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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 30 1987

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Alachlor(090501) - Response to Registration Standard Residue data on Corn, Milo, Peanuts, and Corn Processing Study
Monsanto Report Numbers:
MSL-5678 aka MSL-5603 (Corn) May, 1986
MSL-5702 aka MSL-5534 (Sorghum) May, 1986
MSL-5718 aka MSL-4636 (Peanuts) May, 1986
MSL-5943 (Corn Dry Milled Processed Fractions) September, 1986
[Accession Nos. 262999, 263002, 263022, 264946; RCB Nos. 1367, 1368, 1369, 1444]

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THRU: Charles L. Trichilo, Branch Chief
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TO: David Giampocaro
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and

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Monsanto Company has submitted a response to the Alachlor Registration Standard consisting of residue data for alachlor residues on corn commodities, sorghum (milo) commodities, peanut commodities, and corn dry milled processed fractions. Alachlor [2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide] is the active ingredient in LASSO Herbicide.

The Alachlor Registration Standard was issued 11/20/84. Alachlor was placed into Special Review in December, 1984. The Alachlor PD2/3 was issued in September, 1986.

According to the the Registration Standard, the available residue data did not support the established tolerances on any rac, since a second class of alachlor metabolites was discovered in a plant metabolism study on corn and soybeans (M. Kovacs, PP#0F2348, 4/23/84, Accession No. 251375). Previous residue methodology had detected only those metabolites which contained the diethylaniline moiety (DEA). This method (for corn and soybeans) was the subject of a recent method tryout (MTO). The DEA method has failed the MTO, due to a large range of recoveries, a large c.o.v., the need for custom made glassware, and lack of availability of the analytical standards (F. D. Griffith, 1/15/86). Monsanto has developed similar methods using the same piece of custom made glassware to detect those metabolites containing the hydroxyethylethylaniline moiety (HEEA) in various commodities and a method not requiring the use of custom made glassware.

Tolerances have been established for the combined residues of alachlor and its metabolites in or on numerous commodities, ranging from 0.02 ppm (N) in animal commodities to 3 ppm in or on peanut forage. (40 CFR 180.249). These tolerances are tabulated below. No food or feed additive tolerances for residues of alachlor and its metabolites have been established.

Commodity	Tolerance (ppm)
Beans, field, dry	0.1(N)
Beans, forage & hay	0.2(N)
Corn, forage & fodder	0.2(N)
Corn, fresh (incl. sweet, K + CWHR)	0.05(N)
Corn, grain	0.2(N)
Cotton, forage	0.2(N)
Cottonseed	0.05(N)
Lima beans, green	0.1(N)
Peanuts	0.05(N)
Peanut Hulls	1.5
Peanuts, forage & hay	3
Peas, forage & hay	0.2(N)
Peas w/pods removed	0.1(N)
Potatoes	0.1(N)
Sorghum, fodder & forage	1
Sorghum, grain (milo)	0.1
Soybeans	0.2(N)
Soybeans, forage	0.75
Soybeans, hay	0.2(N)
Sunflower seeds	0.25
Meat, fat, and meat byp of cattle, goats, hogs, horses, poultry, and sheep; milk; and eggs	0.02(N)

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The designation "(N)" means negligible residue; i.e., the tolerance was set at the limit of detection of the analytical method.

This submission includes the following studies:

"Alachlor Residues from Two Metabolite Classes in Corn Commodities following Preemergent Treatment with Lasso and Lasso Micro-Tech Herbicides." Monsanto Report No. MSL-5678 aka MSL-5603, May 14, 1986. EPA Accession No. 262999.

"Alachlor Resisdies from Two Metabolite Classes in Milo Forage, Milo Stover, and Milo Grain." Monsanto Report No. MSL-5702 aka MSL-5534, May 23, 1986. EPA Accession No. 263002.

"Determination of Alachlor Metabolite Residues from Two Metabolite Classes in Peanut Hay, Vines, Hulls, and Nutmeat." Monsanto Report No. MSL-5718, aka MSL-4636, May 27, 1986. EPA Accession No. 263002.

"Alachlor Residues from Two Metabolite Classes in Corn and Dry Milled Processed Fractions." Monsanto Report No. MSL-5943, Sept. 9, 1986. EPA Accession No. 264946.

Previously submitted residue data and protocols have been discussed in the following reviews.

December 24, 1986, Susan V. Hummel (SVH) to Vicky Walters (VW), review of Monsanto protocols for legume and peanut processing studies and waiver for corn processing studies, Accession No. 264946, RCB No. 1443.

May 23, 1986, MLL to ~~ERT~~ & M. McDavit, Analytical Methodology for Meat, Milk, & Eggs - Monsanto Response. No Acc # RCB # 449

May 13, 1986, SVH and Michele L. Loftus (MLL) to VW and Jane Talarico, Changes in conclusions regarding Registration Standard data requirements and dietary exposure estimates based on new information.

May 12, 1986, SVH to VW, Review of Accession No. 260257, RCB No. 448, Monsanto MSL-5165, MSL-3157, Storage Stability Data for Alachlor DEA and HEEA Metabolites (1 year), and Acetochlor MEA metabolites in corn, soybean, and peanut forage (3 years).

April 18, 1986, Michele L. Loftus (MLL) to Robert Taylor (RT), RCB No. 478, Protocol for Field Residue Trials for legumes.

March 17, 1986, SVH to VW, review of Accession No. 260643, RCB No. 452, Monsanto Report MSL-5118, MSL-4534, Residues in corn grain (LOQ 2 ppb).

March 10, 1986, SVH and MLL to Mike McDavit and Gary Burin (GB), review of Accession Nos. 257523 and 257526, RCB No. 942, Monsanto Response to PDl.

February 14, 1986, SVH to VW, review of Accession Nos. 260259 and 260260, RCB No. 284, Monsanto MSL-5158, MSL-4942, MSL-5123, Residues in Soybean Processed Fractions. January 15, 1986, Francis D. Griffith to Mike McDavit (MM) and RT, Alachlor MTO Report (DEA Metabolites only).

November 1, 1985, MLL to RT and TOX, Accession No. 257285, RCB No. 1009, Monsanto MSL-4613, MSL-3886, MSL-4230, Metabolism in Ruminants and Poultry.

October 31, 1985, SVH to VW, Accession No. 257274, RCB No. 1063, Monsanto MSL-4622, MSL-3234, Residues in Dry Beans, DEA Metabolites only.

October 31, 1985, SVH to VW, Accession No. 258142, RCB Nos. 1302 and 1303. Monsanto MSL-4774, MSL-4535, Residues in Soybeans, Preemergent Application

October 31, 1985, SVH to VW, Accession No. 257274, RCB Nos. 1000 and 1001, Monsanto MSL-4625, MSL-3980, Residues in Peanuts, Preemergent Application

October 31, 1985, SVH to VW, Accession No. 257284, RCB Nos. 1012 and 1013, Monsanto MSL-4621, MSL-2869, MSL-2873, Residues in Sunflowers, Preemergent Application, DEA metabolites only, Discussion of previously submitted data on corn, postemergent layby application, DEA metabolites only.

October 29, 1985, MLL to VW and GB, Accession No. 257271, RCB Nos. 1006 and 1007. Monsanto MSL-4636, MSL-3603, Residues in Corn grain, forage, stover, soybean grain, forage, hay, hulls, meal, oil.

REGISTERED USES

The registered uses for alachlor listed here are different from those listed in the Residue Chemistry Science Chapter. The Residue Chemistry Science Chapter discussed only those uses listed in the Index. RCB subsequently became aware of additional uses at higher rates, and/or for sequential treatments on registered Section 3 labels and on 24(c) labels. These uses were not listed in the Index for Alachlor. Consequently, our conclusions in the aforementioned reviews on the adequacy of the previously submitted data have changed. Thus, previous conclusions

are being updated in this memo. Note that the Alachlor Guidance Package did not specify the treatment regimen which needed to be supported.

Corn: The Section 3 labels for corn have a maximum application rate for alachlor on corn of 4-8 lb ai/A, depending on soil type. The application rate > 4 lb ai/A can be used on corn for coarse soils containing 10 percent or more organic matter (4 to 6 lb ai/A) and for peat and muck soils (6 to 8 lb ai/A). For all other soils, the maximum application rate is 4 lb ai/A. The registered labels for corn also allow a second treatment for hard to control weeds (N.T.E. 8 lbs ai/A/season). Both treatments must be before the corn reaches 5 inches in height; i.e., early. The maximum Section 24(c) use for alachlor on corn (NE, IL, CO, OH) is a pre-plant or pre-emergence treatment at $\leq$4 lbs ai/A followed by a late post-emergence (when the corn is up to 40 inches high) layby treatment at 2-3 lbs ai/A (N.T.E 6.5 lbs ai/A/season). Lasso EC is registered for use on corn. Lasso Micro-tech (micro-encapsulated formulation) is not registered for use on corn.

Soybeans: The maximum Section 3 use for alachlor on soybeans is two sequential treatments, each at 4 lb ai/A. No soybean data were included in this submission. Lasso EC and Lasso Micro-Tech are registered for use on soybeans.

Sorghum (milo): The maximum Section 3 use for alachlor on sorghum (milo) is treatment at 4 lb ai/A, preplant incorporated or preemergent. The same rate may be used in tank mixes with Atrazine, Modown, or Propazine. The label does not prohibit sequential applications. Lasso EC is registered for use on sorghum (milo). Lasso Micro-Tech is not registered for use on sorghum (milo). A Lasso/Atrazine premix is registered for use on sorghum (milo) at lower rates than those given here.

