364	1975	23.4	72.8	96.2
CF_3	67	1976	19.7	92.4	112.1
NO_2	82	1975	21.7	59.6	91.3
NO_2	364	1975	34.7	57.1	91.8
NO_2	67	1976	27.6	62.3	89.9

[1] Treatment to Sampling Interval (days)

[2] Based on original combustion data for intact soil sample.

Extractable residue was highest in those samples with the shortest interval from treatment to sampling. The percentage of residue in humin (unextractable) increased with increasing treatment to sampling interval.

TABLE II

Extractability of ^{14}C Residues from RH-2915 Treated Soils

^{14}C RH-2915 Label Site	Soil Sample TSI[1]	Soil Sample Treatment Year	Percent Extraction Benzene Soxhlet	Methanol Soxhlet	Water Shaker	NaOH Shaker	Total Percent Extracted
CF_3	82	1975	26.4	12.3	1.1	30.0	69.8
CF_3	364	1975	24.8	8.7	2.7	36.6	72.8
CF_3	67	1976	48.7	10.4	1.4	31.9	92.4
N	82	1976	11.2	7.6	1.6	39.2	59.6
N	364	1975	11.0	5.1	1.5	39.5	57.1
N	67	1976	16.6	4.3	0.9	40.5	62.3

[1] Treatment to sampling interval (days)

NaOH and benzene extracted the largest amount of radioactive residue from the soil. The percentage extractable ^{14}C residue was higher for the soil samples treated with ^{14}C RH-2915 labeled in the CF_3 position (70-92%) than for the NO_2 labeled one (57-62%).

TABLE III

^{14}C-RH-2915 Soil Metabolite TLC
Characterization and Percent Composition

		% of Total Recovered ^{14}C											
		CF_3 67[1]		CF_3 82[1]		CF_3 364[1]		N 67[1]		N 82[1]		N 364[1]	
Metabolites	Rf	B[2]	M[2]	B	M	B	M	B	M	B	M	B	M
TLC Solvent "A"[3]													
Unknown	0.90	0.9											
RH-2512	0.81	1.9		2.0		2.3							
Unknown	0.79				3.2								15.5
Unknown	0.71	2.0	5.9	2.3								63.0	34.4
RH-2915	0.58	72.9	15.2	68.9	48.6	70.3	31.8	45.8	27.5	59.9	44.8		
Unknown	0.44	4.2		3.2									
Unknown	0.18							30.6					
Unknown	0.11								19.0				
Unknown	0.03	6.2		6.5		8.0		5.4		8.7		10.4	
Origin	0.00	11.7	78.9	17.0	48.2	16.0	68.2	18.2	53.5	31.4	55.2	26.7	50.1

[1] Treatment to Sampling Interval (days) 67 in 1976 and 82,364 in 1975.

[2] Extracts: B= Benzene, M = Methanol

[3] A = Hexane: Benzene, 25:75

Parent RH-2915 was the preponderant compound identified throughout the study. Eight soil metabolites or degradation products were detected. Three major unknown: R_f values 0.18, 0.11 and 0.03 accounted for 30.6, 19.0 and 10.4% of applied activity at 67,82, and 364 days respectively. The unknown with the R_f value of 0.03 increased from 6.5% of activity at day-82 to 10.4% of activity at day-364. One minor metabolite was tentatively identified as RH-2512 (deethoxylated RH-2915) and accounted for 2.3% of activity at day-364. The other 4 unknown metabolite ranged from 0.9 to 4.2% of applied activity. Activity at origin varied from 17.0% at day 82 to 68.2% at day-364 in 1975. When a second application was applied (1/4 lb/A) and sampled 67 days later (total days-431) 78.9% of applied activity was found at the origin.

Conclusions:

1. This study is not referenced to any particular use; however, the application rates do not reflect the highest recommended use rate under actual use conditions.
2. Not enough intervals were used to establish the formation and decline of degradation products nor to determine which degradation products would exceed 10% of the initial application or 0.01 ppm whichever is greater.
3. Three major unknown and the material at the origin were not identified.

"The Fate of RH-2915 Residues in Soil in Pennsylvania"
Technical Report 3423-76-19, Accession No. 095585

This study had the same objective as the study entitled :The Fate of RH 2915 Residues in Soil in North Carolina". Objective: Determine soil residues from ^{14}C-RH-2915 during the growth of rotation crops.

On June 5, 1974, RH-2915 labeled in either the CF_3 group or uniformly in the nitrophenyl ring was sprayed preemergence on plots of peanuts and soybeans at 1/4 lb/A and 1/2 lb/A in Newtown Pennsylvania. The soil had the following composition:

% Coarse Fragments	% Sand	% Silt	% Clay	pH	CEC meg/100g	% OM
36.2	0	36.4	27.4	6.86	15.0	3.6

The soil in the above plots was rototilled on April 9, 1975 and beets, corn, lettuce and spring wheat were planted. Samples of soil for residue analysis were obtained at bimonthly intervals until October 3, 1975. Soil samples were analyzed by combustion/LSC analysis.

