Corn 124 Related to lettuce

EEE BRANCH REVIEW

DATE: IN ____ OUT ____ IN 2/8/77 OUT 8/8/77 IN ____ OUT ____

FISH & WILDLIFE ENVIRONMENTAL CHEMISTRY EFFICACY

FILE OR REG. NO. 100-583

PETITION OR EXP. PERMIT NO. 7F1913

DATE DIV. RECEIVED 1/19/77

DATE OF SUBMISSION

DATE SUBMISSION ACCEPTED 1/19/77 3CID-2B-YES

TYPE PRODUCT(S): I, D, (H) F, N, R, S

PRODUCT MGR. NO. 24-Jacoby

PRODUCT NAME(S) Dual 6E Herbicide

COMPANY NAME CIBA-Geigy Corporation

SUBMISSION PURPOSE For use on soybeans

CHEMICAL & FORMULATION Metolachlor

(2-chloro-N-(2-ethyl-6-methylphenyl-N-(2-methoxy-1-methyethyl) acetamide)(Dual)

1.0 Introduction

1.1 Dual 6E Metolachlor, CGA24705

1.2 Percent Active:

68.5% 2-chloro-N-(2-ethyl-6-methylphenyl-N-(2-methoxy-1-methylethyl) acetamide

6 lbs. ai/gal.

1.3 For use on soybeans alone and in tank mix with Sencor/Lexone or Lorox.

1.4 See previous reviews:

100-EUP-54	2/7/77
5G1553 (100 EUP)	2/4/76
5G1553 (100-EUP-38)	2/4/76
5F1606	6/24/75
5G-1533 (100-EXP-X)	9/11/74
6G1708	1/8/76
100LIG	10/29/76
100-LIG	11/3/76

2.0 Directions for Use

2.1 Dual 6E may be tank mixed with Sencor 50WP, Lexone, or Lorox for preemergence weed control in soybeans.

2.2 Within a rate range given for a specific soil category in rate tables, use the low rate on soil relatively coarse-textured or low in organic matter; use the high rate on soil relatively fine-textured or high in organic matter.

2.3 Dry weather after application may reduce effectiveness. Cultivate if weeds develop.

2.4 Do not graze or feed treated soybean hay or forage.

2.5 Dual 6E is an emulsifiable concentrate to be mixed with water or liquid fertilizer and applied as a spray.

2.6 To determine compatibility of product in liquid fertilizer, mix a small amount and let stand 5 minutes. If it remains mixed or can be remixed readily, the mixture can be used.

2.7 Apply specified amount of Dual 6E or tank mixtures in a minimum of 15 gals. of spray mixture per acre with ground equipment or 5 gals/acre by aircraft.

2.8 Calculate the amount of herbicide needed for band treatment by the formula:

$$\frac{\text{band width in inches}}{\text{new width in inches}} \times \text{broadcast rate per acre} = \text{amount needed per acre of field}$$

2.9 Dual 6E Applied Alone

2.9.1

Preplant Incorporated: Apply to soil and incorporate 2-3 inches before planting.

2.9.2

Preemergence. Apply to prepared seedbed during planting (behind planter) or after planting, but before weeds and soybeans emerge.

2.9.3

Table 1: Dual 6E Alone

	Broadcast rate per acre	
Soil Texture	Less than 3% organic matter	3% organic matter or greater
COARSE: Sand, loamy sand, sandy loam	2 - 2 2/3 pts. (1 1/2 - 2 lbs. a.i.)	2 2/3 pts. (2 lbs. a.i.)
MEDIUM: Loam, silt loam, silt	2 2/3 - 3 1/3 pts. (2 - 2 1/2 lbs. a.i.)	2 2/3 - 3 1/3 pts. (2 - 2 1/2 lbs. a.i.)
FINE: Silty clay loam, sandy clay loam, silty clay, sandy clay, clay loam, clay	2 2/3 - 3 1/3 pts. (2 - 2 1/2 lbs. a.i.)	3 1/3 - 4 pts. (2 1/2 - 3 lbs. ai)

2.10 **Tank Mixture of Dual 6E Plus Sencor 50WP or Lexone**

2.10.1 Apply the tank mix at planting (behind planter) or after planting but before weeds and soybeans emerge. Refer to Sencor 50 WP or Lexone labels for planting details and soybean variety restrictions.

2.10.2

Table 2: Dual 6E + Sencor 50WP or Lexone

	Broadcast rates per acre			
	0.5 to less than 3% organic matter		3% organic matter or greater	
Soil texture*	Dual 6E	Sencor 50WP or Lexone	Dual 6E	Sencor 50WP or Lexone
COARSE: Loamy sand (over 2% organic matter), Sandy loam	1 2/3 pts. (1 1/4 lbs. ai)	1/2 lb.	2 pts. (1 1/2 lbs. ai)	3/4 lb.
MEDIUM: Loam, Silt loam, Silt	2 pts. (1 1/2 lbs. ai)	3/4 lb.	2 2/3 pts. (2 lbs. ai)	1 lb.
FINE: Silty clay loam, Sandy clay loam, Silty clay, Sandy clay, Clay loam Clay	2 2/3 pts. (2 lbs. ai)	1 lb.	2 2/3-3 1/3 pts. (2-2 1/2 lbs. ai)	1 lb.
Mississippi Delta only Silty clay, Clay	2 2/3 pts. (2 lbs. ai)	1 1/2 lbs.	2 2/3-3 1/3 pts. (2-2 1/2 lbs. ai)	1 1/2 lbs.

*Do not use on any sand, or loamy sand with less than 2% organic matter, or on muck.

2.10.3 Do not use the tank mix on soil with less than 0.5% organic matter or on alkaline soil with a pH over 7.4.

2.10.4 If heavy rain occurs soon after application, crop injury may result.

2.11 Tank Mixture of Dual 6E Plus Lorox.

2.11.1 Apply the tank mix at planting (behind planter) or after planting but before weeds and soybeans emerge. Refer to the Lorox label for planting details.

2.11.2

Table 3: Dual 6E + Lorox

	Broadcast rates per acre			
	0.5 to less than 3% organic matter		3% organic matter or greater	
Soil texture*	Dual 6E	Lorox	Dual 6E	Lorox
COARSE: Sandy loam, Loamy sand**	1 2/3 pts. (1 1/4 lbs. ai)	1 lb.	2 pts. (1 1/2 lbs. ai)	1-1 1/2 lbs.
MEDIUM: Loam, Silt loam, Silt	2 pts. (1 1/2 lbs. ai)	1-1 1/2 lbs.	2 2/3 pts. (2 lbs. ai)	1 1/2-2 lbs.
FINE: Silty clay loam, Sandy clay loam, Silty clay, Sandy clay, Clay loam, Clay	2 2/3 pts. (2 lbs. ai)	2 lbs.	2 2/3-3 1/3 pts. (2-2 1/2 lbs. ai)	2 1/2-3 lbs.

*Do not use on sand, gravelly soils, or exposed subsoils.

**Do not use on loamy sand, except in the northeastern U.S. on loamy sand with over 1% organic matter.

2.11.3 Do not use on soil with less than 0.5% organic matter.

2.12 Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal. Open dumping is prohibited. Dispose of pesticide, spray mixture, or rinsate in a landfill approved for pesticides or bury in a safe place away from water supplies. Triple rinse container and recycle, recondition, bury, or dispose of it in an approved landfill.

2.13 Keep out of water bodies. Do not apply where runoff is likely to occur. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not apply when weather conditions favor drift from areas treated.

2.14 Do not use or store near heat or open flame.

2.15 Rotational Crops

2.15.1 If replanting is necessary, soybeans or corn may be replanted immediately. Do not make a second broadcast application of Dual 6E. If the original application was banded and the second crop is replanted in the untreated row middles, a second band treatment may be applied.

2.15.2 Small grains may be planted in the fall following treatment and any crop may be planted the following spring.

3.0 Discussion of Data

3.1 The following are not considered germane by environmental chemistry:

3.1.1 Ion - exchange Characterization of Metabolites of Radioactive Pesticides,

Report Number AG-156, Acc. # 094385, Environmental Data - Volume I, submitted 3/26/75 (PP# 5F1606).

3.1.2 Analysis of Water in Soils and Column Absorbants Using the Aquatest II Electronic Karl-Fischer Titration System,

Report Number AG-192, Acc. # 094385, Environmental Data - Volume I, submitted 3/26/75 (PP# 5F1606).

3.1.3 Biphasic Extraction of Radioactive Metabolites from Treated Biological Material,

Report # AG-214, Acc. # 094385, Environmental Data - Vol. I, submitted 3/26/76 (PP# 5F1606).

3.1.4 Measurement of Total Organic ^{14}C in Soils by Combustion,

Report # AG-213, Acc. # 094385, Environmental Data - Vol. I, submitted 3/25/75 (PP# 5F1606).

3.1.5 Extraction of CGA-10832 Residues from Soil,

Report # 219, Acc. # 094385, Environmental Data - Vol. I, submitted 3/26/75 (PP# 5F1606).

3.1.6 Blending of Soils and Homogenization of Biological Materials for Radioassay and Extraction,

Report # AG-223, Acc. # 094385, Environmental Data - Vol. I, submitted 3/26/75 (PP# 5F1606).

3.1.7 Extraction of CGA-10832 Residues from Soil,

Report # AG-254, Acc. # 094385, Environmental Data - Vol. I, submitted 3/26/75 (PP# 5F1606).

3.1.8 Extraction of Triazine Residues from Soil,

Report # AG-255, Acc. # 094385, Environmental Data - Vol. I, submitted 3/26/75 (PP# 5F1606).

3.1.9 Statistical Methods in the Measurement of Radioactivity,

Report # AG-260, Acc. # 094385, Environmental Data - Vol. I, submitted 3/26/75 (PP# 5F1606).

3.1.10 Gas Chromatographic Determination of Residues of CGA-24705 Metabolites in Corn as CGA-37913,

Report # AG-265, Acc. # 094385, Environmental Data - Vol. I, submitted 3/26/75 (PP# 5F1606).

3.1.11 **Extraction of Humic Acid and Fulvic Acid Fractions from Soil Containing Nonextractable ^{14}C Residues.**

Report # AG-268, Acc. # 094385, Environmental Data - Vol. I, submitted 3/26/75 (PP# 5F1606).

3.1.12 Analytical Method for the Determination of Residues of CGA-24705 Corn Metabolites as CGA-37913 and CGA-49751 by Acid Hydrolysis,

Report # AG-277, Acc. # 094385, Environmental Data - Vol. 1, submitted 3/26/75 (PP# 5F1606).

3.1.13 CGA-24705 - Gas Chromatographic Residue Determination in Plant Material, Grains and Soil,

Report # REM 12/73, Ciba-Geigy, Basle, Switzerland. Acc. # 094376, Environmental Data - Vol. II, submitted 3/26/75 (PP# 5F1606).

3.1.14 Gas Chromatographic Residue Determination of CGA-24705 in Soil,

Report # AG-303, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

3.1.15 A Gas Chromatographic Method for the Determination of Sencor and Metabolites in Soil, J. S. Thornton,

Report No. 40463, Acc. # 095763, Vol. 1 of 25, submitted 1/13/77.

3.1.16 Determination of 3-(p-chlorophenyl)-1,1-dimethylurea in Soils and Plant Tissue, H. E. Bleidner, H. M. Baker, Michael Levitsky, and W. K. Lowen, Report Bleidner, et al,

Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. #100-583, submitted 1/13/77.

3.1.17 Duration of Biological Activity of CGA-24705, T. D. Taylor, Ciba-Geigy, Biological Activity tab,

Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75.

The study discusses crop injury due to residues.

3.2 Hydrolysis

CGA-24705 - Hydrolysis of CGA-24705 Under Laboratory Conditions,

Report # SPR 2/74, Ciba-Geigy, Basle, Switzerland.
Acc. # 094376, Environmental Data - Vol. II of 5F1606,
submitted 3/27/75, previously reviewed 3/5/75,
(PP# 5G-1553).

Hydrolysis at pH 1, 5, 7, 9, and 13 at 100 ppm concentration in brown glass flasks was carried out for 28 days in aqueous solution at 30, 50, and 70° C to determine rate. Hexane extracts were analyzed by GLC. Hydrolysis products of ^{14}C-ring-labeled CGA-24705 were analyzed in a separate study after incubating the compound in 0.1 M HCl or 0.1 M NaOH. Material balance for this study was 84-89%. Hexane extracts were analyzed by thin layer chromatography, autoradiography, gas liquid chromatography, and mass spectroscopy. Results are as follows:

1. At 20°C halflives were greater than 200 days at pH 5, 7, and 9, and 97 days at pH 13.

2. At 50°C halflife ranged from 79 days (pH 5) to 138 days (pH 9); at 70°C halflife ranged from 10 days (pH 5) to 17 days (pH 9).

3. Hydrolysis with 0.1 N NaOH at 30°C resulted in 78% parent and 9% CGA-40172 at 5 days and 51% parent and 37% CGA-40172 at 23 days.