Peanuts: The maximum Section 3 use for alachlor on peanuts is one treatment at 4 lbs ai/A to be applied at planting, preemergence or at cracking. When applied as a tank mix with Dynap, the maximum section 3 use for alachlor on peanuts is two sequential treatments, each at $\leq$4 lbs ai/A, the first at planting and the second at cracking. The maximum Section 24(c) use for alachlor on peanuts is a pre-plant, pre-emergence or at cracking treatment followed by a late post-emergence layby treatment (immediately after the last cultivation), each at $\leq$4 lbs ai/A or a single application - preplant, preemergence, or at cracking - at 8 lb ai/A. Lasso EC is registered for use on peanuts. Lasso Micro-tech is not registered for use on peanuts.

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Dry Beans: The maximum Section 3 use for alachlor on dry beans is one preplant treatment at 3 lb ai/A west of the Mississippi, except in CA or Kern Co., CA. Alachlor may be used on red kidney beans in IL, WI, and IN for a 3 lb ai/A treatment preplant or preemergence. Both Lasso EC and Lasso Microtech may be used on dry beans. The EC only may be used in IN.

Lima Beans: The maximum Section 3 use for alachlor on lima beans is a single preplant or preemergence application of 3 lb ai/A in al states except CA. Both Lasso EC and Lasso Microtech may be used on Lima Beans.

Peas (for processing, MN only): The maximum Section 3 use is one preemergence treatment at 2.5 lb ai/A. Both Lasso EC and Lasso Microtech may be used on peas for processing in MN.

NATURE OF THE RESIDUE - PLANTS

The metabolism of alachlor in corn and soybeans was recently reviewed (PP#0F2348, M. Kovacs, 4/23/84). The residue of concern includes alachlor, metabolites containing the 2,6-diethylaniline moiety (2,6-DEA), and metabolites containing the 2-(1-hydroxyethyl)-6-ethylaniline moiety (2,6-HEEA). TOX has indicated that, in the absence of data showing that the HEEA metabolites are safe, these metabolites should be included in the tolerance expression (A. Malfouz, personal communication, 9/16/85). This requires re-evaluation of the tolerance levels and the analytical methodology, since, prior to M. Kovac°s review, only metabolites containing the DEA moiety were considered.

NATURE OF THE RESIDUE - ANIMALS

The metabolism of alachlor in ruminants and poultry is not adequately understood (M. L. Loftus, 11/1/85, Accession No. 257285, RCB No. 1009). Although 60 to 70% of the residue in goat and hen excreta was characterized and found to contain either the DEA or HEEA moiety, as found in plants, the residue in tissues, eggs and milk was not adequately characterized.

Except for liver, the residues in the tissues were not characterized, and the minimal characterization of the residues in the liver did not provide information on the type of aniline moiety. Twenty-four percent of the residue in eggs was characterized by acid pressure hydrolysis and found to contain residues containing the DEA and HEEA moiety. Twelve percent of the residue in eggs consisted

of other products including those containing the 2,6-di-(1-hydroxyethyl)aniline moiety. Sixty-four percent of the residue in eggs was not characterized. A large portion of the 64% uncharacterized residue in eggs was due to experimental mishap (charring of the water soluble fraction during acid pressure hydrolysis/ acetylation). The goat milk was characterized by acid pressure hydrolysis and found to contain an equal mixture of metabolites containing either the DEA or the HEEA moiety. However, the percent activity attributable to these two types of metabolites in the goat milk was not reported.

No additional animal metabolism data were included in this submission. Thus the deficiencies outlined in our memo of 11/1/85 (K. Loftus, Accession No. 257285, RCB No. 1009) remain outstanding.

ANALYTICAL METHODOLOGY

Monsanto has submitted a number of different methodologies for alachlor residues, all of which are similar to the alachlor DEA metabolite method which failed an MTO (F. D. Griffith, 1/15/86). These methods include a solvent extraction, an acid or base hydrolysis to produce DEA or HEEA from the DEA or HEEA containing metabolites, steam distillation of the DEA and HEEA using custom made glassware. Several different cleanups and detection systems are used. DEA has been cleaned up using an alumina/florisil column and quantitated by GC using a nitrogen/ phosphorus detector. HEEA has been cleaned up using an AG-50 cation exchange column followed by solvent cleanup, derivitization with TFAA, and quantitation by GC/ECD. The DEA portion of this method outline failed the MTO. This combination may be the "separate method" Monsanto referred to in their storage stability data submission.

Methods previously submitted for soybeans and peanuts (S. Hummel, 2/14/86, and 12/24/86) used a solvent cleanup following the steam distillation, followed by separation of DEA and HEEA by normal phase HPLC using an amine bonded phase column. DEA and HEEA were derivitized with HFBA and TFAA, respectively, and quantitated by GC/ECD.

Methods previously submitted for corn grain and legumes (S. Hummel, 3/17/86 and 12/24/86) used a solvent cleanup following the steam distillation, followed by addition of fluoro-DEA as an internal standard. The extract was then derivitized with HFBA, and quantitated by GC/NICI-MS using a DB-5 bonded phase capillary column and selected ion monitoring (SIM).

To date, Monsanto has not submitted data on the applicability of the PAM Multiresidue Methodology to detect alachlor and its metabolites. This requirement was published in the Federal Register on September 26, 1986 (51 FR 34249), and appears in 40 CFR 158.125. Copies of the FR Notice and the 4 Multiresidue protocols are attached to this review. These data are required.

Four different methods are included in these submissions. Three of the four methods are similar to one of the method outlines above. Descriptions of these methods follow.

"Analytical Method for the Determination of 2,6-Diethylaniline (DEA) and 2-(1-Hydroxyethyl)-6-Ethylaniline (HEEA) Yielding Alachlor Metabolites in Corn Forage, Corn Fodder, Field Corn Grain, Sweet Corn Plus Cob with Husk Removed (CWHR)," Appendix C of MSL-5678 and MSL-5603 (Accession No. 262999).

"Analytical Method for the Determination of 2,6-Diethylaniline (DEA) and 2-(1-Hydroxyethyl)-6-Ethylaniline (HEEA) Yielding Alachlor Metabolites in Corn Grain, Corn Meal, Corn Soapstock, Crude Corn Oil, Refined Corn Oil, Bleached Corn Oil, and Deodorized Corn Oil," Appendix C of MSL-5943 (Accession No. 264946).

"Analytical Method for the Determination of 2,6-Diethylaniline (DEA) and 2-(1-Hydroxyethyl)-6-Ethylaniline (HEEA) Yielding Alachlor Metabolites in Milo Forage, Milo Stover, and Milo Grain," Appendix C of MSL-5678 and MSL-5603 (Accession No. 262999).

Samples are extracted with 20% water/acetonitrile. The solvent is evaporated to near dryness. The extract is hydrolyzed in base to produce DEA and HEEA. The reaction of metabolites producing DEA and HEEA is shown in Figure 1. The DEA and HEEA are steam distilled in custom made glassware, and collected in acid. The distillate is washed with hexane, made basic, and the DEA and HEEA partitioned into methylene chloride. The extract is solvent exchanged with iso-octane, and the DEA and HEEA are separated and cleaned up by normal phase HPLC using an amine bonded-phase column with automatic fraction collection. The isolated 2,6-DEA and 2,6-HEEA are derivatized with heptafluorobutyric anhydride (HFBA) and trifluoroacetic anhydride (TFAA), respectively. Quantitation is by GC/ECD. A 15 m DB-5 bonded phase capillary column is used for the separation. Calculations were described.

2,6-Diethylaniline (available from Aldrich) and 2-(1-Hydroxyethyl)-6-ethylaniline (synthesized in-house) are used as standards. Two metabolites, sodium salt of 2-[(2,6-