SD

Soil Residues During Rotation Crops Following Preemergence Applications with ^{14}C-RH-2915

1975 Date	PSI[1] (Days)	TSI[2] (Days)	^{14}C Soil Residues 0-3" Depth as ppm RH-2915							
			1/4 lb/A				.1/2 lb/A			
			CF3*	CF3**	N*	N**	CF3*	CF3**	N*	N**
April 9	0	308	0.014	0.018	0.014	0.117	0.035	0.048	0.046	0.034
June 9	61	369	0.080	0.065	0.059	0.069	0.055	0.076	0.088	0.094
Aug. 15	128	436	0.004	0.037	0.019	0.059	0.047	0.030	0.050	0.024
Oct. 13	187	495	0.003	0.029	0.009	0.009	0.010	0.034	0.018	0.009

[1] Planting to Sampling Interval (with beets, corn, lettuce and spring wheat)

[2] Treatment to Sampling Interval (^{14}C-RH-2915 with peanuts and soybeans)

* Initial preemergence experiment with peanuts

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At the beginning of this study (308 days after the original application) residues found in soil from the 1/2 lb/A application average 0.04 ppm for both labeled positions of RH-2915. For the final sample taken 187 days later (495 days after the original application), the average residue was 0.015 ppm.

Conclusion:

1. This study contains useful information, but it is not an Environmental Chemistry data requirement.

"The Fate of RH-2915 Residues in Soil in North Carolina, Technical Report No.3423-76-21, Accession No. 095585"

To determine RH 2915 residues in soil during the growth of rotation crops, two sets of rotation crops were grown in Norfolk sandy loam plots. The plots had been previously sprayed preemergence on peanuts and soybeans with RH 2915 at a rate of 1/2 lb/A on May 21, 1974. The soil had the following characteristic:

pH	% OM	% Sand	% Silt	% Clay
5.4	1.2	83	14	3

On September 25, 1974, the soil was rototilled in half of the plots and mustard greens, radishes and turnips were planted. These rotation crops were harvested on January 6, 1975. On April 1, 1975, all of the plots were rototilled and carrots, corn, lettuce and spring wheat were grown until the final harvest data of October 22, 1975. Samples of soil for residue analysis were collected periodically during both crop experiments. Samples were analyzed by combustion/LSC analyses.

Soil Residues During Rotation Crops Following Preemergence Applications with ^{14}C-RH-2915 in North Carolina

Date	PSI[1] (days)	TSI[2] (days)	^{14}C Soil Residues 0-3" Depth as ppm RH-2915 1/2 lb/A			
			CF_3*	CF_3**	N*	N**
1974						
Sept. 25	0	127	0.035		0.053	
Oct. 28	33	160	0.025		0.039	
Dec. 4	70	197	0.015		0.017	
1975						
Jan 6	103	230	0.002		0.082	
April 1	0	315	0.010	0.041	0.032	0.023
June 9	69	384	0.005	0.005	0.025	0.025
Aug. 8	129	444	0.009	0.054	0.041	0.013
Oct. 22	204	519	0.009	0.021	0.018	0.015

1 Planting to Sampling Interval (with mustard greens, radishes, and turnips, first, and beets, corn, lettuce, and spring wheat, second).

2 Treatment to Sampling Interval (^{14}C-RH-2915 with peanuts and soybeans).

* Initial preemergence experiment was with peanuts.

** Initial preemergence experiment was with soybeans.

At the beginning of the first rotation crop experiment, 127 days after application, the residues found in soil samples taken to a depth of 3 inches were 0.035 ppm and 0.053 ppm respectively for CF_3 and NO_2 labeled RH 2915. At the end of the second rotation crop study, 519 days after original application, residues found in soil tanke at 0.3 inches, averaged 0.015 ppm and 0.015 ppm for CF_3 and NO_2 labeled RH 2915 respectively.

Conclusion:

1. This study contains useful information, but it is not an Environmental Chemistry data requirement.

"RH-2915 Fallow Field Study" Technical Report 34H-76-5,
Accession No. 095585

RH-2915 was applied at 0.25 lb/A in May, 1975 to freshly rototilled soil containing approximately 0.06 ppm ^{14}C-RH-2915 residues for a prior crop residue study in which RH 2015 was at 0.75 lb/A. After application of ^{14}C-RH-2915, the soil plots were left fallow and hand weeded as needed. The soil characteristic wer as follows:

% Coarse Fragments	% Sand	% Silt	% Clay	pH	CEC meg/100g.	% OM
1.1	0	56.1	42.8	7.06	11.0	2.5

Soil samples in segments of 0-1", 1-", and 3-6" in depth were collected throughout the approximately 1 year study. Samples were analyzed by combustion/LSC analysis.

Calculation of Total 0-6" ^{14}C Residues

TSI	Total Residues Adjusted According to Depth								Grand
	CF_3-^{14}C-RH-2915				NO_2 Ring-^{14}C-RH-2915				
(Days) Depth	0-1"	1-3"[1]	3-6"[2]	2	0-1"	1-3"[1]	3-6"[2]	2	Average
0	.539	.096	----	.635	1.119	.164	-----	1.283	.959
9	.555	.042	.021	.618	.153	.010	.003	.166	.392
18	.226	.074	.009	.309	.208	.076	.003	.367	.338
32	.283	.072	.027	.0382	.221	.022	.022	.356	.369
50	.329	.106	.030	.465	.223	.066	.021	.310	.387
145	.140	.066	.000	.206	.179	.036	.003	.218	.212
316	.188	.086	.000	.274	.264	.132	.006	.402	.338

[1] Determined by multiplying the corresponding data of Table II by two to account for its two inch depth.

[2] Determined by multiplying the corresponding data of Table II by three account for its three inch depth.

Composite ^{14}C-residue in soil from 0-1", 1-3" and 3-6" segments (0.402 ppm) at day-316 was greater than the application rate (0.25 lb/A).