4. Hydrolysis in 0.1 N HCL at 70°C results in 70% parent and 19% CGA-40191 at 5 days and 27% parent and 57% CGA-40919 at 28 days.

5. Acid hydrolysis yielded CGA-41638 which was rapidly converted to CGA-40919.

CGA-40172:

N-(2'-methoxy-1'-methyl-ethyl)-2-ethyl-6-methyl-hydroxyacetanilide

CGA-41638:

N-(2'-hydroxy-1'-methyl-ethyl)-2-ethyl-6-methyl-chloroacetanilide

CGA-40919:

4-(2'-methyl-6'-ethyl-phenyl)-3-methyl-morpholinone-5

Conclusions:

At 20°C, halflife at pH 5, 7, and 9 is over 200 days. This indicates stability under normal environmental conditions. Hydrolysis occurs faster at higher temperatures or at pH 13.

The hydrolysis study is scientifically acceptable because it indicated stability under normal environmental conditions but the following deficiencies are noted:

1. The study must be conducted in the dark unless the chemical does not photodegrade. It does photodegrade in this case. The rate study was done in dark glass flasks, which satisfies the darkness requirement. It is not specified whether the study undertaken to identify hydrolysis products was done in darkness. Darkness is required so that photodegradation does not interfere with the hydrolysis study.

2. Distilled water must be used to prohibit/limit other type degradations. The type of water used was not specified.

Note: For chemicals which are not stable, the following would also be deficiencies:

   1. Two concentrations should be studied unless the pesticide is stable as it is in this case. (In the submitted study, a concentration of 100 ppm was used to determine rate and a lower concentration was used to identify products.) Two concentrations are needed to support the assumption that first order kinetics describe the hydrolysis reaction. If the pesticide is stable at one concentration, it can be assumed stable at another concentration.

   2. A radioisotope should be used to determine halflife unless other methods indicate stability, as they do in this case.

3.3 Photodegradation

3.3.1 Photolysis of CGA-24705 in Aqueous Solutions Under Natural and Artificial Sunlight Conditions,

Report # GAAC-74041, Acc. # 094385, Environmental Data - Vol. I of 5F1606, Photodegradation in Water, submitted 3/26/75, previously reviewed 3/5/75 (PP# 5G-1553).

An aqueous solution (265 ppm) ^{14}C-ring labeled CGA-24705 was exposed in quartz bottles as follows:

Photolysis in Aqueous Solution

Exposure (days)	% Photolysis
Artificial sunlight	
0	0
1	7
4	25
9	33
15	69
Natural sunlight (days)*	
0	0
14	4
30	9

*One day of exposure is equivalent to about 375 Langley units. Percent balance was 90%. Residues were analyzed by liquid scintillation counting, thin layer chromatography, gas chromatography, gas chromatography-mass spectrometry.

Conclusions:

1. Artificial sunlight resulted in 69% photolysis after 15 days, while natural sunlight resulted in 9% at 30 days.

2. 45.5% and 93.5% of recovered radioactivity were parent compound after 15 days artificial and 30 days natural sunlight respectively.

3. After 15 days exposure to artificial sunlight, 70.8% of ^{14}C was extracted by chloroform and 23.0% remained in water (compared to 95.8% and 0.2% respectively for control).

4. Photolysis under artificial sunlight produced 5 chloroform extractable photoproducts, containing 13% of ^{14}C activity. Of these, CGA-13656, CGA-40919 and CGA-40172 were identified. An additional 23% of ^{14}C activity was in the form of water extractable product(s).

5. There was no degradation or loss of ^{14}C in the control.

CGA-40919:

4-(2-methyl-6-ethylphenyl)-5-methylmorpholin

CGA-40172:

N-(2-hydroxyacetyl)-N-(1-methoxyprop-2-yl)-2-ethyl-6-methylaniline

CGA-13656:

N-chloroacetyl-2-ethyl-6-methylaniline

The photodegradation study in water is acceptable with deficiencies. The following deficiencies are noted:

1. Distilled or deionized water must be used to prohibit/limit other type degradations. Type of water was not specified.

2. The pH, temperature, and oxygen content of the water should be reported as these factors influence rate and/or photoproducts.

3. Identity of some degradation products was not determined. Identity of each degradation product which accounts for more than 10% of applied ^{14}C is needed to determine potential for uptake by nontarget organisms.

4. For the artificial light source, the type of source, intensity, percent transmission, and wavelength are not reported. These are needed to assure that natural sunlight is simulated and to define results.

   Report GAAC-74041 refers to AG-208, in which artificial and natural sunlight conditions are described, but study AG-208 is not submitted or referenced with this submission.

3.3.2 Photolysis of CGA-24705 in Aqueous Solution - Additional Information,

Report # GAAC-75021, Acc. # 094385, Environmental Data - Vol. I of PP# 5F1606, Photodegradation in Water, submitted 3/26/75, previously reviewed 6/24/75 (PP# 5F1606).

The following is excerpted from review of 6/24/75:

> Report GAAC-75021 was a follow-up of a study where the parent was exposed to light in aqueous solution (See review of 5G1553 on 3/5/75 for details). In this study 42% of the original was parent after exposure, 23% were unknowns in the aqueous phase and 17% were organic phase unknowns found at the origin. This study attempts to separate the components in the last two categories using chloroform: methanol (9:1). Identification of different zones involved use of diazonium fluoroborate or chromotropic acid sprays. Seven zones were observed but none of the components were identified. Some zones had more than one compound.

Conclusions:

This supplementary report does not identify unknowns found in Report # GAAC-74041.

3.3.3 Photolysis of CGA-24705 on Soil Slides Under Natural and Artificial Sunlight Conditions,

Report # GAAC-74102, Acc. # 094385, Environmental Data - Vol. I of PP# 5F1606, Photodegradation in Soil, submitted 3/26/75, previously reviewed 6/24/75 (5F1606).

Slides of sterile soil with ^{14}C-ring labeled CGA-24705 (4.6 lbs./acre) were exposed in quartz bottles as follows (excerpted from review of 6/24/75):

PHOTOLYSIS OF CGA-24705 ON SOIL SLIDES

Exposure Conditions	CGA-24705, %[a] Covered	CGA-24705, %[a] Exposed	% Photolysis
Artificial sunlight exposure (Material Balance 93% after 168 hrs.)			
Hours			
0 (initial)	100	100	0
2	100	93	7
6	100	85	15
24	97	76	21
48	100	60	40
144	80	38	42
168	82	30	52
Natural sunlight (days)[b] (Material Balance 87.3% after 8 days.)			
0 (initial)	100	100	0
1	85	92	0
2	96	88	8
3	80	69	11
6	90	48	32
8	80	30	50
14	85	11	74

[a] Based on CGA-24705 content of the initial slides. Samples analyzed by GLC.

[b] One-day exposure is equivalent to about 375 langley units.

Both exposures show a halflife for CGA-24705 of about 7-8 days. Initial degradation was much quicker under artificial than natural light situations. Four degradation products were revealed by TLC but only one, N-propen [? propan] -1-ol-2-yl-N-chloroacetyl-2-methyl-6-ethylaniline, a demethylated parent, was identified. It accounted for about 6% of the artificial and 4% of the sunlight products. Parent was 24-33% of the remaining ^{14}C residues. Much of the loss of ^{14}C was attributed to volatilization. None of the chloroform extractable photoproducts comprised

more than 10% of applied ^{14}C. Residues were analyzed by thin layer chromatography and gas liquid chromatography. Nonextractable ^{14}C was 34% under artificial sunlight and 39% under natural sunlight.

Soil characteristics:

17.6% sand, 61.2% silt, 21.2% clay
pH 6.8
Percent organic matter: 2.9
Cation exchange capacity (MEQ): 19.1
Texture: Silt loam

Conclusion:

Half-life for CGA-24705 in soil is 7-8 days.

The study of photodegradation on soil is acceptable with the following deficiencies:

1. Bulk density of the soil is not reported. Bulk density is needed because soil characteristics may affect degradation.

2. For artificial light sources, the type of source, wavelength, intensity, and percent transmission were not reported. These are needed to assure that natural sunlight is simulated and to define results.

3. Degradates comprising more than 10% of initial application should be identified if present and if it is possible to extract and analyze them by any analytical method.

3.4 Anaerobic Soil Metabolism

Abbreviated Anaerobic Metabolism of ^{14}C-CGA-24705 in Silt Loam Soil Under Greenhouse Conditions,

Bio/dynamics, Inc., Report # 73019-3, Acc. # 094376, Environmental Data - Vol. II, submitted 3/27/75, PP# 5F1606, previously reviewed 3/5/75 (PP# 5G1553).

The following is excerpted from the review of 3/5/75:

Ring labelled CGA-24705 was added to Hastings silt loam at 4 lb ai/A. It was incubated 30 days aerobically. Subsamples were incubated an additional 60 days aerobically

and anaerobically (under nitrogen). Soil was extracted with methanol-water and this was re-extracted with water or chloroform. Extracts were counted by liquid scintillation counting. Total soil ^{14}C was determined by combustion.

Soil Characteristics

O.M.	2.9%
Sand	19.2%
Silt	61.2%
Clay	19.6%
pH	5.7%
C.E.C.	20.6 meq/100 g.

% of ^{14}C Activity Found

System	Interval (days after treatment)	Polar extractable	Non-polar extractable	Bound
Aerobic	30	8	53	40
Aerobic	60	13	46	40
Anaerobic	60	11	49	39
Aerobic	90	7	39	54
Anaerobic	90	6	42	53

0.3% or less of the ^{14}C was recovered as volatile ^{14}C or $^{14}CO_2$.

Conclusions:

No significant differences in distribution of ^{14}C activity were found between aerobic and anaerobic conditions.

Rate of degradation is slower in anaerobic soil.

The anaerobic soil metabolism study is acceptable with the following deficiencies:

1. Bulk density of the soil is not reported. Bulk density is needed because soil characteristics may affect degradation.

2. Temperature of the soil should be between 18 and 30° C to resemble environmental conditions but was not reported.

3. Degradates comprising more than 10% of initial application should be identified if present and if it is possible to extract and analyze them by any analytical method. Identity of degradates allows assessment of potential for uptake by nontarget organisms.

4. Material balance is not given. Material balance is needed to determine recoverability and aid in the identification process.

3.5 Effect of Microbes on Pesticides

Soil Degradation Study of CIBA-GEIGY ^{14}C-CGA-24705,

ABC, Inc. Report, Acc. # 094376, Environmental Data - Vol. II of PP# 5F1606, submitted 3/27/75, previously reviewed 6/24/75 (PP# 5F1606).

Soil characteristics:

pH	6.9
Organic Matter	1.5%
Cation Exchange Capacity	2.6 meq/100g
Sand	82.8%
Silt	13.6%
Clay	3.6%
Field Capacity	6.58%
Texture	Loamy Sand

Soil was sterilized by autoclaving.

Comparison of Degradation of CGA-24705 in Sterile and Nonsterile Soils

Day Sampled	Sterile			Nonsterile		
	Mean (g)			Mean (g)		
	Extracted	TLC*	Combusted	Extracted	TLC	Combusted
0	190	185	176	186	184	183
2	188	183	177	190	180	180
4	188	185	188	184	188	178
8	195	201	195	184	188	189
16	181	180	194	170	170	187
32	164	150	195	160	151	183
64	181	170	182	174	159	177

* Extracted parent verified by TLC and corrected for 100% TLC recovery.

Conclusions:

No significant degradation occurred in 60 days under sterile or nonsterile conditions.

The study of effect of microbes on pesticides is scientifically acceptable but has the following deficiency:

> Bulk density of the soil is not reported. Bulk density is needed since metabolism may vary in different soils.

3.6 Effect of Pesticide on Microbes

Effect of CGA-24705 on Microbial Populations in Two Soils, D. Houseworth, Univ. of Missouri, Report # 2, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

The following is excerpted from report of 3/5/75:

> Louisiana commerce loam and Indiana loam soils were treated with 50 and 250 ppm CGA-24705 and incubated at 28°C for 56 days. At intervals, 1g soil was removed, mixed well with 99 ml sterile water, and after serial dilutions the solution was plated on Martins media

(fungi), Thorntons media (bacteria), and glycerol asparaginate agar (actinomycetes). Parallel sterile control soils were used and plate counts were made.

Conclusions:

On the basis of plate counts, there was no apparent killing or reduction in numbers of fungi, bacteria, or actinomycetes.

Changes in species composition, or non-lethal (bacteriostatic) effects were not investigated.

The study is scientifically acceptable but has the following deficiencies:

1. Soil characteristics of percent sand, silt, and clay, percent organic matter, pH, cation exchange capacity, and bulk density are not given. Soil characteristics are needed since they may affect results.

2. Linnaean names for fungi and bacteria used are not given. Organisms should include those that are representative of soil populations.

3.7 Leaching

Report on Parent Leaching Studies for CGA-24705, D. Houseworth, Univ. of Missouri, Report # 1, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

The following is excerpted from the review of 3/5/75:

1.9 mg of ^{14}C-CGA-24705 was added to 12" columns containing 5 soil types. Columns subjected to 20" rain at a maximum rate of 1 inch/hour. Soil from each inch and leachate were counted by liquid scintillation counting.