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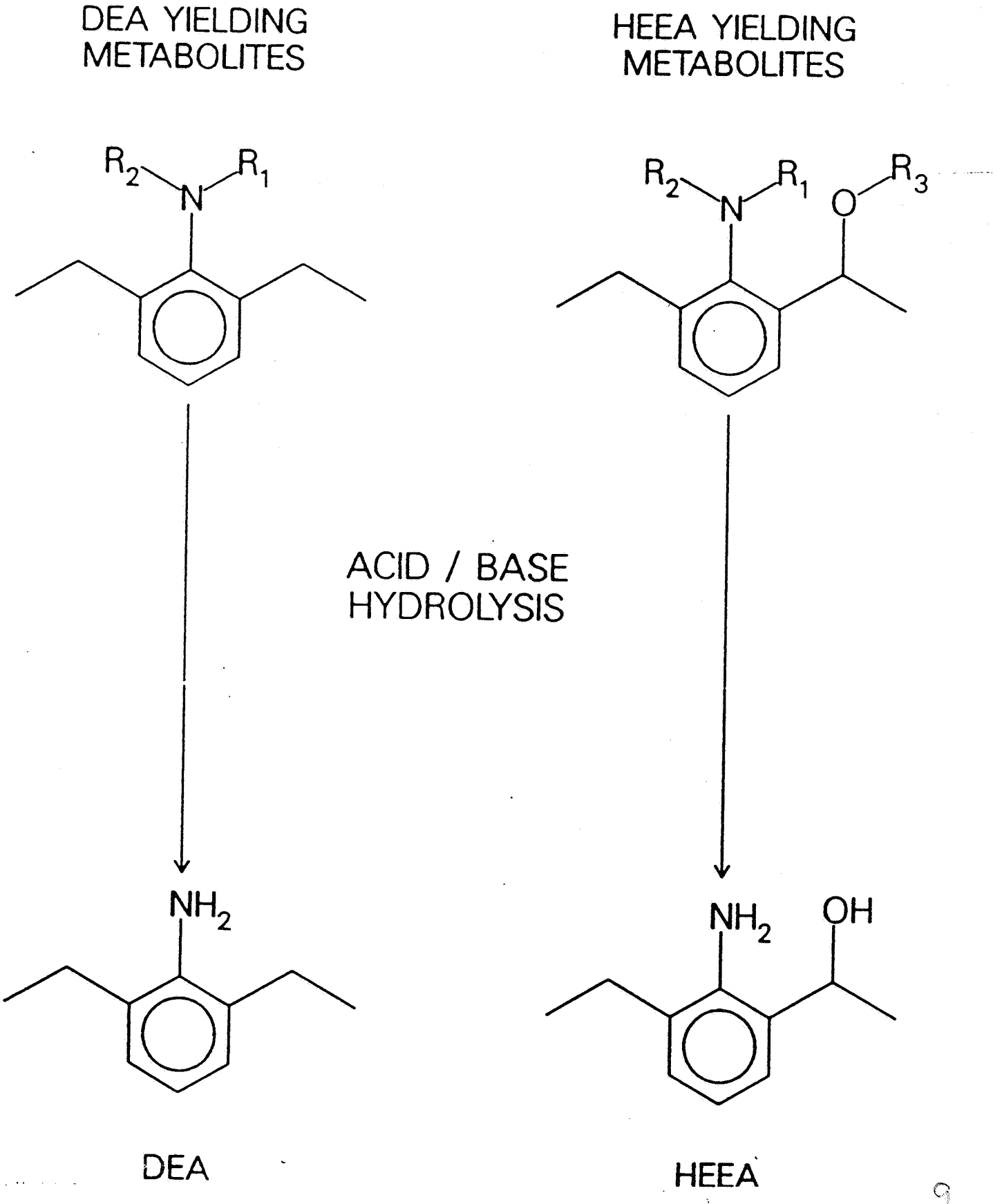
FIGURE 1


DEA YIELDING METABOLITES
HEEA YIELDING METABOLITES
R2
N
R1
R2
N
R1
O
R3
ACID / BASE HYDROLYSIS
NH2
NH2
OH
DEA
HEEA

diethylphenyl) (methoxy-methyl)amino]-2-oxo-ethane sulfonic acid (tertiary amide sulfonic acid metabolite, containing 2,6-DEA moiety), and N-[2(1-hydroxyethyl)-6-ethylphenyl]-N-(methoxymethyl)-2-(methylsulfonyl) acetamide (hydroxyethyl tertiary amide sulfone metabolite containing 2,6-HEEA moiety), are used for fortification and recovery calculations. The structure of these metabolites are shown in Figure 2.

Results are expressed as alachlor equivalents. The limit of quantitation (LOQ) (limit of method validation, i.e., the method was not validated below this level) is reported to be 0.010 ppm in all commodities. Sample chromatograms for one check sample, one field treated sample (6-8 lb ai/A), and one sample fortified at a level greater than the LOQ for each commodity were included with the analytical methods. No chromatograms were included with the samples analyzed for these submissions. These chromatograms are required. Chromatograms are needed for samples fortified at the LOQ. Formulas for sample calculations were included. Recoveries were determined and reported as follows.

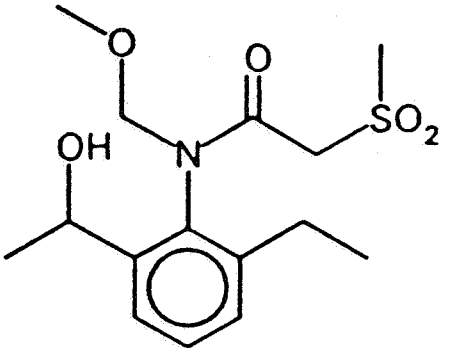
	RECOVERIES (%)			
	2,6-DEA		2,6-HEEA	
Commodity	range	average	range	average
corn forage	68-95	80	52-95	69
corn fodder	49-100	76	48-86	66
corn grain	63-92	75	49-98	68
corn K+CWHR	59-86	74	66-84	73
corn meal	57-95	78	50-96	74
soapstock	55-89	78	40-90	67
crude oil	53-108	79	56-100	78
alk.refined oil	64-90	81	70-85	75
bleached oil	60-118	84	54-88	72
deodorized oil	48-102	81	67-129	86
sorghum grain	59-83	71	57-81	69
sorghum stover	50-84	71	43-88	69
sorghum forage	61-96	72	44-74	65

RCB Conclusions on these methods

These methods (for corn commodities, corn processed products, and sorghum commodities) are not suitable for enforcement. These methods all require the use of custom made glassware, which is not commercially available. Additionally, the range of recoveries is large, and the average recovery is low. We will, however, accept residue data generated using these methods for the Special Review.

FIGURE 2

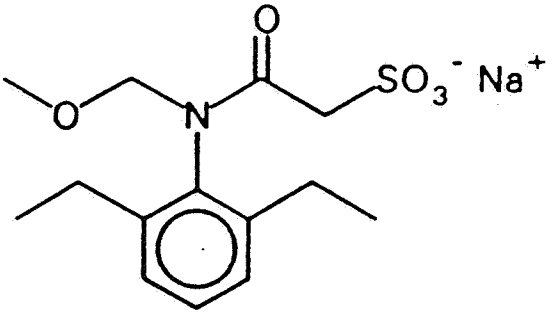
REPRESENTATIVE ALACHLOR METABOLITES



HEEA Yielding

"Hydroxyethyl Methylsulfone Metabolite"

N-[2-(1-hydroxyethyl)-6-ethylphenyl]-N-(methoxymethyl)-
2-(methylsulfonyl)acetamide



DEA Yielding

"Sulfonic Acid Metabolite"

2-[(2,6-diethylphenyl)(methoxymethyl)amino]-
2-oxoethane sulfonic acid, sodium salt

and for generation of residue data for the Registration Standard, provided that the data are adequately validated (raw data including chromatograms, adequate storage stability data, etc.). However, the methods are not sutiable for enforcement. Monsanto must submit an enforcement method.

"Analytical Method for the Determination of 2,6-Diethylaniline (DEA) and 2-(1-Methoxyethyl)-6-Ethylaniline (MEEA) Yielding Alachlor Metabolites in Peanut Hay, Vines, Hulls, and Nutmeats," Appendix D of MSL-5718 and MSL-4636 (Accession No. 263022).

This analytical method is different from previously submitted methods. It does not require the use of the custom made glassware used in the other methods. Methoxyethylethylaniline (MEEA) is produced from HEEA. The DEA and MEEA are determined by HPLC with oxidative coulometric electrochemical detection (OCED). No derivatization is required.

Samples are extracted with 20% water/acetonitrile. The extract is vacuum filtered, washed, and the solvent evaporated to near dryness. The extract is hydrolyzed in base under pressure at 155C to produce DEA and HEEA. The sample is cooled at room temperature for 1 hour. The DEA and HEEA are extracted with methylene chloride, and then with methanolic HCl. After separation, additional methanol is added, and the solution is allowed to sit overnight (for approximately 12 hours) to convert HEEA to MEEA (methoxyethylethylaniline). The pH of the aqueous/methanolic solution is then adjusted to 5-7. The volume of the methanol/water layer is adjusted with 50% methanol/water or HPLC mobile phase. The DEA and MEEA are then separated by reverse phase HPLC using a Zorbax C-8 column (4.6 mm x 15 cm) and 45:55 pH 4.8 acetate buffer/methanol (v/v). The detector is an Oxidative Coulometric Electrochemical Detector - ESA Model 5100A Coulochem Detector with Model 5010 analytical cell and Model 5020 guard cell.

External Standards were used for calibration. Some chromatograms were included with the method. However, none of the chromatograms were for samples fortified at the claimed limit of quantitation (LOQ). Calculations were described.

2,6-Diethylaniline (available from Aldrich), 2,6-HEEA (from Stark Laboratories), and 2-(1-Methoxyethyl)-6-ethyl aniline (synthesized in-house) are used as standards. The same two metabolites listed above for the other methods, sodium salt of 2-[(2,6-diethylphenyl) (methoxy-methyl)amino]-2-oxo-ethane sulfonic acid (tertiary amide sulfonic acid

metabolite, containing 2,6-DEA moiety), and N-[2(1-hydroxyethyl)-6-ethylphenyl]-N-(methoxymethyl)-2-(methylsulfonyl) acetamide (hydroxyethyl tertiary amide sulfone metabolite, containing 2,6-HEEA moiety), are used for fortification and recovery calculations.

Results are expressed as alachlor equivalents. The limit of quantitation is reported to be 0.010 ppm. Sample chromatograms for one check sample, one field treated sample (8 lb ai/A), one peanut sample fortified at 0.05 ppm, and one sample each of hills, vines, and hay, fortified at 0.10 ppm were included. Formulas for sample calculations were included. Recoveries were determined and reported as follows.