Conclusion:

1. This is an unacceptable field dissipation study because of the following deficiencies:
   a. Degradation products were not determined; therefore, dissipatation to 90% loss of parent RH-2915 could not be determined.
   b. Formation and decline of degradation products comprising more than 10% of initial application or 0.01 ppm whichever is greater was not determine or identified.
2. Leaching to at leaching 6 inches was indicated by the occurrence of ^{14}C residue in 3-6" soil cores.

"Soil Residue Decline Studies with RH-2915 and Lasso"
Technical Report 34 H-77-10, Accession No. 095885

Two soil type with the following analytical characteristic were used in the studies.

	Lawrenceville Silt Loam	Pasquotank Sandy Loam
Organic Matter, %	2.70	2.70
Cation Exchange Capacity meq/100 g	9.0	8.25
Mechanical Analysis		
% Sand	16.0	74.0
% Silt	66.0	19.0
% Clay	18.0	7.0
Bulk Density, g/cc^2	1.49	1.42

Each soil was added to one-gallon can to a depth of 6 inches. Soil were individually treated at a rate equivalent to 2 lb/A for RH-2915 and 3 lbs/A for Lasso. As a tank mixture, the same rates were used as when applied individually. After treatment, all cans were placed in a trench and allowed to age under actual field conditions. Untreated controls samples were also field aged.

Analytical Procedure

Soil samples were extracted with acetonitrile in water in a warning blendor. The extraction mixture was filtered and a measured aliquot was evaporated to dryness. The moist residue was dried further by the

addition of anhydrous sodium sulfate. The remaining residue is redissolved in chloroform and an aliquot analyzed by GLC.

2. RH-2915

Analyses for residues of RH-2915 were said to have been carried out using the terminal method described in Technical Report No. 3923-75-22, with detailed analytical results were included in this report, but the cited analytical method could not be found in this submission. Techniques were developed for quantitation of residues due to the two major positional isomers of RH-2915 present in the technical grade material. Their measurements are also reported in this review.

TABLE I

Decline of Lasso Residues in Soils

Soil Type	TSI (days)	Treatment lb ai/A:	Residue (ppm as Lasso) Lasso (3)	Lasso (3)/2915 (2)
Silt Loam	0		0.81	1.11
	7		0.34	0.45
	14		0.32	0.32
	28		0.06	0.14
Sandy Loam	0		1.32	1.22
	7		0.40	0.31
	14		0.24	0.23
	28		0.12	0.10

TABLE II

Decline of RH-2915 Residues in Soils

Soil Type	TSI (days)	Treatment lb ai/A:	Residue (ppm as RH-2915) RH-2915 (2)	RH-2915 (2)/Lasso (3)
Silt Loam	0		0.81	0.83
	7		0.61	0.60
	14		0.45	0.30
	28		0.35	0.38
	59		0.21	0.26
	127		0.35	0.23
Sandy Loam	0		1.20	1.08
	7		0.52	0.45
	14		0.60	0.39
	28		0.56	0.62
	59		0.44	0.44
	127		0.23	0.38

TABLE III

Decline of Isomers of RH-2915 in Soils

Soil Type	Treatment (lb AI/acre)	TSI (days)	Residue Found (ppm as RH-2915) II (6'-NO_2)	II/I	III (5-CF_3)	III/I
Silt Loam	RH-2915 (2)	0	0.03	0.037	0.02	0.025
		7	0.03	0.049	0.02	0.033
		14	0.03	0.067	0.02	0.044
		28	0.02	0.057	0.00	0.000
	RH-2915 (2)/ Lasso (3)	0	0.05	0.060	0.02	0.024
		7	0.03	0.050	0.01	0.017
		14	0.04	0.133	0.02	0.067
		28	0.02	0.053	0.00	0.000
		59	0.01	0.038	0.00	0.000
Sandy Loam	RH-2915 (2)	0	0.08	0.067	0.02	0.017
		7	0.03	0.058	0.00	0.000
		14	0.04	0.067	0.02	0.033
		28	0.03	0.053	0.02	0.036
		59	0.03	0.068	0.01	0.022
		127	0.00	0.000	0.00	0.000
	RH-2915 (2)/ Lasso (3)	0	0.08	0.074	0.03	0.028
		7	0.02	0.045	0.00	0.000
		28	0.02	0.032	0.01	0.016
		127	0.01	0.018	0.00	0.000

TABLE IV

Half-lives Estimate (Days)

	Lasso	Lasso/RH-2915	RH-2915	RH-2915/Lasso
Soil Type				
Silt Loam	1.7	5.4	70	95.4
Sandy Loam	8.5	8.8	68.3	160

Half-lives were estimated from exponential decline curve fitted to to data points using a computer program GRAPH.

Conclusion

1. The tank-mix (two component) studies are unacceptable; the large amount of unaccounted for residue for both herbicides at zero-day mullifies residue decline studies at the stated application rate.
2. The results of this study (extractable RH-2915) are not in agreement with the "^{14}C-RH-2915 Soil Metabolite TLC characterization and Percent composition study. In that study 68% of CF_3 labeled RH 2915 was recovered from Duncannon silt loam 84-days after application under field conditions and 63 % was characterized as RH-2915, 364 days after application. Explain the discrepancies for the tank-mix low soil residues at zero day?

"Soil Residue of Decline Studies with Goal and Paraquat"
Technical Report 34 H-77-21, Accession No. 095885

These studies were conducted similar to the tank-mix studies for Lasso and RH-2915, except that paraquat was applied to Lawrenceville Silt Loam and Pasquotank Sandy Loam at lb/A both individually and in tank-mix. RH-2915 was applied as before 2 lb/A individually and in tank-mix.