Soil Analysis

Soil	Source	Organic matter	pHw	CEC	Sand	Silt	Clay
Muck	New York	77.0	5.1	22.6	76.8	17.2	6.0
Silt loam	Indiana	3.9	5.7	11.7	22.4	66.0	11.6
Sandy loam	Texas	0.6	8.0	12.5	65.2	21.2	13.6
Loam	Louisiana	0.7	6.1	10.9	42.8	49.6	7.6
Sand	Florida	1.6	7.0	2.9	93.6	2.8	3.6

Distribution of ^{14}C in Columns

Inches	Sandy loam	Sand	Loam	Silt loam	Muck
0-3	4.7	26.4	10.7	57.9	100
3-6	10.5	16.1	13.4	22	0
6-9	16.8	18.2	35.5	19.1	0
9-12	31.6	18	37.3	0.4	0
Leachate	36.4	20.9	4.0	0.4	0.0

36.4%, 20.9%, and 4.0% of ^{14}C found was found in leachate for sandy loam, sand, and loam soils respectively.

100% of ^{14}C was retained in 0-3" layer on muck soil.

18-37% of ^{14}C had leached to 9-12" in sandy loam, sand, and loam soils. 0.4% leached to 9-12" in silt loam.

Conclusion:

The compound leaches considerably in sandy soils. It leaches less in silt loam and does not leach below 3 inches in muck. The lower the percent organic matter, the greater the leaching.

The leaching study is scientifically acceptable with the following deficiencies:

1. Bulk density of the soils is not given. Leaching may vary in different soils so bulk density is needed to define results.

2. A leaching study of aged pesticide is not included. An aged study will determine whether degradates leach. In the aged study, one of the soils used in the fast leaching study should be aged for 30 days under aerobic conditions and eluted with 1/2 acre-inch water per day for 45 days.

3. Position of the ^{14}C label is not given. It is preferred that the ring be labeled so that recoverability of residues can be determined.

4. Material balance is not provided. Material balance, the percentage of ^{14}C recovered/^{14}C applied, indicates whether most residues are recovered. It is not clear whether percentages reported are percentages of applied ^{14}C or percentages of ^{14}C found.

3.8 Field Soil Study

See discussion in Section 5.6 and Section 3.9.3.

3.3.1 The Uptake and Distribution of Ø-^{14}C-CGA-24705 in Field Grown Corn, Report # GAAC-74022, Acc. # 094385, Environmental Data - Vol. I, PP# 5F1606, submitted 3/26/75, previously reviewed 3/5/75 (PP# 5G-1553).

Ring labeled CGA-24705 was applied at the rate of 2 lbs/acre to a field plot in which corn was grown.

Soil characteristics:

Soil Type	Bosket Silt Loam
pH	5.6
CEC	9.6
% Organic Matter	0.9
% Sand	26.0
% Silt	62.0
% Clay	12.0

Liquid scintillation counting was used.

The following is excerpted from the review of 3/5/75:

Concentration of ^{14}C in Field Soil

PPM

Interval	1 Day	4 Weeks	8 Weeks	12 Weeks	16 Weeks
0-3"	1.79	0.73	0.75	0.56	0.31
3-6"	0.04	0.14	0.31	0.26	0.10
6-9"	----	0.01	0.08	0.11	0.06

% Distribution of Radioactivity in Soil

Balance (MeOH extraction)	4 Weeks	8 Weeks	16 Weeks
Organic	41.2	34.7	*/d
H_2O/MeOH	19.2	13.3	d
Non-extracted	31.5	45.3	80.5
TLC Data			
CGA-24705	35.0		
Unknown Extracted	28.1		
Balance (CH_3CN Extraction			
Organic	46.6	41.3	d
Polar	17.9	14.7	d
Non-extracted	31.5	41.3	74.5

*/ d - too low for reliable quantitation

Total ^{14}C in 0-9" soil decreased from 1.83 ppm initially to .47 ppm at 16 weeks.

Non-extractable, by methanol, soil residues were 31.5% of ^{14}C present at 4 weeks and 80.5% of ^{14}C present at 16 weeks for methanol. Values ranged from 31.5 to 74.5 at 4 and 16 weeks for acetonitrile.

At 16 weeks there was only a trace of residue that was either methanol or acetonitrile extractable in soil.

Leaching resulted in 0.31 ppm in the 3-6" at 8 weeks and .11 ppm in 6-9" layer at 12 weeks.

Conclusions:

1. Half-life of total ^{14}C in soil was about 8 weeks.
2. Increasingly larger percentages of the ^{14}C present in soil at a given time was bound with time.
3. The amount of ^{14}C that leached increased with time.

The study is not acceptable as a field soil study for the following reasons, but supports aerobic study:

1. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.
2. Residues are not identified as shown by MeOH and CH_3CN extractions and by TLC. Identity is needed to assess potential for uptake by nontarget organisms.
3. Patterns of formation and decline of degradation products are not established but are needed to assess potential for uptake by nontarget organisms.
4. Soil was not sampled to a depth of 12 inches as required for field and vegetable crops. Soil was sampled to a depth of 6 or 9 inches. Soil should be sampled to a depth of 12 inches to recover leached residues.
5. Sampling times should include day of application to aid in determination of decline curves.

6. Precipitation to each sampling is not reported. Precipitation is needed since the chemical leaches.

3.8.2 The Degradation of CGA-24705 in a Field Soil, Report # GAAC-75022, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

Soil Type	Bosket Silt Loam
pH	5.6
CEC	9.6
% Organic Matter	0.9
% Sand	26.0
% Silt	62.0
% Clay	12.0

A field plot was treated with 2 lbs./acre of ring labeled ^{14}C-CGA-24705. Analysis methods were as follows:

1. Extraction with methanol, partition with chloroform and water, and liquid scintillation counting of extracts and residue.

2. Liquid scintillation counting of total ^{14}C in soil.

3. Extraction of humic and fulvic acid from soil with NaOH and liquid scintillation counting of extracts.

The following is excerpted from the review of 5/24/75:

> The rate of loss of total ^{14}C activity was such that a half-life was about 14 weeks and only 70% was degraded after one year. Very little change occurred between 16 weeks and one year. Non-extractables increased from 32 to 80% of the total present between 4 and 16 weeks and remained constant thereafter. Undegraded CGA-24705 was not detected at 16 weeks or after. It was 35% of the total at 4 weeks. A decrease in total activity and in extractables was observed throughout the test. It was concluded that the non-extractables fraction was a reservoir which permitted an equilibrium to exist between bound and nonbound materials. Any loss that occurred after 30 weeks in the 3" layer was presumed due to leaching.

Conclusions:

It does not appear as if the degradation of parent under field conditions is well defined. Radioactive products persist for a long time. Though it is claimed that parent is not found after 16 weeks, data to support this is not supplied. Analysis of total ^{14}C residues shows very little loss from 16 weeks on. Leaching may be the primary mode of loss. A buildup after several years application is possible. Half-life of total ^{14}C is about 14 weeks. Only 70% was degraded after 1 year since loss after 16 weeks was small. The field soil study is not acceptable for the following reasons, but supports the aerobic study:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. Decline curve of parent is not well defined. Also, patterns of formation and decline of degradation products are not established. These are needed to assess potential for uptake by nontarget organisms.

3. Soil must be sampled to a depth of 12 inches but was only sampled to a depth of 9 inches. Soil should be sampled to a depth of 12 inches to recover leached residues.

4. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

5. Precipitation to each sampling is not reported. Precipitation is needed since the chemical leaches.

3.8.3 Residue Report: Soil - Douglas, Illinois, Report AG-A-3133, First Report, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

Soil characteristics:

Silty clay loam	
% organic matter	5.2
cation exchange capacity	36
pH	6.3
% clay	36.0
% silt	57.0
% sand	7.0

2EC formulation of CGA-24705 was applied. Corn was grown. Soil samples were analyzed by methanol extractions, partition in hexane, clean-up on alumina column, and gas chromatography with Dohrmann microcoulometric detection (chloride mode).

Application (lb. ai/A)	Interval (Days)	PPM Residue 0-6"	6-12"
2	0	0.92	--
	61	0.09	<0.05
	151	0.10	<0.05
4	0	0.32	--
	61	0.12	<0.05
	151	0.03	<0.05

Rainfall:

0 days	--
61	9.09 inches
151	4.75 inches

Conclusions:

Half-life of extractable chlorinated residues in silty clay loam is less than 60 days. Residues of less than 0.05 ppm were found in the 6-12" soil layer. Nonchlorinated degradates cannot be identified by the analytical method used but this does not prove they are not extractable. The field soil study is not acceptable because of the following deficiencies:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3.8.4 Residue Report: Soil - Douglas, Illinois, Report # AG-A-3133, Second Report, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

250 EC formulation of CGA-24705 was applied. Corn was grown. Soil was analyzed for Cl compounds by gas chromatography. Rainfall and soil characteristics are the same as in the First Report (Section 3.8.3).

Application (lb. ai/A)	Interval (Days)	PPM Residue 0-6" (Rep. 1)	0-6" (Rep. 2)	6-12"
2	0	0.15	---	---
	61	0.06	<0.03	<0.03
	151	0.03	<0.03	<0.03
4	0	0.58	0.06	---
	61	0.05	0.04	<0.03
	151	0.05	0.08	<0.03

Conclusions:

Half-life of chlorinated extractable residues in silty clay loam is less than 60 days. Less than 0.03 ppm residues were found in the 6-12" layer of soil.

The field soil study is not acceptable because of the following deficiencies:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3.8.5 Residue Report: Soil - Fresno, California, Report # AG-A-3105, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

Soil characteristics:

Sandy loam	
% organic matter	0.8
cation exchange capacity	3.8
pH	5.4
% clay	6.4
% silt	18.4
% sand	75.2

250 EC formulation of CGA-24705 was applied. Corn was grown. Soil samples were analyzed by gas chromatography. Method used is AG 265, HCl hydrolysis 37913 (nonchlorinated compound) determined by EC-nitrogen detection system. Chlorinated 49751 would not be detected.

Application (lb. ai/A)	Interval (Days)	PPM Residue 0-6"	6-12"
2	0	0.88	---
	129	0.12	0.09
4	0	2.4	---
	129	0.13	0.15

Rainfall: None.

Irrigation: Data not available.

Conclusions:

Extractable residues of 0.09-0.15 ppm were found in the 6-12" layer of sandy loam soil after 129 days. These residues appear to be the nonchlorinated residues.

The field soil study is not acceptable because of the following deficiencies:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

4. Amount of irrigation should be reported since the chemical leaches.

3.8.6 Residue Report: Soil - York, Nebraska, Report # AG-A-2969 I-III, First Report, Accession # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

Soil characteristics:

Silt loam	
% organic matter	1.7
cation exchange capacity	14.3
pH	6.1
% clay	23.6
% silt	56.8
% sand	19.6

250 EC formulation of CGA-24705 was applied. Crops were grown. Soil samples were analyzed by methanol extraction, hexane partition, clean-up on alumina column and gas chromatography with Dohrmann microcoulometric detection (Cl detector system). Method REM 12/73 is used for Cl detection of soil residues.

Application (lb. ai/A)	Interval (Days)	PPM Residue 0-6"	6-12"
2	0	0.83	---
	64	0.41	0.15
	107	0.27	0.10
	162	0.17	<0.05
4	0	2.0	---
	64	1.09	0.16
	107	0.37	0.07
	162	0.33	0.05

Rainfall:

64 days	1.85 inches
107	3.39
162	14.52

Conclusions:

On Nebraska silt loam, 0.15 ppm residues had leached to the 6-12" layer after 64 days. Half-life of chlorinated extractable residues is more than 64 days. Monchlorinated residues will not be identified and may not be extracted.

The field soil study is not acceptable because of the following deficiencies:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3.8.7 Residue Report: Soil - Livingston, New York, Report # AG-A-2973, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

250 EC formulation of CGA-24705 was applied. Crops were grown. Soil samples were analyzed by gas chromatography. Method AG 265 was used to determine nitrogen containing molecules. It is unlikely that chlorinated one would be extracted and identified by this method.

Soil characteristics:

% organic matter	1.8
cation exchange capacity	6.5
pH	6.3
% clay	6.0
% silt	26.0
% sand	68.0
sandy loam	

Application (lb. ai/A)	Interval (Days)	PPM Residue 0-6"	6-12"
2	0	0.49	---
	60	0.12	<0.03
	111	0.32	<0.03
4	0	1.07	---
	60	0.16	<0.03
	111	0.09	<0.03

Rainfall:

0 days	---
60	10.83 inches
111	6.05

Conclusions:

Half-life of nonchlorinated extractable residues is less than 60 days in sandy loam soil. Less than 0.05 ppm residue was found in the 6-12" layer of soil.