	RECOVERIES (%)	
	2,6-DEA	2,6-MEEA
Commodities	average	average
peanut hay	91±7.5%	76±7.7%
peanut vines	83±4.8%	77±5.6%
peanut hulls	77±11%	87±8.3%
peanut nutmeat	87±7.7%	78±7.3%

Recoveries were determined again when the samples were analyzed, and were reported as follows.

	RECOVERIES (%)			
	2,6-DEA		2,6-MEEA	
Commodities	range	average	range	average
peanut hay	63-91	78	59-102	77
peanut vines	79-120	96	45-104	80
peanut hulls	62-107	80	57-125	78
peanut nutmeat	67-120	96	67-101	83

RCB Conclusions on Analytical method for Peanut Commodities

This method does not require the use of custom made glassware. Additionally, the range of recoveries is not as large and the average recovery is higher than those for the analytical methods for corn and sorghum commodities discussed above.

This method is being recommended for an MTO. The copy of the method is "clean," i.e., there is no claim of confidentiality.

RESIDUE DATA

Storage Stability Data

Monsanto submitted storage stability data for alachlor DEA and HEEA metabolites on soybean grain stored for one year and storage stability data for acetochlor MEA metabolites on corn, soybean, and peanut forage stored for three years. No storage stability data for alachlor had been submitted previously. (S. Hummel, 5/12/86, Accession No. 260257, RCB No. 448). No significant degradation of residues was reported. However, additional information on the soybean grain analytical methods was needed and has not been submitted to date.

We reserved judgement on the storage stability data for alachlor residues on soybean grain until the analytical methods used are submitted and reviewed or identified and previously reviewed. If considered sufficient, these data will support only those residue data on oil crops for which the samples have been stored less than one year. Since corn grain samples from recently submitted residue field trials were stored for several years (S. Hummel, 3/17/86, Accession No. 260643, RCB No. 452), this storage stability study is not adequate. Thus, a storage stability study reflecting several years of storage of an oil crop are needed.

Translating from acetochlor MEA metabolite residue data, we concluded that residues of alachlor and its DEA metabolites are stable for up to three years in forage crops. We could make no such conclusion for HEEA metabolites of alachlor, because the hydroxylated metabolites of acetochlor were not determined.

To satisfy the storage stability data requirement, we concluded that the registrant must provide storage stability data for the DEA and HEEA metabolites of alachlor on soybean or corn grain stored for $\geq$ 2 years including data points at interim times. Storage stability data were also required for the DEA and HEEA metabolites of alachlor in animal tissues. Storage stability data for residues of the hydroxylated metabolites of alachlor or acetochlor in forage crops were required, as well. The registrant was reminded that the length and conditions of sample storage in the storage stability tests should reflect those in the residue field studies. (S. Hummel, 3/17/86, Accession No. 260643, RCB No. 452).

Storage stability data are typically reqquired on a minimum of three diverse crops. Here, we have required storage stability data on forage from a forage crop, and

on a legume, which will be translated to grain and oilseed crops.

CORN

Prior to 1985, alachlor residue data reflected analysis for DEA metabolites only. In 1985, Monsanto submitted MSL-3603, containing a limited amount of residue data for alachlor where both DEA and HEEA metabolites were measured in corn commodities (M. L. Loftus, 10/29/85, Accession No. 257271, RCB No. 1006, 1007). Monsanto subsequently reanalyzed corn grain samples from these trials using an analytical method with a lower limit of detection (2 ppb). These samples could have been stored 3-1/2 years (4-1/2 years for reanalyzed samples). As stated above, storage stability data for corn grain stored 3 to 5 years are not available. Adequate storage stability data are available only for DEA metabolites on corn forage and fodder.

We previously concluded that Monsanto had not satisfactorily addressed residue chemistry data requirements for corn requested via the Alachlor Registration Standard (M. L. Loftus, 5/13/86). Specifically, Residue data reflecting the maximum Section 3 use (1-2 early treatments at 2-8 lbs ai/A, N.T.E. 8 lbs ai/A/season) and 24(c) use (early treatment at lbs ai/A followed by a late postemergence layby treatment at 2-3 lbs ai/A N.T.E. 6.5 lbs ai/A/season) are needed. In fact, no data reflecting two sequential treatments at 4 lb ai/A have ever been submitted. Alternatively, the second treatment can be be removed from the labels. Residue data for fresh corn (including sweet corn K+CWHR) are also needed. In addition, conclusions 2, 3, and 6 in our memo of 3/17/86 (S. Hummel), and conclusions 1 and 2 of our memo of 10/29/85 are still outstanding. These conclusions are reproduced here:

Conclusion 2, S. Hummel, memo of 3/17/86

> The method included in this submission is considered suitable for the purposes of the Special Review to demonstrate that alachlor residues in corn grain are considerably lower than the established tolerances, but the method is not suitable for enforcement purposes. Thus, an MTO has not been requested. The deficiency in the Alachlor Registration Standard for analytical methodology for plant residues has not been satisfied. Monsanto should propose appropriate enforcement methodology.

Conclusion 3, S. Hummel, memo of 3/17/86

The dates of fortification, the length of sample storage, the conditions of sample storage, and storage stability data reflecting storage for 4-1/2 years from/for these analyses must be submitted. An expanded standard curve should be submitted, demonstrating linearity in the range of the analytical results.

Conclusion 6, S. Hummel memo of 3/17/86

The Registration Standard requirements for residue data on corn commodities remain outstanding.

Conclusion 1, M. Loftus memo of 10/29/85

The deficiency in the Alachlor Registration Standard for analytical methodology for plant residues has not been satisfied. A method tryout (MTO) for the method to determine metabolites containing the 2,6-DEA moiety has been completed and the results are currently being analyzed. An MTO will also be necessary for the method to determine metabolites containing the 2,6-HEEA moiety to satisfy the plant analytical methodology deficiency. Before we can begin an MTO for metabolites containing the HEEA moiety, a clean copy (i.e., without a trade secret stamp) of the method entitled "Analytical Residue Method for 2,6-HEEA Producing Alachlor Metabolites in Corn Forage, Stover, and Grain; Soybean Forage, Hay, Seed, Hulls, Meal and Crude Oil" contained in Monsanto Report MSL-4626 needs to be submitted. In addition, representative chromatograms of blanks fortified at the limit of detection should be submitted for all soybean and corn commodities, as well as representative chromatograms of treated samples, for both the DEA and HEEA methods. These chromatograms are needed not only for an MTO to be carried out, but also to validate the methodologies for the purposes of dietary exposure estimation. While the methodologies may not be adequate for enforcement purposes, they may be adequate for purposes of dietary exposure analysis provided that deficiencies relating to the submission of the aforementioned chromatograms are resolved.

Conclusion 2, M. Loftus memo of 10/29/85

The deficiency in the Registration Standard for residue studies for corn and soybean commodities is not satisfied. The registrant indicates that additional residue studies for corn and soybean products will be submitted. At that time, RCB will determine if this

deficiency has been satisfied. We also note that in order to properly evaluate residue data, chromatograms requested in Conclusion 1 are necessary, as well as a storage stability study and information on the amount of time that samples were stored.

This submission included additional data on corn grain, fodder, forage, and sweet corn (kernels plus cobs with husks removed). However, none of the data submitted reflect the maximum Section 3 use or the maximum 24(c) use. Therefore, this data gap remains outstanding. The additional data included in this submission are discussed below.

The deficiencies regarding the analytical method and its suitability for enforcement purposes are discussed above in the Analytical Methodology section (Conclusion 2, S. Hummel memo of 3/17/86; part of Conclusion 1, M. Loftus memo of 10/29/85).

The deficiencies regarding validation of residue data were not addressed, and therefore remain outstanding (Conclusion 3, S. Hummel memo of 3/17/86; part of Conclusion 1, M. Loftus memo of 10/29/85).

Other conclusions (Conclusion 6, S. Hummel memo of 3/17/86; and Conclusion 2, M. Loftus memo of 10/29/85) will be reevaluated in this review.

Previous residue data

Previously submitted data (MSL-3603, Accession No. 257271, RCB No. 1006, 1007, M. Loftus, 10/29/85), where both DEA and HEEA metabolites of alachlor were determined, reflect preemergent application in four locations (CA, IL, NE, KY) (One forage sample was from ONT instead of NE.). The reanalyzed grain samples (MSL-4534, Accession NO. 260643, RCB No. 452, S. Hummel, 3/17/86), were from fields treated with Lasso EC, since Lasso Microtech is not registered for use on corn. The data from these studies are tabulated below in Table 1. The samples in these studies were collected between September and October, 1980. The original report (MSL-3603) was dated June, 1984. Thus, these samples may have been stored for 3-1/2 years. The report on the reanalysis of these samples was dated Oct., 1985. Thus, the samples may have been stored for 4-1/2 years or more.