Analytical Procedures

1. Paraquat

The soil was refluxed in sulfuric acid to free the paraquat from the absorbed of bound state. the extract (either as is or neutralized) was passed through a cation-exchange resin which adsorbed paraquat, but passed most the soil constituents. The paraquat was eluted from the resin with saturated ammonium chloride solution. Paraquat is reduced by sodium dithionite to an unstable free radical which has an intense blue color and also a strong absorption peak at 394 mu. This reaction was used to estimate paraquat in the ammonium chloride eluate.

2. RH-2915

Method is said to be described in Technical Report No. 3923-75-22, but the method could not be found in this submission.

TABLE I

Decline of Paraquat Residues in Soils

Soil Type	TSI[1] (days)	Treatment (lb ai/A):	Residue Found (ppm calc as Paraquat) Paraquat (1.0)	Paraquat (1.0)/ RH-2915 (2.0)
Silt Loam	0		0.25	----
	7		0.17	0.28
	14		0.33	0.20
	28		0.29	NDR[2]
Sandy Loam	0		0.50	----
	7		0.10	0.28
	14		0.70	0.21
	28		0.28	NDR[2]

[1] TSI is treatment-to-sampling intervals

[2] NDR indicates no detectable residue at the sensitivity of the method (0.10 ppm).

TABLE II

Decline of RH-2915 Residues in Soils

Soil Type	TSI[1] (days)	Treatment (lb ai/A):	Residue Found (ppm as RH-2915) RH-2915 (2.0)	RH-2915 (2.0)/ Paraquat (1.0)
Silt Loam	0		0.81	0.78
	7		0.61	0.67
	14		0.45	0.65
	28		0.35	0.43
	59		0.21	0.21
	127		0.35	0.14
Sandy Loam	0		1.20	0.70
	7		0.52	0.55
	14		0.60	0.62
	28		0.56	0.47
	59		0.44	0.29
	127		0.23	0.45

[1]TSI = Treatment-to-sampling interval

TABLE III

Decline of Residues of Isomers of RH-2915 in Soils

Soil Type	Treatment (lb ai/A)	TSI (days)	Residue Found (ppm as RH-2915) II (6'-NO_2)	II/I	III (5-CF_3)	III/I
Silt Loam	RH-2915 (2)	0	0.03	0.037	0.02	0.025
		7	0.03	0.049	0.02	0.033
		14	0.03	0.067	0.02	0.044
		28	0.02	0.057	0.00	0.000
	RH-2915 (2)/ Paraquat (1)	0	0.05	0.068	0.02	0.027
		7	0.04	0.060	0.02	0.030
		14	0.03	0.046	0.01	0.015
		28	0.02	0.047	0.00	0.000
		127	0.00	0.000	0.00	0.000
Sandy Loam	RH-2915 (2)	0	0.08	0.067	0.02	0.017
		7	0.03	0.058	0.00	0.000
		14	0.04	0.067	0.02	0.033
		28	0.03	0.053	0.02	0.036
		59	0.03	0.068	0.01	0.022
		127	0.00	0.000	0.00	0.000
	RH-2915 (2)/ Paraquat (1)	0	0.04	0.057	0.02	0.029
		7	0.03	0.055	0.01	0.018
		14	0.03	0.048	0.01	0.016
		28	0.02	0.043	0.01	0.021

Table IV

Half-Lives Estimates (Days)

Soil Type	Paraquat	Paraquat/RH 2915	RH 2915	RH 2915/Paraquat
Silt Loam		11	30	50.1
Sandy Loam		11.4	68.8	48.6

Conclusions

1. See conclusion 1 and 2 for residue decline studies for tank mix of Lasso and RH-2915.
2. Based on the application rate, the low value reported for paraquat at zero-day (0.25 ppm) is not consistent with the reported % recovery (67%) for the analytical methods.
3. Half-life estimates can not be made for paraquat in either soil type from the exponential decline curve submitted

ACCUMULATION

"Radioactive Residues in Rotation Crops Grown in Soil Treated with ^{14}C-RH-2915 the Preceding Year" Accession No. 095071, Report No. 34-8

RH-2915 ^{14}C labeled in the C_F group or in the NO_2 ring was applied preemergence at a rate of 0.25 lb/A or 0.50 lb/A to several soil plots at Newton, Pa., and Wilson, North Carolina, after planting soybean and peanuts. In North Carolina rotation crops of carrots, lettuce and oats were planted 306 days and cotton was planted 334 days after the last treatement of radioactive RH-2915. In Newton, Pa., lettuce, beets and wheat were planted 308 days and corn was planted 343 days after last treatment with ^{14}C-RH-2915. Samples of each of the 8 crops were removed for radioassay at intervals during the grown seasor and at harvest.

Sample Preparation:

Samples of the rotational crops were homogenized by grinding with dry ice until a powder-like consistency was attained. The dry ice was allo to sublime and samples were weighed for radioanalysis.

Radioanalysis:

All samples were conbusted and the trapped $^{14}CO_2$ was counted by LSC.