The field soil study is not acceptable because of the following deficiencies:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3.8.8 Residue Report: Soil - York, Nebraska, Report # AG-A-2969 I-IV, Second Report, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

Soil characteristics:

Silt loam	
% sand	19.6
% silt	56.8
% clay	23.6
% organic matter	1.7
pH	6.1
cation exchange capacity	14.8

250 EC formulation of CGA-24705 was applied. Crops were grown. Soil samples were analyzed by gas chromatography. Method AG 265 for nitrogen containing compounds. Chlorinated compounds may be lost by this method.

Application (lb. ai/A)	Interval (Days)	PPM Residues 0-6" (Rep. 1)	0-6" (Rep. 2)	6-12" (Rep. 1)	6-12" (Rep. 2)
2	0	0.28	0.42	---	---
	64	0.31	0.15	0.04	0.03
	107	0.12	---	<0.03	---
	162	0.09	---	<0.03	---
	347	0.18	---	<0.03	---
4	0	1.7	1.2	---	---
	64	1.2	0.47	0.09	0.03
	107	0.13	---	<0.03	---
	162	0.21	---	<0.03	---
	347	0.32	---	0.04	---

Conclusions:

Half-life in silt loam field soil for nonchlorinated compounds is more than 64 days. Less than 0.05 ppm nonchlorinated extractable residues were found in the 6-12" layer after 64 days at 2 lb./A. At 4 lb./A, corresponding residues were 0.03 or 0.09 ppm.

The field soil study is not acceptable because of the following deficiencies:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

4. Precipitation to each sampling is not given. Precipitation is needed since the chemical leaches.

3.8.9 Residue Report: Soil - Washington, Mississippi, Report # AG-A-2929 I-V, Second Report, Acc. # 094376, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

Soil characteristics:

% sand	48.4
% silt	37.2
% clay	14.4
% organic matter	1.4
Loam	
cation exchange capacity	9.0
pH	6.1

250 EC formulation of CGA-24705 were applied. Crops were grown. Residues were analyzed by gas chromatography (Method AG 265).

Application (lb. ai/A)	Interval (Days)	PPM Residue First Analysis 0-6"	First Analysis 6-12"	Second Analysis 0-6"	Second Analysis 6-12"
2	0	1.0	----	0.83	----
	60	0.13	<0.05	0.18	0.05
	126	<0.05	<0.05	0.03	<0.03
	363	0.06	<0.04	0.04	<0.04
4	0	1.2	----	2.4	----
	60	0.48	<0.05	0.56	0.05
	126	0.32	<0.05	0.28	0.04
	363	0.07	<0.04	0.08	----

Conclusions:

Half-life of nonchlorinated extractable residues in loam field soil was less than 60 days. Less than 0.05 ppm residue was found in the 6-12" layer of soil.

The field soil study is not acceptable because of the following deficiencies:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

4. Precipitation to each sampling is not given. Precipitation is needed since the chemical leaches.

3.8.10 Residue Report: Soil - Washington, Mississippi, Report # AG-A-2929 I-IV, First Report, Acc. # 094375, Environmental Data - Vol. II, PP# 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP# 5G-1553).

Soil characteristics:

Loam	
% organic matter	1.4
cation exchange capacity	9.0
pH	6.1
% clay	14.4
% silt	37.2
% sand	48.4

250 EC formulation of CGA-24705 was applied. Crops were grown.

Application (lb ai/A)	Interval (days)	PPM residue 0-6"	6-12"
2	0	0.92	----
	60	0.11	1/ND
	126	ND	ND
	363	ND	ND
4	0	2.1	----
	60	0.23	ND
	126	0.14	ND
	363	ND	ND

1/ ND = No data.

Rainfall:

60 days	3.86 inches
126	10.40
363	62.21

Soil samples were analyzed by methanol extraction, hexane partition, clean-up on alumina column and gas chromatography with Dohrmann microcoulometric detection. Method REM 12/73 to determine chlorinated residues.

Conclusions:

Half-life of extractable chlorinated residues was less than 60 days. Less than 0.05 ppm residue was found in the 6-12" layer of soil.

The field soil study is not acceptable because of the following deficiencies:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3.9 Combination and Tank Mixes

See discussion of analysis of degradates in sections 3.9.3 and 5.6.

3.9.1 Metolachlor Plus Metribuzin Tank Mix Soil Dissipation, L. G. Ballantine, Report No. ABR-76092, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

A summary (with tables) of sections 3.9.1.1 through 3.9.1.5 is presented.

3.9.1.1 Residue Report, Report No. AG-A-3707 I-V, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

CGA-24705 (Dual GE) and metribuzin (Sencor 50W) were applied in a tank mix to silt loam soil in Nebraska.

Soil characteristics:

% sand	21.0
% silt	57.9
% clay	21.1
pH	6.2
cation exchange capacity	11.8
% organic matter	2.4

Application was preemergence broadcast to soybeans. Method AG 303 or modified REM 12/73 GC-Cl detection system.

Lbs. a1/A	Formulation 0-6" Depth	Application Date	Interval (Days)	CGA-24705 Residue (ppm)	Cumulative Rainfall (inches)
2.5	Dual 6E	6/13/75	0	2.7	----
			60	0.45	7.37
			119	0.29	8.94
			242	0.37	14.19
			366	0.07	25.02
2.5 +0.75	Dual 6E + Sencor 50W	6/13/75	0	2.8	
			60	0.23	
			119	0.22	
			242	0.32	
			366	0.08	

Conclusions:

Half-life for extractable chlorinated CGA-24705 residues applied alone and in a mixture with Sencor 50W was less than 60 days in silt loam. Dissipation rates were similar.

The tank mix study in silt loam soil is not acceptable for the following reasons:

1. Only parent CGA-24705 was analyzed. See discussion in section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by non-target organisms.

3.9.1.2 - Residue Report, Report No. AGA 3722 I-IV, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

CGA-24705 (Dual 6E) and metribuzin (Sencor 50W) were applied in a tank mix to clay loam soil in Illinois.

Soil characteristics:

% sand	20.4
% silt	50.4
% clay	29.2
% organic matter	5.5
pH	6.5
cation exchange capacity	21.6

Application was preemergence broadcast to soybeans.

Lbs. ai/A	Formulation 0-6" Depth	Application Date(s)	Interval (Days)	CGA-24705 Residue (ppm)	Cumulative Rainfall (inches)
2.5	Dual 6EC	6/6/75	0	1.8	----
			62	0.60	12.50
			123	0.33	19.80
			291	0.18	35.50
2.5 +0.75	Dual 6EC + Sencor 50W	6/6/75	0	1.1	
			62	0.71	
			123	0.27	
			291	0.27	

Conclusions:

Half-life of extractable chlorinated CGA-24705 residues when applied alone was less than 62 days. Half-life of extractable chlorinated residues when applied with Sencor 50W was more than 62 days. Dissipation rates were similar.

The tank mix study in clay loam soil is not acceptable for the following reasons:

1. Only parent CGA-24705 was analyzed. See discussion in section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by nontarget organisms.

3.9.1.3 Residue Report, Report No. AG-A 4140, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

This is a continuation of sampling of Report AG-A 3707, Acc. # 095763.

Lbs. ai/A	Formulation 0-6" Depth	Application Date(s)	Sample Date(s)	Interval (Days)	CGA-24705 Residue (ppm)	Cumulative Rainfall (inches)
2.5	Dual 6E	6/6/75	5/7/76	335	0.11	37.50
2.5+ 0.75	Dual 6E + Sencor 50W	6/6/75	5/7/76	335	0.11	

Conclusions:

See Report AGA 3707, Acc. # 095763 as AG-A 4140 is a continuation of sampling.

3.9.1.4 Chemagro Agricultural Division - Mobay Chemical Corporation Soil Persistence Study MW-HR-409-75, Report No. Chemagro #50842, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

Dual 6 EC and Sencor 50 WP were applied as a tank mix to clay loam soil in Illinois.

Appln Date	Sencor Oz Active/Acre[1] Per Appln	Days Final Appln To Sampling	Sampling Depth (inches)	Gross[3] Residue (ppm)	Sencor	DADK
6/06/75	12	0	0-6	0.25	0.22	ND[2]
	12	62	0-6	0.20	0.08	0.08
	"	123	0-6	0.11	0.02	0.06
	"	291	0-6	0.08	0.02	0.05
	"	335	0-6	0.05	0.01	0.03

[1] Plus 40 oz. active/acre/application Dual.

[2] None detected.

[3] Calculated on a dry weight basis.

Sencor 50 WP was applied to the same clay loam soil.

Appln Date	Oz Active/Acre Per Appln	Days Final Appln To Sampling	Sampling Depth (inches)	Sencor	DADK	Gross Residue (ppm)
6/6/75	12	0	0-6	0.14	ND	0.16
6/6/75	12	62	0-6	0.05	0.06	0.13
"	"	123	0-6	0.03	0.06	0.10
"	"	291	0-6	0.01	0.04	0.07
"	"	335	0-6	0.01	0.04	0.05

Soil characteristics:

pH	6.5
Texture: Clay loam	
% sand	20.4
% silt	50.4
% clay	29.2
% organic matter	5.5
cation exchange capacity	21.6 (MEq/100g)

Conclusions:

Residues of Sencor and DADK of 0.25 ppm at day 0 decreased to 0.11 on the 123rd day when Sencor was applied in a tank mix with Dual 6 EC. Residues of Sencor and DADK when Sencor was applied alone were similar.

The tank mix study is not acceptable for the following reasons:

1. Sencor and DADK in a tank mix were analyzed but residues of CGA-24705 were not analyzed. See discussion in Section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by non-target organisms.

3.9.1.5 Chemagro Agricultural Division - Mobay Chemical Corporation Soil Persistence Study 4-HR-8-75, Report No. Chemagro #50843, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

Dual 6 EC and Sencor 50 WP were applied in a tank mix to silt loam soil in Nebraska.

Soil characteristics:

pH	6.2
% sand	21.0
% silt	57.9
% clay	21.1
% organic matter	2.4
cation exchange capacity	11.8 mEq/100g

Appln Date	Oz Active/Acre[1] Per Appln	Days Final Appln To Sampling	Sampling Depth (inches)	Equivalent Gross Sencor Value SENCOR	DADK	Gross[2] Residue (ppm)
6/13/75	12	0	0-6	0.97	ND[3]	1.19
6/13/75	12	60	0-6	0.03	0.05	0.09
"	"	119	0-6	0.01	0.07	0.09
"	"	242	0-6	0.04	0.07	0.13
"	"	366	0-6	ND	0.04	0.05

[1] Plus 40 oz. active/acre/application Dual.

[2] Calculated on a dry weight basis.

[3] None detected.

Sencor 50 WP was applied alone to the same silt loam soil.

Appln Date	Oz Active/Acre Per Appln	Days Final Appln To Sampling	Sampling Depth (inches)	Equivalent Gross Sencor Value SENCOR	DADK	Gross Residue (ppm)
6/13/75	12	0	0-6	0.77	ND	0.93
6/13/75	12	60	0-6	0.04	0.06	0.12
"	"	119	0-6	0.03	0.07	0.10
"	"	242	0-6	0.03	0.08	0.14
"	"	366	0-6	ND	0.02	0.04

Conclusion:

Half-life of Sencor residue (parent and DADK) when applied individually and in a tank mix was less than 60 days. Amounts of residues were similar when applied in a tank mix and alone.

The tank mix study is not acceptable because of the following deficiencies:

1. Residues of CGA-24705 are not analyzed. See discussion in Section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by non-target organisms.

3.9.2 Metolachlor Plus Linuron Tank Mix Soil Dissipation, L. G. Ballantine, Report No. ABR-76079, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

A summary (with tables of sections 3.9.2.1 through 3.9.2.3) is present.

3.9.2.1 Residue Report, Report No. AG-A-3706 I-V, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

A tank mix of Dual 6E and Lorox 50W (Linuron) was applied to silt loam soil, preemergence broadcast to soybeans.

Soil characteristics:

% sand	21.0
% silt	57.9
% clay	21.1
cation exchange capacity	11.8
pH	6.2
% organic matter	2.4

Interval (days)	Rainfall (inches*)
0 (6/13/75)	----
50	7.37
119	3.94
242	14.19
366	25.02

Lbs. a.i. per gallon	Formulation	Appln Date	Interval (days)	Residue - ppm (0-6" depth) CGA-24705	*Linuron
2.5	Dual 6E	6/13/75	0	2.1	----
			60	0.31	----
			119	0.18	----
			242	0.33	----
			366	0.06	
1.5	Lorox 50W	6/13/75	0	----	1.2
			60	----	0.88
			119	----	0.94
			242	----	1.6
			366	----	0.30
2.5+ 1.5	Dual 6E + Lorox 50W	6/13/75	0	2.9	2.2
			60	0.23	0.77
			119	0.16	1.0
			242	0.21	1.4
			366	<0.05	0.42

* Linuron residues were converted to 3,4-dichloroaniline for analysis.

Conclusions:

Half-life of extractable chlorinated CGA-24705 residues was less than 60 days when applied alone and when applied in a tank mix with Lorox.

The tank mix study is not acceptable for the following reasons:

1. Only parent CGA-24705 was analyzed. See discussion in section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by non-target organisms.