TABLE 1

MAXIMUM RESIDUES IN CORN RAC°s

Crop	lb ai/A	PHI, days	ppm DEA	ppm HEEA	Total
LASSO EC					
grain	4	103-152	0.014*	0.005	0.016
	8	103-152	0.004	0.010	0.014
forage	4	55-63	0.07	§0.05	§0.12
	8	55-63	0.41	0.24	0.63
stover	4	103-152	0.06	§0.05	§0.11
	8	103-152	0.33	0.27	0.60
LASSO MICROTECH (not registered for use on corn)					
grain	4	103-152	§0.03	§0.05	§0.08
	8	103-152	§0.03	§0.05	§0.08
forage	4	55-63	0.05	§0.05	§0.10
	8	55-63	0.25	0.15	0.40
stover	4	103-152	0.12	0.15	0.25
	8	103-152	0.27	0.32	0.59

* Monsanto rejects this value as an outlier. The next highest residue is 3 ppb DEA + 5 ppb HEEA = 8 ppb total

Additional residue data were included in this submission. Lasso EC and Lasso Microtech were applied preemergent in 12 locations in NE, CA, ID, IN, IA, NY, SC, TN, MN, and MI. Corn forage and fodder samples were taken from all of these locations. Grain samples were obtained from 9 locations in NE, CA, IA, NY, SC, TN, and MI. Corn on the cob samples were taken from two locations in IN and MN. The geographic representation of these data is inadequate. Additional grain samples are needed from IL/IN. Additional corn on the cob (K+CWHR) samples are needed from FL, NY, OH/PA, and OR/WA/ID. To maintain registration of sequential treatments and late post emergence layby treatments, data on corn grain, forage and fodder are needed from IL/IN/IA, MN/WI, NE, and OH/MI; and corn on the cob (K+CWHR) data are needed from FL, NY, OH/PA, and OR/WA/ID.

Monsanto claims that the limit of quantitation (LOQ) for the analytical method is 0.010 ppm. However, no chromatograms of samples fortified at the LOQ are submitted. From the data submitted, it appears that the limit of quantitation may be lower than 0.010 ppm. Additionally, Monsanto has used methodology with a lower LOQ in the past. (Previous samples were analysed by a method with an LOQ of 2 ppb (0.002 ppm). Methodology with an LOQ of 0.10 ppm would be adequate for enforcement purposes. However, to determine the % DEA in the total residue, and to determine concentration/reduction factors from the processing studies, it is helpful to have methodology with a lower LOQ. On the raw data sheets, residues are reported to four decimal places. In Table 2, we have tabulated maximum residues found, using three decimal places for corn grain and corn on the cob (K+CWHR). Control samples had apparent residues of up to 0.006 ppm alachlor equivalents. Some of the highest residues were found on field corn samples with the shortest PHI (Reevesville, SC, PHI 138 days for corn grain and fodder. DEA metabolites averaged 63% of total residues in corn forage, 55% in corn fodder, and 29% in corn grain.

TABLE 2

MAXIMUM RESIDUES IN CORN RAC°s

Crop	lb ai/A	PHI, days	ppm DEA	ppm HEEA	Total
LASSO EC					
grain	4	138-180	0.002	0.005	0.006
	8	138-180	0.002	0.018	§0.019
K+CWHR	4	84-86	0.002	0.003	0.005
	8	84-86	0.002	0.002	0.004
forage	4	49-64	0.14	0.11	0.21
	8	49-64	0.36	0.24	0.60
fodder	4	85-180	0.10	0.06	0.16
	8	85-180	0.14	0.13	0.20

TABLE 2, continued

Crop	lb ai/A	PHI, days	ppm DEA	ppm HEEA	Total
LASSO MICROTECH (not registered for use on corn)					
grain	4	138-180	0.002	0.012	0.014
	8	138-180	0.008	0.016	0.024
K+CWHR	4	84-86	0.002	0.002	0.004
	8	84-86	0.004	<0.001	<0.005
forage	4	49-64	0.45	0.38	0.83
	8	49-64	0.78	0.46	1.2
fodder	4	85-180	0.09	0.10	0.18
	8	85-180	0.22	0.19	0.37

The dates of fortification, the length of sample storage, and the conditions of sample storage were not submitted and are needed. Chromatograms were not submitted with the raw data and are needed. A limited number of chromatograms were submitted with the analytical method. However, no chromatograms were for samples fortified at the LOQ. Chromatograms of samples fortified at the LOQ are needed. Based on the dates of sampling, and the date of the report, it appears that the samples were stored up to four months. Adequate storage stability data for corn grain (translated from soybeans) may be available. Additional information on the analytical methods used for the storage stability data is still needed. Adequate storage stability data for DEA metabolites on forage and fodder are available (translated from MEA metabolites of acetochlor). No storage stability data are available for HEEA metabolites in corn forage and fodder.

For the purposes of the Special Review, we previously concluded tentatively, that residues of alachlor and its metabolites in corn grain would not exceed 0.016 ppm. Residues in corn forage and fodder would not be expected to exceed 0.2 ppm. Data from one treatment at 4 lb ai/A was used, since <1% of corn receive >4 lb ai/A. We now tentatively conclude that residues of alachlor and its metabolites will not be expected to exceed 0.016 ppm in corn grain, 0.21 ppm in corn forage, 0.20 ppm in corn fodder, and 0.005 ppm in sweet corn (kernels plus cobs with husks removed) from one early treatment at $\leq$ 4 lb ai/A. These conclusions are

tentative due to the inadequately validated data and the lack of valid storage stability data. Note that we have not used data from Lasso Microtech, since Lasso Microtech is not registered for use on corn. We do, however, note that residues of alachlor DEA and HEEA metabolites are significantly higher when the microencapsulated formulation is used.

For the purposes of the Registration Standard, we could tentatively conclude that alachlor metabolite residues are not expected to exceed 0.019 ppm in corn grain, 0.60 ppm in corn forage, 0.20 ppm in corn fodder, and 0.005 ppm in sweet corn (kernels plus cobs with husks removed) resulting from a single treatment at 8 lb ai/A, if all sequential treatments and the 24(c)'s for late postemergence layby application are removed from the labels. In this case, current tolerances for fresh corn (including sweet corn K+CWHR) and corn grain would be adequate and the corn grain tolerance could possibly be lowered to 0.05 ppm. The tolerance for corn forage is inadequate and must be raised. A tolerance of 1 ppm would be appropriate, provided that sequential treatments and the 24(c)'s for late postemergence layby application are removed from the labels.

If sequential treatments and late postemergence treatments are <u>not</u> removed from the labels, we cannot make any conclusions about the level residues of alachlor and its metabolites, because no data are available for these uses where both DEA and HEEA metabolites are measured.

These conclusions are tentative because the residue data submitted are inadequately validated. The dates of fortification, the length of sample storage, the conditions of sample storage, and storage stability data reflecting storage for at least as long as the samples were stored (4-1/2 years for the analyses in MSL-4534) must be submitted for each of the corn studies. Note that we will accept storage stability data on soybean grain in lieu of data on corn grain.

For the reanalysis of corn grain (MSL-4534, Accession No. 260643, RCB No. 452, S. Hummel, 3/17/86), an expanded standard curve is still needed, to demonstrate linearity in the range of the analytical results.

<u>Corn Processing Study</u>

Monsanto Company has submitted a corn processing study (MSL-5943, Accession No. 264946). Corn grain was processed by dry milling into meal, soapstock, crude, and refined oils. Products of the wet milling process (starch, crude,

and refined oil) were not included. Data from the wet milling process are also needed. Both wet milling and dry milling processes are described by R. A. Anderson and S. A. Watson, "The Corn Milling Industry," in CRC Handbook of Processing and Utilization in Agriculture, I. A. Wolff, Ed., Volume II, Part 1, CRC Press, Boca Raton, FL, 1982, p31.

In the dry milling process, corn may be ground into meal after degerming or without degerming. Non-degermed corn meal has a high fat content, a short shelf life, and is typically used locally to the mill. To obtain a product with a longer shelf life, the hull and germ of the corn grain are removed, leaving the endosperm (which contains starch and gluten). The endosperm is ground to produce corn grits, meal, and flour, which differ only in particle size. The germ, containing 45-55% oil can be extracted by screwpress or solvent extraction to produce crude corn oil and corn germ meal. The corn germ meal is used in animal feed. Crude corn oil is refined in three steps to produce food grade corn oil: (1) alkali refining with concentrated sodium hydroxide to remove free fatty acids and phospholipids (soapstock is byproduct); (2) bleaching with activated clay; and (3) deodorizing by steam distillation under high vacuum at high temperature (230-260C).

Monsanto did not have degerming equipment, consequently, non-degermed meal was produced. Corn grain was ground and fractionated by Soxhlet extraction using hexane as a solvent. The defatted corn meal was air dryed. Crude oil was produced by evaporation of the hexane. The crude oil was alkali refined by adding 10% NaOH. The mixture was shaken, heated at 60-70C for 30 minutes and shaken for another 10 minutes. After phase separation, the lower aqueous layer was discarded. The soapstock/oil emulsion was centrifuged at 11,000 rpm for 20 minutes. The alkali refined oil and the soapstock were analyzed. The alkali refined oil was then bleached by adding 1% Fullers earth and heating under vacuum using a rotary evaporator with boiling water. The oil was centrifuged and decanted. Bleached oil was deodorized by steam distillation at 250C and 5-10 mm Hg. This processing procedure is similar to the processing procedure Monsanto used for soybean samples, and similar to commercial practice.