TABLE I

Radioactive Residues in Rotation Crops
Grown at Newtown, Pa. (ppm calc as RH-2915)

		Label Site:	CF_3 Group		NO_2 Ring	
		1974 Rate (lb/A):	0.25	0.50	0.25	0.50
PSI (days)[1]	Sample Type					
CORN						
26	Foliage		NDR[2]	NDR	NDR	NDR
64	Foliage		NDR	.025	NDR	NDR
97	Foliage		.008	.027	NDR	NDR
154	Stalks		.023	.030	NDR	.013
154	Husks		NDR	.016	NDR	.012
154	Kernels		NDR	NDR	NDR	.017
154	Cobs		NDR	NDR	NDR	.010
WHEAT						
35	Foliage		NDR	----	NDR	NDR
61	Foliage		NDR	.014	NDR	NDR
99	Straw		.016	.042	.015	.013
99	Chaff		NDR	.031	NDR	NDR
99	Grain		.011	.032	NDR	.014
BEETS						
35	Foliage		----	NDR	NDR	----
61	Foliage		.023	.012	NDR	.017
99	Foliage		.012	.044	NDR	NDR
132	Foliage		.017	.024	NDR	NDR
132	Roots		NDR	.015	NDR	NDR
LETTUCE						
35	Foliage		----	NDR	NDR	----
61	Foliage		NDR	NDR	NDR	NDR
99	Foliage		NDR	NDR	NDR	NDR

[1]PSI = Planting-to-Sampling Interval

[2]NDR = No detectable residue

TABLE II

Radioactive Residues in Rotation Crops
Grown at Wilson, North Carolina (ppm calc as RH-2915)

PSI (days)[1]	Sample Type	Label Site: 1974 Rate (lb/A):	CF_3 Group 0.50	NO_2 Ring 0.50
CARROTS				
42	Foliage		.026	NDR[2]
112	Foliage		.015	.007
112	Root		.008	NDR
133 —	Foliage		.041	NDR
133 —	Root		.013	NDR
LETTUCE				
42	Foliage		NDR	.018
69	Foliage		.019	NDR
112	Foliage		----	NDR
OATS				
42	Foliage		NDR	NDR
69	Foliage		NDR	NDR
112	Grain		.020	NDR
COTTON				
34	Plant		.015	NDR
99	Plant		.012	NDR
169	Seed		NDR	NDR
169	Fiber		NDR	NDR

[1]PSI = Planting-to-Sampling Interval

[2]NDR = No detectable residue

Conclusions:

1. Low levels (0.007 to 0.042) of ^{14}C-residues were found in all matured rotation crops grown in soil treated in the previous year at 0.25 or 0.5 lb/A with RH 2915 labeled in either the CF_3 group or nitrophenyl ring except cotton and lettuce.
2. Since all of the rotational crops except cotton and lettuce contained low levels of ^{14}C-residues, and since only 1/8 or 0.25 lb/A and 1/4 or 0.5 lb/A of the recommended amount of RH 2915 was applied, field studies using formulated product under actual use conditions are needed to assess uptake of residues in crops rotated 1 year after the last application of Goal.

"Radioactive Residues in Rotation Crops Following ^{14}C-RH-2915 Preemergence Application to Peanuts at Wilson, North Carolina", Accession No. 095071, Report No. 3923-75-16.

Peanuts were grown in soil that had been treated preemergence at 0.5 lb ai/A with RH-2915 labeled either in the CF_3 group or nitrophenyl ring. After harvesting the peanuts, the soil tilled (127 days after treatment-immediately after harvest) and mustard, radish, and turnips were planted in the treated area as rotational crops. samples of the seedling and more mature plants were taken until cold weather destroyed the remainder of the crop.

Sample Preparation

Samples of plants and radishes were homogenized by grinding with dry ice until a powder-like consistency was attained. The dry ice was allowed to sublime and samples were weighed for radioanalyses.

Radioanalysis:

All samples were combusted and the trapped $^{14}CO_2$ was counted by LSC.

TABLE I

Radioactive Residues (ppm calc as RH-2915) in Rotation Crops

From plots treated with nitrophenyl ring labeled RH-2915

Crop	Planting to Sampling Interval (days) 26	54	83
Mustard leaves	.008	NDR	NDR
Turnip leaves	.01		.005
Radish leaves	.006		----
Edible Radish	----		NDR

From plots treated with CF_3 labeled RH-2915

Mustard leaves	.01	.04	.01
Turnip leaves		.03	.008
Radish leaves		.03	----
Edible Radish		.006	.006

Results:

Low levels (0.01 ppm or less (0.005 ppm) of radioactive residues were present in rotated mustard leaves, turnip leaves and edible radish at day-83 after planting.

Conclusion:

1. A field study using formulated product under actual use conditons is needed to assess uptake of residues in corps rotated immediately after harvest for the following reasons:
   (a) Turnip roots were not analyzed in this study.
   (b) No data were reported for day-83 radish leaves samples.
   (c) A small grain was not included in this study.
   (d) Only 1/4 or 0.5 lb/A of the recommended amount of RH 2915 was applied. Use directions recommend up to 2 lbs/A per season. No data were submitted to support the 2 lbs/A application for rotational crop.

"A Residue and Metabolism Study of ^{14}C-RH-2915 in Bluegill Sunfish"
Accession No. 096886, Report No. 34-23

Bluegill were continuously exposed to ^{14}C-RH-2915 (10 ug/l) in well water (pH of 7.1, total hardness of 35 milligrams per liter as calcium carbonate) at a temperature of 16 $\pm$ 1°C for 40 days. The dissolved oxygen in the water ranged from 5.5 to 9.1 mg/l. Samples of fish and water were removed for radio analysis throughout 40 days of exposure.

After exposure, the remaining fish were transferred to herbicide free well water for 14 days. Total ^{14}C-residues were determined in muscle, visceral tissue and whole body samples.

Analysis of Samples

Water: Triplicate aliquots of water samples were counted by LSC.