3.9.2.2 Residue Report, Report No. AG-A 3719 I-IV, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

A tank mix of Dual 6E and Lorox 50W (Linuron) was applied to clay loam soil, preemergence broadcast to soybeans.

Lbs. a.i. per gallon	Formulation	Appln Date	Interval (days)	Residue - ppm (0-6" depth) CGA-24705	Linuron**	
2.5	Dual 6E	5/6/75	0	1.2	----	
			62	0.96	----	
			123	0.23	----	
			291	0.19	----	
1.5	Lorox 50W	6/6/75	0	----	1.2	
			62	----	0.92	
			123	----	0.41	
			291	----	0.71	
2.5 + 1.5	Dual 6E + Lorox 50W	6/6/75	0	1.2	0.71	0.76*
			62	0.59	0.87	
			123	0.36	0.77	
			291	0.16	0.78	

* The sample was reanalyzed.
** Residues convertible to 3,4-dichloroaniline.

Soil characteristics:

Clay loam	
pH	6.5
organic matter	5.5%
cation exchange capacity	21.6

Rainfall:

Interval (days)	Rainfall (inches)
0	-----
62	14.73
123	22.00
291	35.50

Conclusions:

Half-life of extractable chlorinated CGA-24705 residues when applied alone in clay loam soil was between 62 and 123 days. Half-life of extractable chlorinated CGA-24705 residues when applied in a tank mix with Lorox 50W was less than 62 days. Half-life of Linuron residues convertible to 3,4-dichloroaniline when Linuron is applied alone cannot be determined from data given since values decrease and increase again. Linuron residues when applied in a tank mix did not decrease over a period of 291 days.

The tank mix study is not acceptable for the following reasons:

1. Soil characteristics of bulk density and percent sand, silt, and clay are not given. These are needed since dissipation may vary in soils with different soil characteristics.

2. Only parent CGA-24705 was analyzed. See discussion in section 3.9.3.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by nontarget organisms.

3.9.2.3 Residue Report, Report No. AG-A No. 4139 I, II, Acc. # 095763, Vol. 1 of 25, PP# 7F1913, EPA Reg. # 100-583, submitted 1/13/77.

A tank mix of Dual 6E and Lorox 50W was applied to clay loam soil, preemergence broadcast to soybeans.

Lbs. Active/A	Formulation	Appln. Date	Interval (days)	Residue - ppm (0-6" depth) CGA-24705	Linuron*	
2.5	Dual 6E	6/6/75	335	0.13	----	
1.5	Lorox 50W	6/6/75	335	----	0.30	0.32**
			398	----	0.50	
2.5 + 1.5	Dual 6E + Lorox 50W	6/6/75	335	0.16	0.63	0.64**
			393	----	0.61	

* Residues which are hydrolyzable to 3,4-dichloroaniline.

** Samples were reanalyzed.

Rainfall:

Interval (days)	Rainfall (inches)
335	37.50
398	47.41

Conclusion:

This study is a continuation of sampling begun in Report AG-A 3719 I-IV. Refer to conclusions in that report.

3.9.3 Discussion of Analysis of Degradates of Dual in Tank Mixes

Studies 3.9.1.1 and 3.9.1.2 compared degradation of parent Dual when applied alone and in tank mix with Sencor. Studies 3.9.1.3, 3.9.1.4, and 3.9.1.5 compared degradation of Sencor and DADK when Sencor was applied alone and in tank mix with Dual.

Studies 3.9.2.1 through 3.9.2.3 compare degradation of parent Dual and Lorox residues convertible to 3,4-dichloroaniline when Dual and Lorox are applied alone and in a tank mix.

Studies in Sections 3.9.1 and 3.9.2, when considered as a group, would be acceptable with deficiencies provided that Dual degradates cannot be analyzed by any analytical method. If degradates can be analyzed, the tank mix studies would have to be done again in order to analyze Dual degradates. Identity and amounts of degradates are needed to assess potential for uptake by non-target organisms. An analytical method which might be used to resolve this problem is described in the recommendations (section 5.6).

3.10 Rotational Crop Study

See section 3.10.10 for conclusions of section 3.10 as a whole.

3.10.1 The Uptake of ø-^{14}C-CGA-24705 and Its Aged Soil Degradation Products in Rotation Wheat, Report # GAAC-74071, Accession # 094385, Environmental Data - Vol. I, PP# 5F1606, submitted 3/26/75, previously reviewed 6/24/75 (PP# 5F1606).

Winter wheat was grown in the greenhouse in soil which had been treated with 2 lbs/acre ring labeled ^{14}C-CGA-24705 six months before and in which corn had been grown. Treatment to sampling interval was 39 weeks.

Soil characteristics:

pH	5.7
CEC	3.4
% organic	3.6
% sand	28.8
% silt	56.4
% clay	14.8

Liquid scintillation counting was used.

Conclusions:

At maturity, straw contained 0.60 ppm and wheat grain contained 0.03 ppm equivalent to ^{14}C-CGA-24705.

The greenhouse study is acceptable and shows residues in rotational crop. When residues are found, a field study must be provided to determine if residues would occur under actual use conditions. Sufficient field soil studies are provided in Sections 3.10.3 through 3.10.9.

The following deficiencies are noted. (These deficiencies are not to be met since residues were found.)

1. Sandy loam soil is preferred soil for a lab or greenhouse study. Silt loam soil was used in the study.

2. A root crop, small grain, and leafy vegetable crop are to be studied. The study submitted was on wheat. (The field study should include each of these three categories since residues may be found in some crop categories but not others.)

3. Dosage or rate applied in this study was 2 lb ai. The registrant now proposes 3 lb ai/A. We cannot determine the amount of residue that would be present in rotational crops if the higher rate is used.

3.10.2 The Uptake of β-^{14}C-CGA-24705 and Its Aged Soil Degradation Products in Rotation Oats, Report # GAAC-74085, Accession # 094385, Environmental Data - Vol. I, PP# 5F1606, submitted 3/26/75, previously reviewed 6/24/75 (PP# 5F1606).

Oats were grown in the greenhouse in soil which had been treated with 2 lbs./acre of ring-labeled ^{14}C-CGA-24705 nine months earlier and in which corn had been grown. Treatment to sampling interval was 50 weeks.

Soil characteristics:

pH	5.7
CEC	8.4
% organic	3.6
% sand	28.8
% silt	66.4
% clay	14.8

Radioassays were performed by liquid scintillation counting.

Conclusion:

Oat straw contained 0.27 ppm and grain contained 0.05 ppm equivalent to ^{14}C-CGA-24705.

The greenhouse study is acceptable and shows residues in rotational crop. When residues are found, a field study using formulated product must be provided to determine if residues would occur under actual use conditions. Sufficient field soil studies are provided in Sections 3.10.3 through 3.10.9.

The following deficiencies are noted. (These deficiencies are not to be met since residues were found.)

1. Sandy loam soil is preferred soil for a lab or greenhouse study. Silt loam soil was used in the study.

2. A root crop, small grain, and leafy vegetable crop are to be studied. The study submitted was on oats. (The field study should include each of these three categories since residues may be found in some crop categories but not others.)

3. Dosage or rate applied in this study was 2 lbs. Ai. The registrant now proposes 3 lb. Ai/A. We cannot determine the amount of residues that would be present in rotational crops if the higher rate is used.

3.10.3 The Uptake of β-^{14}C-CGA-24705 and Its Aged Soil Degradation Products in Rotation Carrots, Report # GAAC-74112, Acc. # 094385, Environmental Data - Vol. I, PP# 5F1606, submitted 3/26/75, previously reviewed 6/24/75 (PP# 5F1606).

Carrots were grown in a field plot which had been treated with 2 lbs./acre of ring labeled ^{14}C-CGA-24705 nine months earlier and in which corn had been grown. Treatment to sampling interval was 48 weeks.

Soil characteristics:

Soil Type	Bosket Silt Loam
pH	5.6
CEC	9.6
% organic	0.9
% sand	26.0
% silt	62.0
% clay	12.0

Radioassays were performed by liquid scintillation counting.

Each [illegible]

1. [illegible]

Conclusions:

1. Carrot tops contained 0.03 ppm and roots 0.02 ppm equivalent to ^{14}C-CGA-24705.

2. The study is acceptable as a crop rotation study on a root crop.

3. Bulk density of the soil is not reported. Dissipation may vary in soils with different soil characteristics.

4. Dosage or rate applied was 2 lbs/A. The proposed rate is 3 lb. ai/A. We cannot determine the amount or if any residues would be present in rotational crops at the higher rate.

3.10.4 The Uptake of β-^{14}C-CGA-24705 and Its Aged Soil Degradation Products in Rotation Soybeans, Report No. GAAC-74113, Acc. #094385, PR. No. 5F1606, submitted 3/26/75, previously reviewed 6/24/75 (PP #5F1606). Environmental Data - Vol. I.

Soybeans were grown in a field plot which had been treated with 2 lbs./acre of ring labeled ^{14}C-CGA-24705 nine months earlier and in which corn had been grown. Treatment to sampling interval was 48 weeks.

Soil characteristics
Basket silt loam

pH	5.6
Cation exchange capacity	9.6
Percent organic matter	0.9
% Sand	26.0
% Silt	62.0
% Clay	12.0

Radioassays were performed by liquid scintillation counting.

Conclusions:

1. Residues in ppm equivalent to ^{14}C-CGA-24705 were found in soybeans as follows:

Stalks	0.07 ppm
Beans	0.04 ppm
Meal	0.05 ppm
Oil	less than 0.01 ppm

2. The study is acceptable as a crop rotation study on soybeans.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics.

4. Dosage or rate applied was 2 lbs.Ai. The proposed rate is 3 lbs. Ai/A. We cannot determine the amount or if any residues would be present in rotational crops at the higher rate.

3.10.5 Residue Report: Oats--Washington, Mississippi, Report No. AG-A-3150, I-II, Acc. No.094376, Environmental Data -- Volume II, PP No. 5F1606, submitted 3/27/75, previously reviewed 6/24/75 (PP #5F1606).

Oats were planted in the field after corn treated at 2 and 4 lbs. ai/acre. Soil type was loam. Treatment to planting interval was 134 days. Treatment to sampling intervals was 203 days for oat forage and 370 days for oat fodder and grain.

Conclusions:

Residues in CGA-24705 equivalents were 0.04/0.05** ppm for oat forage and less than 0.03 ppm (at 2 and 4 lbs./acre) for oat fodder and grain.

**4 lbs./acre treatment

The study is acceptable as a rotational crop study on a small grain. The following deficiencies are noted:

1. Soil characteristics of pH, cation exchange capacity, bulk density, percent organic matter, and percent sand, silt, and clay are not given. Dissipation may vary in soils with different soil characteristics.

3.10.6 Residue Report: Wheat--Douglas, Illinois, Report No. AG-A-3554, Acc. No. 094376, Environmental Data -- Volume II, PP No. 5F1606, submitted 3/27/75, previously reviewed 6/24/75 (PP #5F1606).

Wheat was planted in the field after corn treated at 2 and 4 lbs./ai/acre. Treatment to sampling interval was 336 days for wheat forage and 412 days for wheat fodder and grain.

Conclusions:

Residues in CGA-24705 equivalents were <0.03** ppm in wheat forage, <0.03/0.07** ppm (at 2 and 4 lbs./acre) in wheat grain, and <0.03/0.07** ppm in wheat fodder.

**4 lbs./acre treatment.

The study is acceptable as a rotational crop study on a small grain. The following deficiencies are noted:

1. Soil characteristics of pH, cation exchange capacity, bulk density, percent organic matter, and percent sand, silt, and clay are not given. Dissipation may vary in soils with different soil characteristics.

3.10.7 Residue Report: Sugarbeets--York, Nebraska, Report No. AG-A-3282, I (2nd), II, Acc. No. 094376, Environmental Data - Volume II, PP No. 5F1606, submitted 3/27/75, previously reviewed 6/24/75 (PP #5F1606).

Sugarbeets were planted in the field after corn treated at 2 and 4 lbs. a.i./acre. Soil characteristics:

Silt loam
Cation exchange capacity: 14.0
pH 6.4
% sand 20.4
% silt 58.6
% clay 21.0
% organic matter 2.9

Treatment to planting interval was 207 days. Treatment to sampling interval is 372 days for forage and 455 days for tops and roots.

Conclusion:

Residues in sugarbeets in CGA-24705 equivalents were <0.03/0.07** ppm for forage, and 20.09 ppm for tops (at 2 lbs./acre) and roots (at 2 and 4 lbs./acre).

This is an acceptable crop rotation study on a root crop at 2 lbs. ai/A. The following deficiency is noted:

Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics.

**4 lbs./acre

The study is not acceptable for the 4 lb. a.i./A rate since the tops were not analyzed after treatment at that rate. The highest proposed rate is 3 lbs. a.i./A. We cannot determine the amount or if any residue would be present in tops at the highest proposed rate.

3.10.8 Residue Report: Soybean--Washington, Mississippi, Report No. AG-A-3244, II, Acc. No. 094376, Environmental Data - Volume II, PP No. 5F1606, submitted 3/27/75, previously reviewed 6/24/75 (PP #5F1606).