Corn grain samples from the corn residue field trials discussed above were processed. As discussed above, the claimed limit of quantitation (LOQ) was 0.010 ppm in each commodity. However, no chromatograms were submitted for samples fortified at the claimed LOQ. Residues reported in the raw data sheets were used in the calculation of Concentration/Reduction factors. A concentration/ reduction factor is a number which may be multiplied by the residue

in corn grain to obtain the residue in the processed fraction. A factor greater than one (1) indicates concentration; and a factor less than one (1) indicates reduction in residue. The concentration/reduction factors determined for corn grain processed fractions are presented in Table 3. Alachlor residues can concentrate slightly in corn meal. Residues concentrate in soapstock and crude oil, but are reduced to less than the residue in the grain when the oil is refined for human consumption (alkali refined, bleached, and deodorized). No food or feed additive tolerances will be needed, since refined rather than crude oil is regulated, corn soapstock is not regulated at this time, and the slight concentration in corn meal will be covered by the tolerance on the rac. Revised estimates of residues in corn processed products are presented in Table 4. Special Review estimates are obtained by multiplying the maximum residue found on the rac when treated at 4 lb ai/A by the average concentration/reduction factor. Residue estimates for the purpose of tolerance setting are obtained by multiplying the maximum residue found on the rac when treated at 8 lb ai/A by the maximum concentration/reduction factor. These estimates are tentative, due to the lack of validation data as discussed above.

TABLE 3

CONCENTRATION/REDUCTION FACTORS FOR CORN PROCESSED FRACTIONS

Fraction	Range	Average	Average %DEA
Meal	0.76-1.1	0.91	12
Soapstock	1.0 -2.5	1.8	23
Crude Oil	0.86-4.0	2.6	15
Alkali Refined Oil	0.85-3.9	2.3	8
Bleached Oil[1/]	<0.31-1.8	<1.0	6
Deodorized Oil[2/]	<0.05-0.17	<0.12	-[3/]

1/ Alkali Refined and Bleached Oil
2/ Alkali Refined, Bleached, and Deodorized Oil
3/ Cannot determine due to low residues

TABLE 4

RESIDUE ESTIMATES IN CORN RACS AND PROCESSED PRODUCTS

Product	Special Review Estimate (ppm)[1/]	Maximum Residue (ppm)[2/]
grain	0.016	0.019
meal	0.015	0.021
(soapstock)	0.029	0.048
crude oil	0.042	0.076
refined oil	0.0019	0.003
forage	0.21	0.63
fodder & stover	0.16	0.60

[1/] Assumes single treatment at 4 lb ai/A
[2/] Assumes single treatment at 8 lb ai/A

SORGHUM (milo)

Lasso EC is registered for preplant incorporated and preemergent application at rates up to 4 lb ai/A. The label does not prohibit the use of both preplant incorporated and preemergent application.

Residue data included in this submission (MSL-5534, Accession No. 263002) reflect preemergent application of Lasso EC and Lasso Microtech at 3 and 6 lb ai/A in six locations in KS, NE, OK, CA, TX, and IL, comprising 28, 10, 4, 0.5, 32, and 1% of the sorghum acreage annually (See Agricultural Statistics). The geographical representation of these data is adequate. We note that no forage samples were analyzed from TX and no grain samples were analyzed from CA.

Samples from these field trials were harvested in 1980. The length and conditions of storage prior to analysis were not submitted. The dates of analysis were not submitted. Storage stability data translated from acetochlor would indicate that DEA metabolite residues would be stable up to three (3) years. No storage stability data are available for HEEA metabolite residues.

The results of these field trials are presented in Table 5. No chromatograms were submitted with these analyses. Chromatograms were included with the analytical method; however, no chromatograms from samples fortified at the limit of quantitation were included. These chromatograms are needed.

TABLE 5

MAXIMUM RESIDUES IN SORGHUM RAC's

Crop	lb ai/A	PHI, days	ppm DEA	ppm HEEA	Total
LASSO EC					
grain	3	96-143	0.007	0.014	0.021
	6	96-143	0.022	0.035	0.057
forage	3	57-70	0.70	0.39	1.1
	6	57-70	1.2	0.74	1.9
stover	3	96-143	0.27	0.20	0.47
	6	96-143	0.52	0.65	1.0
LASSO MICROTECH	(not registered for use on sorghum)				
grain	3	96-143	0.013	0.015	0.026
	6	96-143	0.028	0.027	0.042
forage	3	57-70	0.52	0.38	0.90
	6	57-70	0.70	0.65	1.4
stover	3	96-143	0.13	0.083	0.21
	6	96-143	0.35	0.26	0.61

No residue data were submitted for the maximum rate, 4 lb ai/A. We can estimate residues for the 4 lb ai/A rate by interpolation from residues at 3 and 6 lb ai/A. We tentatively conclude that residues of alachlor and its metabolites in sorghum (milo) will not exceed 0.035 ppm in sorghum grain, 1.4 ppm in sorghum forage, and 0.65 ppm in sorghum fodder and stover, when alachlor is applied preemergently at 4 lb ai/A, and provided the label is amended to prohibit sequential applications. DEA metabolites averaged 62% of residues in sorghum forage, 62% in sorghum stover, and 42% in sorghum grain. The established tolerances of 0.1 ppm in sorghum grain (milo) and 1 ppm in sorghum fodder appear to be adequate. The 1 ppm tolerance in/on sorghum forage needs to be raised. A tolerance of 2 ppm may be appropriate,if the label is amended to prohibit sequential treatments. Our conclusions are tentative due to lack of valid storage stability data, chromatograms, and complete history of sample handling, including dates of analysis.

The highest residues were generally found in Learned, KS or Martel, NE. These locations had the longest PHI's, 143 and 138 days, respectively. Controls were less than or close to the limit of quantitation for sorghum forage samples, up to 0.12 ppm for sorghum stover samples, and up to 0.006 ppm for sorghum grain.

Previously submitted data for residues on sorghum commodities reflected analysis for DEA metabolites of alachlor only. Previous analyses of these samples (DEA only) were not submitted. DEA metabolite residues reported in previous studies were lower than those reported here.

PEANUTS

Previous Residue Data and Conclusions

Previously submitted residue data for alachlor on peanuts were discussed in our memos of 5/13/86 (M. L. Loftus) and 10/31/85 (S. V. Hummel, Accession No. 257274, RCB Nos. 1000, 1001, MSL-4625, MSL-3980).

Residue data previously submitted reflect one preemergent treatment at 4 and 8 lbs ai/A (1x and 2x). No data have been submitted reflecting the maximum allowed use of two sequential treatments, each at $\leq$4 lbs ai/A, one pre-plant or preemergence and one at cracking. Following one preemergent treatment, total residues (DEA + HEEA) in the nuts were <0.1 ppm at 4 lbs ai/A and $\leq$ 0.5 ppm at 8 lbs ai/A. At 4 lbs ai/A, total residues ranged up to 3.3 ppm in the forage, 1.6 ppm in the vines, and 0.3 ppm in the hulls. At 8 lbs ai/A, total residues ranged up to 4 ppm in the forage, 1.9 ppm in the vines, and 2.8 ppm in the hulls (Monsanto Report MSL-4625, MSL-3980, Accession No. 257274, RCB Nos. 1000, 1001, October 31, 1985 review of S. Hummel). These data are presented in Table 6, including data from the use of Lasso Microtech, which is not registered for use on peanuts.

Available residue data to evaluate the 24(c) use of one application of 4 lb ai/A preplant, preemergence, or at cracking, followed by one late postemergence layby application at 4 lb ai/A are inadequate. Few sites were studied and only parent and DEA metabolites were measured. Available field residue trials are for an at cracking treatment at 8 lbs ai/A, an at cracking treatment at 4 lbs ai/A followed by a late postemergence layby treatment at 2 lb ai/A; and a 4 lbs ai/A at cracking treatment followed by a late post-emergence layby treatment at 4 lb ai/A. DEA residues were up to 0.08 ppm in the nuts, 14 ppm in the hay, and 25 ppm in the forage. (PP# 7G2002. No Accession Number).

TABLE 6

MAXIMUM RESIDUES IN PEANUT COMMODITIES

FROM PREEMERGENT TREATMENT

RAC	RATE (lb ai/A)	PHI (days)	RESIDUE (PPM ALACHLOR) from 2,6-DEA	from 2,6-HEAA	total
LASSO EC					
peanut forage	4	55-104	0.94	2.38	3.32
	8	55-104	1.51	2.49	3.96
peanut vines	4	139-155	0.40	1.17	1.57
	8	139-155	3.68	15.8	19.47
peanut hulls	4	147-155	0.12	0.14	0.26
	8	147-155	1.08	1.72	2.80
peanut nuts	4	147-155	§0.05	0.05	§0.10
	8	147-155	0.05	0.46	0.51
LASSO MICROTECH (not registered for use on peanuts)					
peanut forage	4	55-104	0.40	0.87	1.27
	8	55-104	1.08	3.07	3.93
peanut vines	4	139-155	0.45	2.29	2.73
	8	139-155	0.43	1.73	2.16
peanut hulls	4	147-155	0.28	0.28	0.54
	8	147-155	0.36	0.38	0.74
peanut nuts	4	147-155	§0.05	0.09	§0.14
	8	147-155	§0.05	0.09	§0.14

In our memo of 5/13/86, we concluded that Monsanto had not satisfactorily addressed residue chemistry data requirements for peanuts requested via the Alachlor Registration Standard. Peanut field studies reflecting the maximum use on the Section 3 labels (two sequential treatments, a pre-plant or pre-emergence followed by an at cracking treatment, each at 4 lbs ai/A) must be submitted. Studies must also be submitted reflecting the maximum 24(c) use in NC (a preplant, preemergent, or at cracking treatment followed by a late postemergence layby treatment, each at 4 lbs ai/A). Alternatively, the second treatment on peanuts

and the late postemergence layby treatment may be removed from the labels. In addition, there are deficiencies in peanut residue data already submitted in response to the Standard. These deficiencies are listed in conclusions 3, 5, and 6 in our memo of 10/31/85 (S. Hummel, Accession No. 257274, RCB Nos. 1000, 1001), and are reiterated below.