Fish: Muscle and visceral tissue of three bluegill were air dried and combusted. Evolved $^{14}CO_2$ was trapped and counted by LSC. Carcasses of two fish along with their fillets and viscera at each sampling were air dried and combusted. Evolved $^{14}CO_2$ was trapped and counted by LSC. ^{14}C-residue was quantitated on a whole body bais. Duplicate sets of three fish were sampled on day 10 and 40 of exposure. Muscle tissue from each set was extracted successive with hexane and methanol to determine the relative distribution of polar, non-polar and non-extractable ^{14}C-residues. Activity in hexane and emthanol extracts was counted by LSC. The tissue remaining after hexane and methanol extraction was combusted and evolved $^{14}CO_2$ quantitated as non-extractable residue using LSC.

Metabolites Characterization

Viscera or edible tissue was Soxhlet extracted with methanol. Methanoli extract was concentrated and residue partitioned between water and ether After radioanalysis of organic and aqueous phases, the organic phase (ether) was concentrated and analyzed by TLC using two systems, (1) hexane/benzene and (2) acetone/benzene. Spots were visualized by radio- autographs and quantified by removing ^{14}C-silica gel spots from TLC plat and counted by LSC. Identification was by cochromatography with standar

Table 1 -- Mean measured ^{14}C-residues, calculated as RH-2915, in water and bluegill sunfish (Lepomis macrochirus) during 40 days of continuous aqueous exposure to a nominal concentration of 10 µg/ℓ CF_3-labelled ^{14}C-RH-2915 and during a 14 day depuration period.

Period	Day	Conc. in water (µg/ℓ)	^{14}C-residue concentrations (mg/kg) muscle	viscera	whole fish
Exposure	1	2.6(0.1)[a]	0.63(0.09)	4.8(1.1)	1.4(0.2)
	3	5.8(0.5)	1.7(0.2)	15(2)	4.2(0.1)
	7	18(9)	2.8(0.5)	19(5)	7.0(0.0)
	10	9.8(0.2)	2.6(0.4)	25(8)	5.5(1.3)
	14	6.7(1.0)	3.6(0.9)	30(7)	9.3(2.4)
	22	7.5(0.3)	4.1(1.0)	40(13)	12(5)
	30	7.0(0.3)	5.5(1.3)	34(13)	14(5)
	40	9.3(0.4)	6.4(1.7)	50(9)	18(0)
Depuration	1		5.1(2.3)	44(26)	7.9(5.1)
	3		4.6(2.7)	54(45)	19(11)
	7		1.5(0.7)	13(10)	4.2(2.8)
	10		1.2(0.5)	7.5(5.0)	3.4(2.5)
	14		0.88(0.75)	8.3(9.5)	3.3(2.6)

[a] Mean and (standard deviation).

Table 2 -- Mean measured ^{14}C-residues, calculated as RH-2915, in water and bluegill sunfish (Lepomis macrochirus) during 40 days of continuous aqueous exposure to a nominal concentration of 10 µg/ℓ NPR-labelled ^{14}C-RH-2915 and during a 14 day depuration period.

Period	Day	Conc. in water (µg/ℓ)	^{14}C-residue concentrations (mg/kg) muscle	viscera	whole fish
Exposure	1	2.3(0.1)[a]	0.54(0.12)	3.8(1.0)	0.95(0.07)
	3	3.0(0.1)	1.6(0.2)	16(4)	3.1(0.0)
	7	6.6(0.6)	2.6(0.3)	20(4)	6.2(0.3)
	10	10(0)	2.8(0.4)	35(12)	7.8(1.5)
	14	9.0(0.7)	3.4(0.9)	33(7)	8.6(0.4)
	22	6.2(0.4)	3.5(1.1)	31(6)	8.2(2.6)
	30	6.9(0.5)	3.8(0.6)	33(13)	9.0(1.0)
	40	8.3(0.3)	5.6(0.9)	39(3)	13(0)
Depuration	1		4.9(1.7)	53(29)	12(4)
	3		2.2(1.7)	29(20)	8.1(3.2)
	7		2.9(2.8)	25(32)	2.2(1.1)
	10		0.59(0.45)	7.5(6.9)	0.69(0.40)
	14		0.36(0.19)	3.2(2.5)	1.0(0.0)
			6.4 %	8.2%	7.7 %

[a] Mean and (standard deviation).

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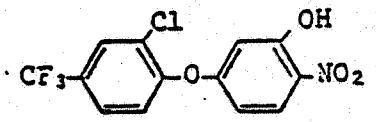
TABLE V

Thin Layer Chromatography Characterization of Viscera and Eviscerated Body Extracts

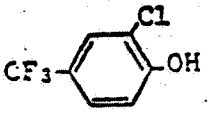
Rf	Identity[2]	% of Total Radioactivity Recovered[1]							
		Viscera		Eviscerated Bodies		Viscera		Eviscerated Bodies	
		10 Day	30 Day	10 Day	30 Day	10 Day	30 Day	10 Day	30 Day
Solvent System A		RH-2915 CF_3				RH-2915 NO_2 (HPR)			
0.87	Unknown	2.2	1.5	3.3	3.0	0.0	0.0	2.1	2.1
0.77	RH-2915	68.3	72.1	91.5	92.8	42.9	68.7	91.4	93.8
0.64	RH-34,670	7.1	7.6	1.9	1.7	5.7	7.4	2.4	1.7
0.40	RH-34,800	2.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0
0.26	Unknown	4.6	3.8	0.0	0.0	4.1	3.9	0.0	0.0
0.14	"	4.5	3.9	1.4	0.0	5.1	4.0	1.3	1.0
0.00	"	7.9	7.2	0.0	0.0	32.7	9.5	2.0	0.0
Pread-sorbent		3.0	2.7	0.0	0.0	8.8	5.3	0.0	0.0
Solvent System B									
0.90	Composite	83.6	84.3	96.3	96.5	47.0	76.0	95.8	97.0
0.82	Unknown	2.0	0.0	0.0	1.0	4.7	3.1	0.0	1.3
0.76	"	1.1	2.4	0.0	0.0	3.1	3.2	0.0	0.0
0.65	RH-34,860	3.2	3.7	1.4	1.0	3.0	3.0	1.4	0.0
0.50	Unknown	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0
0.35	"	1.4	0.0	0.0	0.0	2.6	1.3	0.0	0.0
0.22	"	1.5	0.0	0.0	0.0	2.5	1.2	0.0	0.0
0.00	"	2.0	4.2	0.0	0.0	28.2	6.0	0.0	0.0
Pread-sorbent		4.2	2.5	0.0	0.0	7.5	5.3	0.0	0.0