Soybeans were planted in the field after corn treated at 2 and 4 lbs. a.i./acre. Treatment to planting interval was 286 days. Treatment to sampling interval was 540 days.

Conclusions:

Residues in soybeans in CGA-24705 equivalents were <0.03** ppm for fodder and grain at 2 and 4 lbs. a.i./A.

**4 lbs. a.i./acre.

This is an acceptable crop rotation study on soybeans. The following deficiencies are noted:

1. Soil characteristics of pH, cation exchange capacity, bulk density, percent organic matter, percent sand, silt, and clay are not given.

   Dissipation may vary in soils with different soil characteristics.

3.10.9 Residue Report: Soybeans--York, Nebraska, Report No. AG-A-3283, I (2nd), II, Accession No. 094376, Environmental Data - Volume II, PP No. 5F1606, submitted 3/27/75, previously reviewed 6/24/75 (PP #5F1606).

Soybeans were planted in the field after corn treated at 2 and 4 lbs. a.i./acre. Treatment to planting interval was 358 days. Treatment to sampling interval was 405 days.

Soil characteristics:
silt loam
20.4% sand, 58.6% silt, 21.0% clay
2.9% organic matter
Cation exchange capacity: 14.0
pH 6.4

Conclusions:

Residues in soybeans in CGA-24705 equivalents were 0.06 ppm in forage (at 2 and 4 lbs./acre), 0.04/0.05** ppm in fodder, and <0.03 ppm (at 2 and 4 lbs./acre) in grain.

**4 lbs. a.i./acre.

The study is acceptable as a crop rotation study on soybeans.

Deficiency of thesubmitted study is as follows:

> Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics.

3.10.10 Conclusions for Section 3.10:

Soil persistence data accompanying the GAAC reports support other soil persistence studies which show virtually no dissipation following several months aging. In each case studied, whether the soils were extracted or not, very little change was noted in amounts of radiolabeled material in the soils from the time the rotation crop was planted to the harvest of that crop. Occasionally, greater amounts of residue were found in the soil on dates midway through the rotational crop studies, than at the beginning of those studies.

Some residues were found in most crops tested. Cold studies revealed some detectable residues in soybeans at both 2 and 4 lbs./acre treatment at 400-500 days, in oat forage from 2 and 4 lb. treatments at 200 days,and in sugarbeets (370 days)and wheat fodder(412 days)from 4 lb. treatments. These cold studies were reinforced by detectable radioactive residues in almost all crops at times between 36 and 50 weeks after treatment. Since companion soil dissipation studies show almost no dissipation from aged soils and the establishment of an apparent equilibrium between bound and nonbound residues, it would appear as if residues would be available for uptake to rotational crops for at least one year and possibly longer.

The highest proposed rate is 3 lb. a.i./A. Sugarbeet tops were not analyzed at 4 lbs. a.i./A so we cannot determine residues in the tops of the root crop at the proposed rate of 3 lbs. a.i./A.

3.11 Fish Accumulation:

Exposure of Fish to ^{14}C-CGA-24705; Accumulation, Distribution, and Elimination of ^{14}C-Residues, Bionomics Report, Accession No. 094376, Environmental Data - Volume II, submitted 3/27/75, PP No. 5F1606, previously reviewed 6/24/75 (PP #5F1606).

The following is excerpted from the review of 6/24/75:

This was a dynamic flow bluegill study at nominal 1000 and 10ug/L. concentrations. Tests were run for 70 days accumulations and 18 day depuration:

RESIDUE ACCUMULATION IN BLUEGILL SUNFISH

HIGH LEVEL

Day Sampled	Concentration Water (ug/L)	Tissue (mg/kg) Edible	Non-Edible	Bioconcentration Ratios	
1	760	9.92		13.05	
3	990	11.67		11.79	
7	1430	12.58		8.80	
10	1400	10.88		7.61	
14	1150	13.00		11.30	
21	1200	14.00		11.66	
28	1425	12.83		9.00	
35	1150	21.00	(679.00)	18.26	(590.4)
42	1453	23.25	(581.00)	16.00	(399.9)
49	1075	16.00	(497.00)	14.88	(462.32)
56	1010	21.52		21.31	
63	845	24.17		28.60	
70	825	21.46	(583.20)	26.01	(706.91)
71*	0	13.28	985.80	---	---
73	0	16.75	155.00	---	---
77	0	14.33	73.80	---	---
80	0	19.83	25.60	---	---
84	0	14.50	15.12	---	---
91	0	14.38	--	---	---
98	0	11.69	12.52	---	---

*Withdrawal

RESIDUAL ACCUMULATION IN BLUEGILL SUNFISH

Day Sampled	Concentration Water (ug/L)	LOW LEVEL Tissue (mg/kg) Edible	Non-Edible	Bioconcentration Ratios	
1	6.75	0.25		3.70	
3	8.85	0.39		4.41	
7	11.00	0.54		4.91	
10	9.30	0.45		4.84	
14	8.50	0.57		6.71	
21	8.70	0.89		10.47	
28	9.20	0.107		11.63	
35	9.30	0.126	(4.54)	13.55	(488.2)
42	10.20	0.142	(5.74)	13.92	(562.7)
49	9.08	0.152	(4.12)	16.74	(453.7)
56	11.09	0.177		14.87	
63	8.52	0.188		22.07	
70	9.73	0.187	(4.54)	19.22	(466.6)
71*	0	0.139	3.30	--	--
73	0	0.168	2.67	--	--
77	0	0.130	0.78	--	--
80	0	0.132	0.75	--	--
84	0	0.108	0.33	--	--
91	0	0.108	--	--	--
98	0	0.083	0.14	--	--

*Withdrawal

Fish had an average length of 57 mm and a mean weight of 2.9 g. Aerated well water at pH 7.1, dissolved oxygen greater than 5.0 mg/l, and temperature of 20°C + 1.0 was used. Ring labeled ^{14}C-CGA-24705 was used. Analysis method was liquid scintillation counting.

Of the ^{14}C-residue in edible tissue, 51% was extractable with hexane and 49% was extractable with methanol at the high treatment level. Corresponding percentages for the low treatment level were 37% and 63%.

Conclusion:

A fish accumulation study showed low residues in edible tissue (a BR of about 15-25) but significant accumulation in non-edible tissue (400-700 BR) occurs. The concentration in non-edible tissue is 25 to 40 times that of edible tissue, which is an unusual ratio. Withdrawal is rapid from non-edible tissue until it reaches a level 1-2 times as great as edible tissue. However, the level following withdrawal in edible tissue is more than 50% that of the so-called plateau. A true plateau does not appear to have been reached except possibly in the case of low level exposure in non-edible tissue. Hazards cannot be assessed.

The fish accumulation study is scientifically acceptable but has the following deficiencies based on current procedures:

1. Identity of residues are not determined for water, whole body fish, edible tissue and viscera or carcass. This should be determined at each sample interval. Identity is needed to assess potential for uptake by nontarget organisms.

2. Amount of residues in whole body fish are not determined. This should be determined at each sample interval. The amount in whole body fish determines how much is available for concentration in the food chain.

3. A static system study on catfish is not included. A catfish study in a static system will determine accumulation of residues from treated soil. The herbicide should be added to sandy loam soil at the use rate and allowed to age under aerobic conditions for 2 to 4 weeks before catfish exposure.

3.12 Ancillary Study:

Runoff Characteristics of ^{14}C-CGA-24705 Applied to Sandy Loam Soil Under Greenhouse Conditions, Bio/dynamics, Inc., Report No. 73022-1, Accession No. 094376, Environmental Data - Volume II, PP No. 5F1606, submitted 3/27/75, previously reviewed 3/5/75 (PP #5G-1553).

The following was excerpted from the review of 3/5/75:

1 lb. a.i./A of ^{14}C-ring CGA-24705 were applied to upper third of a 1' x 3' sandy loam slab soil runoff apparatus with an 8° slope. Runoff water, sediment, and leachate were counted by LSC. Area was subjected to artificial rainfall at 1, 3, and 7 days after treatment.

Soil characteristics: O.M. - 1.5%; sand - 82.8%; silt - 13.6%; clay - 3.6%; pH - 6.9; CEC - 2.6.

Distribution of ^{14}C Activity

Interval days	Rainfall acre-inches	^{14}C-Activity, %, in Runoff		
		Leachate	Water	Sediment
1	0.37	0.24	0.76	0.51
3	0.46	0.02	1.06	0.46
7	0.69	0.02	1.33	0.44
Totals	1.52	0.28	3.15	1.41

Conclusions:

Of the applied ^{14}C, 3.15% was found in runoff water and 1.41% was found in runoff sediment.

This study on runoff is not required by environmental chemistry but is an ancillary study. The potential adverse effect is runoff of less than 5% of the applied ^{14}C in water and sediment.

3.13 Ancillary Study:

The Uptake and Distribution of ϕ-^{14}C-CGA-24705 from Soil in Greenhouse Grown Corn, Report No. GAAC-74015, Accession No. 094385, Environmental Data - Volume I, PP No. 5F1606, submitted 3/26/75, previously reviewed 3/5/75 (PP #5G-1553).

The following is excerpted from the review of 3/5/75:

Corn in a greenhouse was treated with 2 lb. a.i. ring-labeled CGA-24705. Excerpts were quantitated by liquid

scintillation counting. Ionic character of metabolites was determined by an ion exchange technique using Dowex 1 and 50 columns. Thin layer chromatography and liquid scintillation counting were also used.

Soil Characteristics

Type	Silt Loam
pH	5.7
CEC	8.4
% O.M.	3.6
% Sand	28.8
% Silt	66.4
% Clay	14.8

Concentration of Radioactive Metabolites in Soil

Interval	1 Day	4 Weeks	8 Weeks	12 Weeks	16 Weeks
Total ppm:					
0-3"	3.02	1.92	0.50	0.69	0.65
3-6"	0.03	0.73	0.20	0.43	0.24
6-9"	--	0.43	0.25	0.30	0.14

Distribution of ^{14}C in Soil (Percent Present)

	4 Weeks	8 Weeks	16 Weeks
Methanol Extraction			
Organic	43.8	6.0	10.8
Polar	5.7	6.0	3.1
Non-extractable	50.5	86.0	78.5
CGA-24705	39.4	--	3.6
Unknown Extractables	10.1	--	10.3
Acetonitrile Extraction			
Organic		18.0	19.8
Polar		6.0	10.8
Non-extractable		70.0	60.0

1. Concentration of ^{14}C in soil went from 3.02 ppm at one day to 0.65 ppm at 16 weeks.

2. Non-extractable residues in soil increased from 51% of ^{14}C present at 4 weeks to 79% of ^{14}C present at 16 weeks.

3. Organic phase of methanol extractable ^{14}C in soil changed from 43.8% of total at 4 weeks to 10.8% at 16 weeks. 89% of this organic phase at 16 weeks was parent compound.

Conclusions:

1. Half-life of ^{14}C in greenhouse soil is approximately 6 weeks.

2. An increasingly greater percentage of the ^{14}C present was bound with time.

3. The compound is very mobile by leaching.

This study is not required by environment/chemistry but is an ancillary study. Potential adverse effects shown in this study are mobility by leaching, half-life in soild of 6 weeks, and a larger percentage of ^{14}C bound with time (over 50% in 4 weeks).

3.14 Ancillary Study:

Uptake of Non-extractable Soil Metabolites of β-^{14}C-CGA-24705 by Soybeans, Report No. GAAC-74056, Accession No. 094385, Environmental Data - Volume I, PP No. 5F1606, submitted 3/26/75, previously reviewed 6/24/75 (PP #5F1606).

Soybeans were grown in soil which had been treated with 2 lbs./acre of β-^{14}C-CGA-24705, aged 32 weeks, and extracted with methanol. Plants grown 28 days had residues equivalent to 0.18 ppm β-^{14}C-CGA-24705.

Conclusion:

Study GAAC-74056 is not required by environmental chemistry. It investigates uptake of bound residues in a rotational crop grown in soil extracted with methanol. The study is an ancillary study. The adverse effect is residues equivalent to 0.18 ppm of β-^{14}C-CGA-24705 in the soybean plant when grown in soil containing only unextractables.

3.15 Ancillary Study:

Uptake of Non-extractable Soil Metabolites of β-^{14}C-CGA-24705 by Carrots, Report No. GAAC-74057, Accession No. 094385, Environmental Data - Volume I, PP No. 5F1606, submitted 3/26/75, previously reviewed 6/24/75 (PP #5F1606).

Carrots were grown in soil which had been treated with 2 lbs./acre of β-^{14}C-CGA-24705, aged 32 weeks, and extracted with methanol. Carrots (tops) grown 28 days had residues equivalent to 0.15 ppm β-^{14}C-CGA-24705.

Conclusion:

Study GAAC-74057 is not required by environmental chemistry. It investigates uptake of bound residues in a rotational crop grown in soil extracted with methanol. The study is an ancillary study. The adverse effect is residues equivalent to 0.15 ppm of β-^{14}C-CGA-24705 in the carrot top when grown in soil containing only unextractable residues.