Conclusion 3, Memo of 10/31/85

The dates of fortification and analysis, the length of sample storage, the conditions of sample storage, storage stability data, and representative chromatograms from these analyses must be submitted.

Conclusion 5, Memo of 10/31/85

Based on the limited amount of residue data available, we tentatively conclude that residues of alachlor and metabolites should be based on the maximum observed residues of 3.3, 1.6, 0.26, and 0.10 ppm in peanut forage, vines, hulls, and nut meats, respectively, pending submission of additional residue data. We recommend that Monsanto be advised that additional data are required from NC/VA and TX. We await the submission of the additional residue data.

Conclusion 6, Memo of 10/31/85

Processing data on peanuts, reflecting analysis of alachlor and its DEA and HEEA metabolites, are needed to determine if residues concentrate in the processed fractions. No conclusions can be made at this time regarding residues in peanut processing fractions.

Current Submission

None of our previous conclusions were specifically addressed. However, some of the additional residue data submitted reflect a single application of alachlor at cracking. Samples are analyzed for both DEA and HEEA metabolites. Residue data still have not been provided for the maximum use on Section 3 labels or on 24(c) labels. Conclusion 3, regarding validation of data has not been addressed. Conclusion 5 has been partially addressed in this submission with data from TX and OK. However, no data have yet been submitted from NC/VA. These data are needed. Conclusion 6 was not addressed in this submission. However, we note that data on peanut processed fractions were recently submitted, but have not been reviewed.

Residue data included in this submission reflect preemergent or at cracking applications of Lasso EC and Lasso Microtech in nine locations in six states: AL, GA, MN, NC, OK, and TX, comprising 13%, 41%, <1%, 11%, 7%, and 16% of the US peanut acreage, respectively. VA grows 7% of the US acreage for peanuts. Locations in TX, AL, and NC received one preemergent application. Locations in AL, OK, GA, and NM received one treatment at cracking. Samples were analyzed from only 7 locations in 5 states. Samples from NC were not analyzed because the samples could not be positively identified. Without the samples from NC, the peanut data are not geographically representative. Data from NC/VA are required, reflecting the maximum registered use.

Maximum residues found in peanut racs are presented below in Table 7.

TABLE 7

MAXIMUM RESIDUES IN PEANUT RAC's

Crop	lb ai/A	PHI, days	ppm DEA	ppm HEEA	Total
LASSO EC					
peanuts	4	119-173	<0.010	0.26	<0.27
	8	119-173	0.035	0.83	0.87
hulls	4	119-173	0.19	0.69	0.88
	8	119-173	0.18	2.6	2.7
hay	4	57-77	0.52	2.8	3.3
	8	57-77	1.1	4.3	4.8
vines	4	119-173	0.70	3.3	3.4
	8	119-173	1.5	11	12
LASSO MICROTECH (not registered for use on corn)					
peanuts	4	119-173	0.018	0.48	0.50
	8	119-173	0.064	0.80	0.83
hulls	4	119-173	0.19	0.76	0.90
	8	119-173	1.1	2.2	3.3
hay	4	57-77	0.59	2.2	2.5
	8	57-77	0.98	3.2	3.5
vines	4	119-173	0.58	6.5	7.1
	8	119-173	1.5	13	14

Residues of alachlor metabolites in peanuts reported here are considerably higher than residues previously reported (from the preemergent application). Residues from the use of Lasso Microtech were generally, but not always, higher than residues from the use of Lasso EC. Some of the lowest residues and some of the highest residues were from samples which had received preemergent application. The highest residues were from samples grown in TX, OK, and NM (all of the southwest peanut growing locations). The data included n this submission showed a significantly smaller percentage of DEA metabolites in the total residue than previous samples. The average percentage of DEA metabolites in the total residue from field trials in the current submission was 20% in peanut hay, 11% in peanut vines, 20% in peanut hulls,
and 7% in peanuts. The difference may be due to the at cracking treatment. (Previous data were from preemergent application.)

No data were submitted for sequential treatments: preplant incorporated or preemergent treatment followed by at cracking treatment, each at 4 lb ai/A; or preplant incorporated, preemergent, or at cracking treatment, followed by late post emergence layby application, each at 4 lb ai/A. These data are required. Alternatively, this 24(c) use could be cancelled and the sequential treatment removed from registered Section 3 labels.

As in previous submissions, these data are lacking complete sample history (length and conditions of storage, dates of analysis) and representative chromatograms run at the same time as the samples. This information is needed to validate the residue data.

Monsanto had previously indicated that they planned to restrict feeding of peanut forage and hay. Consequently, peanut forage and hay were not considered as part of the livestock diets for the purposes of the Special Review. Monsanto now indicates that they plan to propose higher tolerances for peanut forage and hay. This may have a significant effect on estimated residues in meat and poultry products.

Our previous tentative estimates of alachlor residues were <0.10 ppm in peanuts, 0.3 ppm in peanut hulls, 1.6 ppm in peanut vines, and 3.3 ppm in peanut forage. We now revise those tentative estimates as follows: 0.27 ppm in peanuts, 0.9 ppm in peanut hulls, 3.4 ppm in peanut vines, and 3.4 ppm in peanut forage. These estimates assume a single treatment of $\leq$ 4 lb ai/A at or before cracking.

Higher tolerances on peanut commodities are needed. If the 8 lb ai/A at cracking treatment is to remain registered under Section 24(c), we tentatively estimate that residues will not exceed 0.87 ppm in peanuts, 2.7 ppm in peanut hulls, 4.8 ppm in peanut hay, and 12 ppm in peanut vines. These estimates are tentative due to lack of validation data, as discussed above.

SOYBEANS

On Section 3 labels, the maximum registered rate for alachlor on soybeans is 4 lb ai/A. For hard to control weeds, a second treatment is allowed; the maximum yearly dose not to exceed 8 lb ai/A. Applications must be made before the soybeans exceed the unifoliate stage (first two true leaves).

Residue data reflecting two sequential treatments on soybeans each at 4 lbs ai/A have not been submitted. Residue data are available reflecting one treatment at 4 lb ai/A. The maximum residue (DEA + HEEA) found in/on soybeans following one treatment at 4 lb ai/A was 0.21 ppm (Monsanto Report MSL-4626, 3603, Accession No. 257271, RCB Nos. 1012, 1013, October 29, 1985 review of M. Loftus).

We previously concluded that Monsanto had not satisfied the Registration Standard data requirements for soybeans (M. Loftus, 5/13/86). Specifically, soybean field studies reflecting two sequential treatments must be submitted. Alternatively, the second treatment on soybeans may be removed from the label. In addition, there are deficiencies in soybean residue data previously submitted in response to the Standard. These deficiencies are listed in Conclusions 2, 4, and 5 in our memo of 2/14/86 (S. Hummel, Accession No. 260259, 260260, RCB No. 284, MSL-5158, MSL-4942, MSL-5123); Conclusions 2 and 3 in our memo of 10/31/85 (S. Hummel, Accession No. 258142, RCB Nos. 1302, 1303, MSL-4774, MSL-4535); and conclusions 1 and 2 in our memo of 10/29/85 (M. Loftus, Accession No. 257271, RCB Nos. 1006, 1007, MSL-4636, MSL-3603). These conclusions are reiterated below.

Conclusion 2, S. Hummel memo of 2/14/86

The dates of fortification and analysis, the length of sample storage, the conditions of sample storage, storage stability data, and representative chromatograms from these analyses must be submitted. We question whether the limit of detection is actually 0.02 ppm.

Conclusion 4, S. Hummel memo of 2/14/86

Since soybean soapstock is a byproduct of the alkali refining process and 50% of the residue is no longer in the oil, we would expect higher residues in the soapstock. No data were submitted on soapstock. These crude oil samples should be reprocessed (alkali refined) and the alachlor residues in the alkali refined oil and the soapstock should be determined.

Conclusion 5, S. Hummel memo of 2/14/86

Data submitted earlier on soybean forage and hay showed residues of 2.6 ppm and 2.0 pm DEA + HEEA metabolites in soybean forage and hay, respectively. These residues exceed the currently established tolerances of 0.75 and 0.2 ppm for alachlor metabolite residues in soybean forage and hay, respectively. Depending on the outcome of the Special Review, tolerances of 3.0 ppm and 2.0 ppm may be required for alachlor residues in soybean forage and hay, respectively. Additionally, residue data are needed on ensiled soybeans, another animal feed item. Alternatively, a feeding restriction may be proposed.

Conclusion 2, S. Hummel memo of 10/31/85

The deficiency in the Alachlor Registration Standard for analytical methodology for plant residues has not been satisfied. A method tryout (MTO) for a method to determine metabolites containing the 2,6-DEA moiety has been completed and the results are currently being analyzed. An MTO will also be necessary for the method to determine metabolites containing the 2,6-HEEA moiety to satisfy the plant analytical methodology deficiency. We suggest that the method, "Analytical Residue Method for the Determination of 2,6- Diethyl-aniline (DEA) and 2-1-Hydroxyethyl)-6-Ethylaniline (HEEA) Yielding Alachlor Metabolites in Whole Soybean Grain, Soybean Hulls, Crude Soybean Oil, and Defatted Soybean Meal," contained in Appendix D of MSL-4774 and MSL-4535 (Accession No. 258142), be subjected to an MTO. The copy of this method, included in this submission is "clean", i.e., there is no claim of confidentiality, so no additional copy of the method is needed to initiate an MTO.