Chemical Structure associated with Code No. Designation (TLC) Identification.

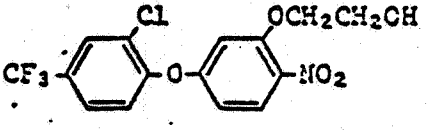
RH-34,670



RH-34,800



RH-34,860



Conclusions:

1. RH-2915 showed a potential to biocentrate in bluegill; however, accumulated residues decline during depuration.
2. The highest ^{14}C-residue was found in muscle, viscera and whole fish on the last day of exposure to either labeled form of RH 2915; ^{14}C-residue was increasing in muscle, viscera and whole fish at end of exposure.
3. Mean $^{14}CF_3$-residues found in muscle, viscera and whold body fish at end of exposure were 6.4, 50, and 18 ppm respectively. Mean residue in water at day-40 was 9.3 ppb.
4. During withdrawal, mean $^{14}CF_3$- residues declined from 5.1 ppm to 0.88 ppm, from 44 ppm to 8.3 ppm and from 7.9 ppm to 3.3 ppm in muscle, viscera and whole fish respectively.
5. Three metabolites: RH 34,670, RH-34800 and RH-34860 were found in both viscera and eviscerated tissue for 10 and 30 day samples. Mc of each metabolite was found in viscera than eviscerated tissue.
6. Activity at the origin which accounted for 32.7% of 10 day viscera sample (NPR labeled) in Solvent System A, and 28.2% of the activi for the same sample in Solvent System B was not identified.
7. Identification of metabolite was not determined for samples betwe 10 and 30 days; therefore, it can not be determined if identified metabolites exceeded 10% of accumulated activity.

"Accumultaion and Depletion of Residues Due to ^{14}C-R2915 in Catfish Unde Simulated Field Conditions", Accession No. 095586, Report No. 34-15, Tab. 20.

Posquotank sandy loam (analytical composition in adsorption desorption study) was treated with formulated RH 2915:

RH-2915	0.352 g	(354 uCi) nitropheyl ring labeled

The product was dissolved in 300 ml of water and applied to 128 kg of air dried soil evenly distributed over the bottom of a pool at a rate of 1 lb/A (1 ppm). The soil was aged outdoors for 30 days. Following aging, the pool was flooded with 1570 liters of aerated well water, allowed to equilibrate 3 days, and the stocked with channel catfish.

After exposure, the fish were transferred to herbicide free water where release (dissipation) of accumulated residue was monitored by periodic sampling of fish.

Analysis of Samples

1. Soil

Duplicate subsamples of soil (1.0 g) were combusted, $^{14}CO_2$ produced was trapped and aliquots of CO_2 trapping solution were radioanalyzed by LSC.

2. Fish

Viscera and edible tissues of three fish were combusted (oxidated), evolved $^{14}CO_2$ trapped in Carbo Sorb and mixed with scintillator solution and counted by LSC.

3. Water

Duplicate aliquots of water samples were counted by LSC.

4. Soxhlet Extractions

Fish samples from days 5 and 10 of the exposure period were Soxhlet extracted sequentially with hexane, methanol and water to determine the relative distribution of non-polar, polar and water soluble ^{14}C residues. The remains of the fish following the three extractions were oxidized to determine extraction efficiency.

Soil samples from days 10 and 20 of the exposure period were Soxhlet extracted as described above. All soil samples were combusted after the Soxhlet extractions to determine extraction efficiency.

5. Thin Layer Chromatograph (TLC

Fish and soil extracts were cochromatographed on silica gel thin layers along with non-radioactive standards of RH-2915, amino-RH-35451), acetamido-RH-2915 (RH-35450) and azoxy-RH2915 (RH-35449) using a solvent system of either (1) heptane/benzene (for hexane extracts) or (2) methanol/benzene (for methanol extracts). Radioactive compounds on TLC plates were visualized using radioautography.

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6. TLC Quantitation

Radioactive areas on silica gel thin layer were scrapped into counting vials. After addition of water and scintillator solution to vials, the activity was counted by LSC.