3.16 Ancillary Study:

Uptake of Non-extractable Soil Metabolites of β-^{14}C-CGA-24705 by Winter Wheat, Report No. GAAC-74058, Accession No. 094385, Environmental Data - Volume I, PP No. 5F1606, submitted 3/26/75, previously reviewed 6/24/75 (PP #5F1606).

Winter wheat was grown in soil which had been treated with 2 lbs./acre of β-^{14}C-CGA-24705, aged 32 weeks, and extracted with methanol. Wheat grown 28 days had residues equivalent to 0.13 ppm β-^{14}C-CGA-24705.

Conclusion:

Study GAAC-74058 is not required by environmental chemistry. It investigates uptake of bound residues in a rotational crop grown in soil extracted with methanol. The study is an ancillary study. The adverse effect is residues equivalent to 0.13 ppm of β-^{14}C-CGA-24705 in winter wheat when grown in soil containing only unextractable residues.

4.0 Conclusions

CGA-24705 is stable to hydrolysis under normal environmental conditions since half-life is over 200 days at 20°C and pH 5, 7, 9. Photolysis in water resulted in 69% degradation in 15 days under artificial sunlight and 8% in 30 days under natural sunlight. In the photolysis study in soil, half-life was 7-8 days. No significant differences were found in distribution of ^{14}C under aerobic and anaerobic conditions. Rate of degradation is slower in anaerobic soil. No significant degradation occurred in 60 days under sterile or nonsterile conditions. CGA-24705 had no apparent effect on number of fungi, bacteria, or actinomycetes. CGA-24705 leaches considerably in sandy soils. It leaches less in silt loam and does not leach below 3 inches in muck. The lower the percent organic matter, the greater the leaching. Half-life of total ^{14}C (both extractable and non-extractable) in Bosket silt loam field soil was 8 to 14 weeks. Larger percentages of the ^{14}C present at a given time were bound in Bosket silt loam field soil with time. Leaching may be the primary mode of loss. Because little loss of ^{14}C occurred after 16 weeks, only 70% of the ^{14}C applied (extractable and unextractable) was gone after one year. Half-lives of extractable chlorinated residues in silty clay loam and loam field soils are less than 60 days and chlorinated extractable residues of less than 0.05 ppm were found in the 6-12 inch layer of soil. Half-lives of nonchlorinated extractable residues in sandy loam and loam field soils are less than 60 days and less than 0.05 ppm nonchlorinated extractable residues were found in the 6-12 inch layer of soil. Nonchlorinated extractable residues of 0.09-0.15 ppm were found in sandy loam soil after 129 days. In Nebraska silt loam, 0.15 ppm chlorinated extractable residues had leached to the 6-12" layer after 64 days and half-life of chlorinated extractable residues was more than 64 days. In Nebraska silt loam, half-life of nonchlorinated extractable residues was less than 64 days and 0.09 ppm or less of the nonchlorinated extractable residues leached to the 6-12" layer after 64 days. On silt loam, half-life for extractable chlorinated residues CGA-24705 alone and in a tank mix with Sencor was less than 60 days. Dissipation rates were similar for CGA-24705 alone and in a tank mix in silt loam and clay loam soils. In clay loam, half-life of extractable chlorinated CGA-24705 residues when applied alone was less than 62 days. Half-life of extractable chlorinated

CGA-24705 residues in a tank mix with Sencor was more than 62 days. Residues of Sencor (parent and DADK) on clay loam and silt loam when applied alone and in a tank mix were similar. Half-life of Sencor parent and DADK on silt loam was less than 60 days. Half-life of extractable chlorinated CGA-24705 residues on silt loam was less than 60 days alone and in a tank mix with Linuron. On clay loam, half-life of extractable chlorinated CGA- 24705 residues alone was between 62 and 123 days. Half-life of extractable chlorinated CGA-24705 residues when applied in a tank mix with Linuron was less than 62 days on clay loam. Linuron residues are persistent alone and in a tank mix. Some residues were found in most rotational crops tested. Soil dissipation studies show almost no dissipation and the establishment of an apparent equilibrium between bound and nonbound residues. It appears that residues would be available for uptake by rotational crops for at least one year and possibly longer especially at rates higher than 2 lbs. a.i./A. A fish accumulation study shows low levels in edible tissue and accumulation in non-edible tissue.

5.0 Recommendations

5.1 No opinion is given.

5.2 The following studies are not acceptable:

A. Field Soil Studies:

Deficiencies of Report GAAC-74022:

1. Bulk density of the soil is not given. Degradation varies in soils with different soil characteristics so bulk density is needed to define results.

2. Residues are not identified as shown by MeOH and CH_3CN extractions and by TLC. Identity is needed to assess potential for uptake by nontarget organisms.

3. Patterns of formation and decline of degradation products are not established but are needed to assess potential for uptake by nontarget organisms.

4. Soil was not sampled to a depth of 12 inches as was needed for field and vegetable crops. Soil was sampled to a depth of 6 or 9 inches. Soil should be sampled to a depth of 12 inches to recover leached residues.

5. Sampling times should include day of application to aid in determination of decline curves.

6. Precipitation to each sampling is not reported. Precipitation is needed since the chemical leaches.

Deficiencies of Report GAAC-75022:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. Decline curve of parent is not well defined. Also patterns of formation and decline of degradation products are not established. These are needed to assess potential for uptake by nontarget organisms.

3. Soil must be sampled to a depth of 12 inches but was only sampled to a depth of 9 inches. Soil should be sampled to a depth of 12 inches to recover leached residues.

4. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics so bulk density is needed to define results.

5. Precipitation to each sampling is not reported. Precipitation is needed since the chemical leaches.

Deficiencies of Reports AG-A-3133, First Report; AG-A-3133, Second Report; AG-A-2969 I-III, First Report; AG-A-2973, AG-A-2979 I-IV:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation

and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics so bulk density is needed to define results.

Deficiencies of Report AG-A-3105:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics so bulk density is needed to define results.

4. Amount of irrigation should be reported since the chemical leaches.

Deficiencies of Reports AG-A-2969 I-IV, Second Report and AG-A-2929 I-V, Second Report:

1. Residues are not identified. Identity is needed to assess potential for uptake by nontarget organisms.

2. More sampling times are needed to better define half-life and decline curves. Patterns of formation and decline of degradation products are also needed to assess potential for uptake by nontarget organisms.

3. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics so bulk density is needed to define results.

4. Precipitation to each sampling is not given. Precipitation is needed since the chemical leaches.

B. Tank Mix Studies:

Tank mix studies when considered as a group would be acceptable with deficiencies provided that Dual degradate cannot be analyzed by any analytical method. If degradates can be analyzed, the tank mix studies would have to be done again in order to analyze Dual degradates. An analytical method which might be used to resolve this problem is described in the recommendations (Section 5.6).

Deficiencies of Report AG-A-3707 I-V:

1. Only parent CGA-24705 was analyzed. See discussion in Section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by nontarget organisms.

Deficiencies of Report AG-A-3722 I-IV:

1. Only parent CGA-24705 was analyzed. See discussion in Section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics, so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by nontarget organisms.

Deficiencies of Report Chemagro 60842:

1. Sencor and DADK in a tank mix were analyzed but residues of CGA-24705 were not analyzed. See discussion in Section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by nontarget organisms.

Deficiencies of Report No. Chemagro 50843:

1. Residues of CGA-24705 are not analyzed. See discussion in Section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by nontarget organisms.

Deficiencies of Report No. AG-A-3706 I-V:

1. Only parent CGA-24705 was analyzed. See discussion in Section 3.9.3.

2. Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics so bulk density is needed to define results.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by nontarget organisms.

Deficiencies of Report No. AG-A-3719 I-IV:

1. Soil characteristics of bulk density and percent sand, silt, and clay are not given. These are needed since dissipation may vary in soils with different soil characteristics.

2. Only parent CGA-24705 was analyzed. See discussion in Section 3.9.3.

3. More sampling times are preferred to better define half-life. Half-life is needed to assess potential for uptake by nontarget organisms.

5.3 The following studies are acceptable with deficiencies:

A. Hydrolysis:

The hydrolysis study is scientifically acceptable because it indicates stability under normal environmental conditions but the following deficiencies are noted:

1. The study must be conducted in the dark unless the chemical does not photodegrade. It does photodegrade in this case. The rate study was done in dark glass flasks, which satisfies thedarkness requirements It is not specified whether the study undertaken to identify hydrolysis products was done in darkness. Darkness is required so that photodegradation does not interfere with the hydrolysis study.

2. Distilled water must be used to prohibit/limit other type degradations. The type of water used was not specified.

NOTE: For chemicals which are not stable, the following would also be deficiencies:

1. Two concentrations should be studied unless the pesticide is stable as it is in this case. (In the submitted study, a concentration of 100 ppm was used to determine rate and a lower concentration was used to identify products.) Two concentrations are needed to support the assumption that first order kinetics describe the hydrolysis reaction. If the pesticide is stable at one concentration, it can be assumed stable at another concentration.

2. A radioisotope should be used to determine half-life unless other methods indicate stability, as they do in this case.

B. Photodegradation in water:

Deficiencies:

1. Distilled or deionized water must be used to prohibit/limit other type degradations. Type of water was not specified.

2. The pH, temperature, and oxygen content of the water should be reported as these factors influence rate and/or photoproducts.

3. Identity of some degradation products was not determined. Identity of each degradation product which accounts for more than 10% of applied ^{14}C is needed to determine potential for uptake by nontarget organisms.

4. For the artificial light source, the type of source, intensity, percent transmission, and wavelength are not reported. These are needed to assure that natural sunlight is simulated and to define results.

   Report GAAC-74041 refers to AG-208, in which artifical and natural sunlight conditions are described, but study AG-208 is not submitted or referenced with this submission.

C. Photodegradation in soil:

Deficiencies:

1. Bulk density of the soil is not reported. Bulk density is needed because soil characteristics may affect degradation.

2. For artificial light sources, the type of source, wavelength, intensity, and percent transmission were not reported. These are needed to assure that natural sunlight is simulated and to define results.

3. Degradates comprising more than 10% of initial application should be identified if present and if it is possible to extract and analyze them by any analytical method.

D. Anaerobic soil metabolism:

Deficiencies:

1. Bulk density of the soil is not reported. Bulk density is needed because soil characteristics may affect degradation.

2. Temperature of the soil should be between 18 and 30°C to resemble environmental conditions but was not reported.

3. Degradates comprising more than 10% of initial application should be identified if present and if it is possible to extract and analyze them by any analytical method. Identity of degradates allows assessment of potential for uptake by non-target organisms.

4. Material balance is not given. Material balance is needed to determine recoverability and aid in the identification process.

E. Effect of Microbes on Pesticides:

Bulk density of the soil is not reported. Bulk density is needed since metabolism may vary in different soils.

F. Effect of Pesticide on Microbes:

1. Soil characteristics of percent sand, silt, and clay, percent organic matters, pH, cation exchange capacity, and bulk density are not given. Soil characteristics are needed since they may affect results.

2. Linnaean names for fungi and bacteria used are not given. Organisms should include those that are representative of the soil populations.

G. Leaching:

1. Bulk density of the soils is not given. Leaching may vary in different soils so bulk density is needed to define results.

2. A leaching study of aged pesticide is not included. An aged study will determine whether degradates leach. In the aged study, one of the soils used in the fast leaching study should be aged for 30 days under aerobic conditions and eluted with 1/2 acre-inch water per day for 45 days.

3. Position of the ^{14}C label is not given. It is preferred that the ring be labeled so that recoverability of residues can be determined.

4. Material balance is not provided. Material balance, the percentage of ^{14}C applied/^{14}C recovered, indicates whether most residues are recovered.

   It is not clear whether percentages reported are percentages of applied ^{14}C or percentages of ^{14}C found.

H. Rotational Crop Study. (Studies on a root crop are not acceptable for the higher proposed rate of 3 lbs. a.i./A.)

Deficiencies of Reports GAAC-74112, GAAC-74113:

1. Bulk density of the soil is not reported. Dissipation may vary in soils with different soil characteristics.

2. Dosage or rate applied was 2 lbs. a.i./A. The highest proposed rate is 3 lbs. a.i./A. We cannot determine the amount or if any residues would be present in rotational crops at the higher rate.

Deficiencies of Reports AG-A-3282 I (2nd), II:

1. Bulk density of the soil is not reported. Dissipation may vary in soils with different soil characteristics.

2. Tops were not analyzed at 4 lbs. a.i./A. The highest proposed rate is 3 lbs. a.i./A. We cannot determine the amount or if any residue would be present in tops at the highest proposed rate.

Deficiency of Report AG-A-3283 I (2nd), II:

Bulk density of the soil is not given. Dissipation may vary in soils with different soil characteristics.

Deficiency of Reports AG-A-3150 I-II, AG-A-3554, and AG-A-3244 II:

Soil characteristics of pH, cation exchange capacity, bulk density, percent organic matter, and percent sand, silt, and clay are not given. Dissipation may vary in soils with different soil characteristics.