Results:

^{14}C Residues in Fish, Soil, and Water During Aging, Exposure, and Withdrawal (ppm as RH-2915)

	Day	In Soil			In Water			In Viscera			In Tissue		
		Ave.	S.D.	N	Ave.	S.D.	N	Ave.	S.D.	N	Ave.	S.D.	N
RH-2915 Exposure	1	0.5609	0.3321	6	0.0039	0.0001	2	8.1700	0.2120	3	1.2010	0.1470	6
	3	0.3011	0.0721	4	0.0045	0.0001	2	20.0000	2.4800	3	2.6280	0.2530	6
	5	0.5794	0.0890	4	0.0051	0.0003	2	27.3700	4.1400	3	3.5540	0.5560	6
	10	0.7869	0.4377	6	0.0065	0.0000	2	6.0360	2.0120	2	3.5000	1.6710	6
	15	1.3280	0.5130	2	0.0071	0.0001	2	15.4500	11.3800	3	1.7210	0.5800	5
	20	2.8980	0.9440	2	0.0084	0.0004	2	13.9800	1.3500	2	1.9560	0.8040	6
	25	3.7990	2.0530	2	0.0092	0.0000	2	8.3120	4.3130	3	1.8870	0.4580	5
	30	1.6970	0.2890	2	0.0096	0.0004	2	18.5800	4.2700	3	2.8610	0.8300	6
Grouped		1.4938	1.2526	8	0.0068	0.0022	8	14.7372	7.2037	8	2.4135	0.8589	8
RH-2915 Withdrawal	31							7.3970	6.3220	3	0.7766	0.2519	6
	33							1.0020	0.1630	3	0.2986	0.0642	6
	35							0.3112	0.1311	3	0.0798	0.0160	6
	40							0.3201	0.0840	3	0.0757	0.0257	6
	45							0.2509	0.1396	3	0.0452	0.0111	6
	50							0.0668	0.0621	3	0.0421	0.0100	6
	55							0.2449	0.0069	2	0.0411	0.0076	6
	60							0.1543	0.0500	2	0.0325	0.0076	6
								1.2184	2.5127	8	0.1739	0.2588	8
Grouped Aging	0	1.13	0.3420	5									
	15	2.30	0.3360	5									
	30	0.93	0.2818	3									

TABLE II

Percent of Total ^{14}C Residues in Fish Extracts

Phase II Exposure Time (days)	Solvent: Hexane	Methanol	Water	Oxidized Residue	Efficiency
5	8.80	90.61	0.07	0.52	99.48
20	10.20	84.10	1.60	4.10	95.90

TABLE III

Percent of Total ^{14}C Residues in Soil Extracts

Phase II Exposure Time (days)	Solvent: Hexane	Methanol	Water	Combusted Residue	Efficiency
10	3.90	72.10	1.10	22.90	77.10
20	1.40	53.10	1.40	44.10	55.90

^{14}C-residue in fish tissue reached maximum level (35540 ppm, SD 0.5560) at day 5 of exposure. At 30 days exposure, ^{14}C-residue was 2.8610 ppm, SD 0.8300. Concentration of ^{14}C-residues in water for the respective residue levels in edible tissue were 0.0051 ppm SD 0.0003 and 0.0096 ppm SD 0004.

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2.861 / 0.0096 = 298

3.5540 / 0.0051 = 696

At the end of withdrawal (30 days), ^{14}C-residues in edible tissue had decline to 0.0325 ppm SD 0.0076.

All residue found in fish and soil were identified as unaltered RH-2915.

Conclusions:

1. Even though residue in catfish was approximately 98% eliminated during withdrawal, there is a potential for fish to be exposed to low level of RH 2915 residue if RH 2915 reaches the aquatic environment. This potential exposure to low levels of reidue is due to RH 2915 strong adsorption to soil and slow release (desorption) into water. Additionally RH 2915 is stable to hydrolysis.
2. There is a discrepancy in the experimental discription of application of test material to soil. On page 939, it was stated that RH 2915 was applied in a formulation. On page 953, it was stated that RH-2915 was applied in 300 ml of water. Which method of application is correct? Further, if the water solubility of RH 2915 is approximately 0.1 ppm, then how can 350 mg of RH 2915 be dissolved in 300 ml of water? We need clarification of test material application.

Recommendations

I. We do not concur with the proposed uses of GOAL on corn and soybeans for the following reasons.

A. Use directions recommend up to 2 lbs active ingredient per acre per season (corn) yet the highest dose rate cited for rotational crop uptake data was 0.5 lbs a.i./acre.

B. The nature of the residues in rotational crops has not been elucidated.

C. The nature of the degradation products of aerobic and anaerobic soil metabolism have not been adequately established.

II. We do not concur with the tank mix use for RH-2915 on soybeans:

A. Decline studies submitted to support the tank mix (2 components) uses are unacceptable; the large amount of unaccounted for residues for both herbicides - Lasso/RH 2915 - and Paraquat/RH 2915 - in both studies at zero-day nullify the residue decline studies for the stated application rates.

B. Tank mix (3 components) uses: No residue decline data were submitted to support the 3 components - Goal: Paraquat: Lasso - tank mix uses.

III. The following apply to Manufacturing Use Product:

The following information will have to be obtained from the applicant in order to more completely evaluate the potential concentrations that a municipal sewage treatment plant may receive.

1. The geographical locations for manufacture of Goal.
2. Local municipality regulations in the manufacturing use area in regards to pre-treatment before discharge to a receiving treatment plant.
3. What is the local load (i.e. ppm) that will be received by the receiving plant.

Ecological effects should be informed that 3% of the load (consisting of 80% parent Goal and 20% amino-Goal) will be discharged by the plant to the receiving aquatic habitat--the significance of this and the need for indirect discharge data requirements should be addressed.

The significance of the effects observed should be referred to appropriate personnel in the Effluent Guidelines Division and Enforcement Division for the appraisal. The above does not apply if the chemical is manufactured outside the United States.

IV. Data deficiencies noted in the Conclusions sections of the individual studies should also be resolved by the applicant.

Carroll W. Collier

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