I. Fish Accumulation Study:

Deficiencies:

1. Identity of residues are not determined for water, whole body fish, edible tissue and viscera or carcass. This should be determined at each sample interval. Identity is needed to assess potential for uptake by nontarget organisms.

2. Amount of residues in whole body fish are not determined. This should be determined at each sample interval. The amount in whole body fish determines how much is available for concentration in the food chain.

3. A static system study on catfish is not included. A catfish study in a static system will determine accumulation of residues from treated soil. The herbicide should be added to sandy loam soil at the use rate and allowed to age under aerobic conditions for 2 to 4 weeks before catfish exposure.

5.4 An aerobic soil metabolism study is needed to determine hazards associated with fate of CGA-24705 in the environment. Metabolism in soil may be the major route of transformation. An aerobic soil metabolism study is needed to determine potential adverse effects on nontarget organisms.

5.5 Study AG-208 was referred to in Report GAAC-74041 but was not submitted.

5.6 We do not feel that Environmental Chemistry data as submitted is valid because of the lack of characterization of residues.

A quick way that may help to resolve this problem is to extract soil treated with ^{14}C-ring labeled metolachlor (CGA-24705) after it has aged at least 4 to 8 weeks as follows:

1. Extract soil with methanol to remove metabolites and parent (like that done in GAAC-74056). Take extract and proceed with method AG-277. Also determine how much is unextracted from the soil and how much remains in the methanol extract.

2. Extract and analyze soil by using method AG-277. Also determine how much remains in soil. It is hoped that this will clarify the unidentified product but may lead to further questions and data requirements.

3. If soil method AG-265 is used to extract and identify residues, please explain what will happen to chlorinated residues in soil.

5.7 Examples of protocols required by environmental chemistry to assess hazards:

1. Hydrolysis: Studies are to be conducted in darkness using radioisotopic or other comparable detection techniques at different pH values (acidic, neutral, and basic) at two concentrations and two temperatures. Aliquots in duplicate should be taken at four sampling time intervals, with at least one observation made after one-half of the pesticide is hydrolyzed, or thirty days, whichever is shorter. A material balance, half-life estimate, and identification of degradation products for the pesticide must be provided. Studies utilizing distilled water provide an upper limit estimate for persistence of pesticides in the aquatic environment. Hydrolysis in natural waters may be carried out to supplement studies in distilled water. Concentrations should approximate use rate and 10X use rate.

2. Photolysis: Conduct photodegradation studies using radioisotopic or comparable detection techniques at one concentration (approximately use rate) under natural or simulated [greater than 280 nm (280 x 10^{-9} meters) wavelength] sunlight. Such studies must provide a material balance, half-life estimate, and the identification of photoproducts. Rate studies are conducted in distilled or deionized water at pH of maximum stability, and sampling should continue up to twenty percent degradation with sampling for identification of photoproducts to half-life, or thirty days, whichever comes first. Yield of photoproducts may be increased by changing such conditions as wavelengths, concentration, photosensitizers, and solvents other than water. The intensity of incident sunlight and time of exposure must be reported if sunlight is used as a source. Information on artificial light sources should contain type of source, intensity, wavelength, and time of exposure. Photodegradation data must be supported by incident light intensity and percent transmission. Values for intensity in candles per unit area or lambert units are required for artificial light sources. Latitude, time of year, atmospheric cover, and other major variables which affect incident light are to be reported when natural sunlight is used.

   Characteristics of water must be reported including pH, temperature, and oxygen content.

3. Aerobic soil metabolism: Rate, type, and degree of metabolism of the pesticide residues are to be determined in a sandy loam, loam, silt loam, or other textured soil appropriate to the intended application sites. Radiolabeling in one or more positions in the pesticide molecule is required to assure adequate coverage of chemical transformations. Where radiolabeling will be of little benefit, comparable detection techniques are required. Residues comprising more than ten percent of initial application or 0.01 ppm should be identified. A material balance, including nonextractable residues, must be provided. The experimental dose rate must approximate field application rate. Treated soil must be maintained at temperatures of 18 to 30°C at or below 75% of 0.33 bar moisture content. Collect data until a

ninety percent loss of the pesticide occurs and until patterns of formation and decline of metabolic products are established. Preferred sampling times are at pre-treatment, 0,1,2, and 7 days, 2 and 3 weeks, and 1,2,3, 4,6,9, and 12 months. The study need not be conducted for more than one year for terrestrial crop and non-crop uses, and terrestrial/aquatic uses.

Characterization of soils must be reported including texture (percent sand, silt, and clay), percent organic matter, pH, cation exchange capacity, and bulk density.

4. Anaerobic soil metabolism: Terrestrial anaerobic soil studies should use the same soil as used in aerobic studies. Obtain an aliquot at the thirty-day interval from the aerobic soil study, and establish anaerobicity by either waterlogging or purging with inert gases. Preferred sampling intervals are thirty and sixty days after anaerobicity has been established.

5. Effects of microbes on pesticides: Impact of microbes on pesticide transformation is measured by comparisons of metabolic processes under sterile and non-sterile conditions during a thirty-day period. Preferred sampling intervals are 1,3,7,14,20, and 30 days, but other intervals may be appropriate. Acceptable soil sterilization methods are heat or high energy ionizing radiation. Attempts should be made to identify organisms responsible for degradation. For organisms which are difficult to identify, family names will be sufficient. Isolates that cannot be identified to family level must have descriptive characteristics which can be substituted for generic classification. Alternately, studies utilizing pure or defined and characterized mixed cultures of bacteria, algae, and/or fungi are adequate.

6. Effects of pesticides on microbes: Data on effects of pesticides on microbes are obtained from studies of effects on microbial functions or microbial populations. Studies of effects on microbial functions constitute a more direct approach, and are preferred to studies of effects on populations. Some effects cannot be measured directly and population studies may be the only recourse. When the functional approach is chosen, data on the effects on nitrogen fixation, nitrification and degradation of cellulose, starch, and protein are required for

terrestrial and aquatic uses, and for terrestrial/aquatic uses, an additional pectin degradation study is required. When the population approach is chosen, effects on pure or mixed culture populations of representative microorganisms from soil or water or obtained from culture collections should be recorded for terrestrial/aquatic or aquatic uses. Appropriate organisms include free-living nitrogen-fixing bacteria and blue-green algae such as Azotobacter, Clostridium, and Nostoc, and nitrifiers such as Nitrosomonas and Nitrobacter. For cellulose, starch, pectin, protein, and similar degradation, include at least one each of soil bacteria, actinomycetes, and molds such as Bacillus, Pseudomonas, Arthrobacter, Cellulomonas, Cytophaga, Streptomyces, Penicillium, Flavobacterium, Trichoderma, Aspergillus, Chaetomium, and Fusarium. Animal or plant pathogens and indicators of fecal pollution are unsuitable.

7. A leaching study using radioisotopic or comparable techniques is required. A minimum of four soils are used, including soils such as sand (agricultural), sandy loam, silt loam, clay or clay loam having a pH range of 4 to 8 with at least one soil having an organic matter content less than one percent. The pesticide is added to soil corresponding to the highest recommended rate for a single application. Each soil is immediately leached with the equivalent of twenty acre-inches of water. In addition, one of the above treated soils is aged for 30 days under aerobic conditions prior to initiation of leaching, which is at the rate of equivalent one-half acre-inch of water per day for forty-five days. A material balance, depth of leaching, and quantity and identity of the pesticide and its degradation products or metabolites must be provided.

   Characterization of soils must be reported including texture (percent sand, silt, and clay), percent organic matter, pH, cation exchange capacity, and bulk density.

8. A field dissipation study under actual use conditions is required. Analyses are continued until a ninety percent loss of the pesticide occurs or until patterns of formation and decline of degradation products are established or to a maximum test duration of eighteen months. Soil samples are taken in increments to a

depth of 12 inches from sites in four agricultural use areas. Sampling times include preapplication, day of application, and shortly post-application. Succeeding samples are dependent upon degradation and metabolism characteristics.

Identification of residues comprising more than ten percent of initial application or 0.01 ppm is needed to construct decline curves of residues in soil.

Characterization of soils must be reported including texture (percent sand, silt, and clay), percent organic matter, pH, cation exchange capacity, and bulk density.

9. Rotational crops: Studies are required to establish if pesticide residue uptake occurs in rotational crops, emergency replanting, or in situations where crops receive water from treated areas. The applicant must identify crops that can be rotated in the proposed use areas. Treat a sandy loam soil with radiolabeled pesticide at a rate equivalent to that expected under actual use conditions. Following treatment, age the pesticide aerobically for a time approximating the anticipated cultural practice; for example, one year for crops rotated the following year, 120 days for crops rotated immediately after harvest, and 30 days for assessing circumstances of crop failure. Plant a root crop, small grain, and leafy vegetable crop at the above times and periodically analyze to maturity. When residues are found, a field study using formulated products shall be undertaken to determine when residues would not occur in subsequent crops under actual use conditions. A crop residue study under actual use conditions is required for those practices where a subsequent crop is treated with the same active ingredient as the initial crop. This study is not required for a cover crop if typically plowed under and not grazed. A crop residue study under actual field use conditions is required where water from treated areas, including holding ponds or effluent and other discharges, is typically used to irrigate crops.

NOTE: Data which are to be reported from field tests include precipitation (accumulated from first application to each sampling), water table, grade (slope), and soil type. In addition, dates of planting and harvesting,

application and sampling times; dates and stages of crop and pest development; application-to-harvest and application-to-sampling intervals for each treatment; and the depth, weight, or volume of each sample and the weightsand volumes of aliquots taken for analysis must be reported. When water flow is measured in situ, flow meters or comparable techniques are required. (Data in gallons per minute or liters per minute will be acceptable.)

Characterization of soils must be reported including texture (percent sand, silt, and clay), percent organic matter, pH, cation exchange capacity, and bulk density.

10. Fish residue accumulation data using radioisotopic or comparable technique are required. Two exposure systems are required: flow-through (with constant concentration of aqueous solution of pesticide) and static (with ambient concentration of residues). Sunfish are preferred in flow-through system and catfish required in the static system. For the static system treat water overlayering a sandy loam soil at the proposed application rate and allow system to "age" for 2 to 4 weeks prior to initiation of fish exposure.

    Exposure duration is 30 days with suggested sampling times at 0, 1, 3, 7, 10, 14, 22, and 30 days of exposure; while fish and water samples are taken on 0, 1, 3, 7, 10, and 14 days of withdrawal of exposure. Obtain soil and water samples prior to fish exposure interval. Determine the amount and identity of the residue in water, soil, whole body fish, edible tissue, and viscera or carcass at each sample interval.

    Characteristics of water must be reported including pH, temperature, and oxygen content.

11. Combination and Tank Mixes: A laboratory or field study comparing dissipation in soil between a mixture and that of individually applied active ingredients is required. Pesticides are applied individually and as a mixture at the recommended rates to light and heavy textured soils. In the field, sample to a depth of 6 inches; and in the laboratory, sample to the bottom of the container until a residue decline curve is established, or for a maximum test duration of 6 months.

RR/Hey 9/20/77

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Table 1- Summary of environmental chemistry data requirements by intended use pattern

Data Requirements* / Use Patterns	Domestic Outdoor	Greenhouse	Terrestrial Uses: Non-crop	Terrestrial Uses: Fruit-Nut Crop (Tree)	Terrestrial Uses: Field-Veg. Crop	Aquatic Uses: Aquatic Food Crop	Aquatic Uses: Aquatic Non-Crop	Terrestrial/Aquatic Uses: Forest	Aquatic Impact Uses: Direct Discharge	Aquatic Impact Uses: Indirect Discharge	Aquatic Impact Uses: Wastewater Treatment	For Supporting Registration of: Manufacturing Use Product	For Supporting Registration of: F[illegible]
PHYSICO-CHEMICAL DEGRADATION:													
Hydrolysis	X	X	X	X	X	X	X	X	X	X	X	X	
Photodegradation			X	X	X	X	X	X	X				
METABOLISM													
Aerobic soil	X	X	X	X	X			X					
Anaerobic soil					X								
Anaerobic aquatic						X	X	X	X				
Aerobic aquatic						X	X		X				
Effects of microbes on pesticides			X	X	X	X	X	X	X				
Effects of pesticides on microbes			X	X	X	X	X	X[a]	X				
Activated sludge										X	X	X	
MOBILITY													
Leaching			X	X	X			X[b]					
Volatility		X		X	X	X		X					
Adsorption						X	X	X	X				
Water dispersal						X	X		X				
Field DISSIPATION:													
Soil	X		X	X	X	X		X					
Water						X	X	X[c]					
Ecosystem (X[d] or-hand study with [illegible])								X[d]					
ACCUMULATION:													
Rotational Crop					X	X							
Irrigated Crop						X	X						
Fish			X	X	X	X	X	X	X				

*Data requirements cited in paragraphs (c)(4)(iii)(C), (vi) and (vii); (c)(5)(v), (d), and (e) of Section 162.79 are not included in Table