Conclusion 3, S. Hummel memo of 10/31/85

The dates of fortification and analysis, the length of sample storage, the conditions of sample storage, storage stability data, and representative chromatograms from these analyses must be submitted.

Conclusion 1, M. Loftus memo of 10/29/85

The deficiency in the Alachlor Registration Standard for analytical methodology for plant residues has not been satisfied. A method tryout (MTO) for the method to determine metabolites containing the 2,6-DEA moiety has been completed and the results are currently being analyzed. An MTO will also be necessary for the method to determine metabolites containing the 2,6-HEEA moiety to satisfy the plant analytical methodology deficiency. Before we can begin an MTO for metabolites containing the HEEA moiety, a clean copy (i.e., without a trade secret stamp) of the method entitled "Analytical Residue Method for 2,6-HEEA Producing Alachlor Metabolites in Corn Forage, Stover, and Grain; Soybean Forage, Hay, Seed, Hulls, Meal and Crude Oil" contained in Monsanto Report MSL-4626 needs to be submitted. In addition, representative chromatograms of blanks fortified at the limit of detection should be submitted for all soybean and corn commodities, as well as representative chromatograms of treated samples, for both the DEA and HEEA methods. These chromatograms are needed not only for an MTO to be carried out, but also to validate the methodologies for the purposes of dietary exposure estimation. While the methodologies may not be adequate for enforcement purposes, they may be adequate for purposes of dietary exposure analysis provided that deficiencies relating to the submission of the aforementioned chromatograms are resolved.

Conclusion 2, M. Loftus memo of 10/29/85

The deficiency in the Registration Standard for residue studies for corn and soybean commodities is not satisfied. The registrant indicates that additional residue studies for corn and soybean products will be submitted. At that time, RCB will determine if this deficiency has been satisfied. We also note that in order to properly evaluate residue data, chromatograms requested in Conclusion 1 are necessary, as well as a storage stability study and information on the amount of time that samples were stored.

Conclusion 2, 10/31/85 and part of Conclusion 1, 10/29/85, are discussed above in the section on Analytical Methodology. We have determined that the soybean analytical method, previously considered for an MTO would not be suitable for enforcement.

Conclusion 2, 2/14/86; Conclusion 3, 10/31/85; and part of Conclusion 1, 10/29/85; relate to validation of the residue data. Since no additional information has been

submitted, these deficiencies are still outstanding. We require the dates of fortification and analysis, the length of sample storage, the conditions of sample storage, storage stability data, and representative chromatograms from these analyses to be submitted. For the data in Accession No. 260259 and 260260 (RCB No. 284, MSL-5158, MSL-4952, MSL-5123, S. Hummel, 2/14/86), we question whether the limit of detection of the analytical method is actually 0.02 ppm. Additionally, chromatograms of samples fortified at the limit of detection are required.

Conclusion 4, 2/14/86, regarding soybean soapstock has not been addressed. However, data on corn soapstock have been received and can be translated. We tentatively estimate that residues will not exceed 0.38 ppm in soybean soapstock for the purposes of the Special Review. For the purposes of the Registration Standard, we estimate that residues in soybean soapstock will not exceed 0.52 ppm. A feed additive tolerance will be needed. At this time, it appears that a tolerance of 0.6 ppm would be appropriate.

Conclusion 5, 2/14/86, regarding soybean forage and hay residues exceeding established tolerances, has not been addressed and is still outstanding. Higher tolerances are needed for soybean forage and hay. Tolerances of 3 ppm in forage and 2 ppm in hay would be appropriate, provided that sequential treatments are removed from the label. If sequential treatments are not removed from the label, then additional data and probably higher tolerances will be needed. Additionally, residue data are needed on enxiled soybeans, another animal feed item. Alternatively, the registrant could propose feeding restrictions.

Our tentative conclusion for the purposes of re-evaluating tolerances has not changed. We tentatively conclude that residues of alachlor and its metabolites will not exceed 0.21, 0.32, 0.36, and 0.19 ppm in soybean grain, hulls, meal, and oil, respectively, provided that the residue data are validated and that sequential treatments are removed from the label. If these are done, a tolerance for residues of alachlor and its metabolites in soybean grain at 0.25 ppm would be appropriate. A Feed Additive tolerance should be proposed for residues of alachlor and its metabolites in soybean hulls and soybean meal at 0.4 ppm. A food additive tolerance should be proposed for residues of alachlor and its metabolites in soybean meal (and soybean soapstock, as discussed above). These conclusions are tentative due to the lack of validation data, and pending a label amendment removing sequential treatments from the label.

SUNFLOWER SEEDS, COTTONSEED, LEGUMES

Residue data for these commodities are needed, where both DEA and HEEA metabolites are analyzed. We note that residue data on these commodities, and processing data, have been received by the Agency, but not reviewed. The registrant should be reminded that complete sample history and sample chromatograms are required to validate all residue data.

MEAT, MILK, POULTRY, AND EGGS

Substantially higher residues have been reported on a number of commodities which are feed items. Additional data have been received on additional feed items, but not reviewed. Residue data are unavailable for maximum registered uses of corn, soybeans, and peanuts. We note that Monsanto plans to request increased tolerances for peanut forage and hay. These were not considered as feed items for the purposes of the Special Review and are likely to have a substantial effect on the residue estimates in meat and poultry products. Consequently, at this time, we are unable to make conclusions on residues in meat, milk, poultry, and eggs.

CONCLUSIONS

1. The nature of the residue in plants is adequately understood. The residue of concern is alachlor and its metabolites containing the DEA and HEEA moieties. The nature of the residue in ruminants and poultry is not adequately understood. Deficiencies are discussed in our memo of 11/1/85 (M. Loftus, Accession No. 257285, RCB No. 1009). These deficiencies need to be resolved.

2. Analytical methods submitted by Monsanto which require the use of custom made glassware which is not commercially available are not suitable for enforcement purposes. These methods also have a large range of recoveries and a low average recovery. The Monsanto method for peanut commodities, "Analytical Method for the Determination of 2,6-Diethylaniline (DEA) and 2-(1-Methoxyethyl)-6-Ethylaniline (MEEA) Yielding Alachlor Metabolites in Peanut Hay, Vines, Hulls, and Nutmeats," Appendix D of MSL-5718 and MSL-4636 (Accession No. 263022), may be suitable for enforcement purposes and is being recommended for an MTO. The copy of the method included in the submission is "clean," i.e., there is no claim of confidentiality.

2a. To date, Monsanto has not submitted data on the applicability of the PAM Multiresidue Methodology to detect alachlor and its metabolites. This requirement was published in the Federal Register on September, 26, 1986 (51 FR 34249), and appears in 40 CFR 158.125. Copies of the Federal Register Notice and the 4 Multiresidue protocols are attached to this review. These data are required.

3. Additional information is needed on the analytical methods used for the storage stability data on soybean grain. If this information were provided, we could conclude that residues of alachlor DEA and HEEA metabolites are stable in oil crops stored up to one year. We note, however, that many studies had oil crop samples stored several years. Adequate storage stability data are available for alachlor DEA metabolites in forage crops stored up to 3 years (translated from acetochlor MEA metabolites). Storage stability data are still needed for HEEA metabolites of alachlor. Storage stability data are also needed for DEA and HEEA metabolites of alachlor in animal tissues.

4. Monsanto submissions of residue data for alachlor are consistently lacking complete sample history (dates of fortification and analysis, length and conditions of sample storage) and sample chromatograms obtained when the samples were analyzed (not when the analytical method was validated). Often, no chromatograms of samples fortified at the limit of detection have been submitted.

5. Tentative estimates of maximum residues for the purpose of tolerance setting and best available estimates for the Special Reivew dietary exposure are tabulated below. Estimates are tentative due to lack of validation data, as described above in Conclusion 4; and due to uncertainty about the maximum use pattern to be supported. Tentative Registration Standatd residue estimates are for a single application at 8 lb ai/A for corn and 4 lb ai/A for other crops. Tentative Registration Standard residue estimates for processed products are obtained by multiplying the tentative maximum residue estimate for the rac by the maximum concentration/reduction factor. Tentative Registration Standard residue estimates for peanut commodities after a single application at 8 lb ai/A are listed in footnote 2 of the table. Tentative Special Review residue estimates are based on the typical application rate of 4 lb ai/A for these commodities. Tentative Special Review residue estimates for processed commodities are obtained by multiplying the tentative maximum Special Review residue estimate for the rac by the average concentration/reduction factor. Data from the use of the microencapculated formulation (Lasso Microtech) were not used when Lasso Microtech was not registered for use on that crop. Deficiencies outlined

below in the following conclusions must be corrected. All of these estimates assume that sequential applications and late postemergence applications will be removed from the Section 3 labels and 24(c) labels. If sequential and late postemergence applications are not removed from the labels, then residue data are needed for these uses and our residue estimates will likely increase.

TENTATIVE RESIDUE ESTIMATES (PPM)

Crop	Registration Standard	Special Review
Corn		
grain	0.019	0.016
K+CWHR	0.005	0.005
forage	0.60	0.60
fodder&stover	0.20	0.20
meal	0.021	0.015
(soapstock)[1/]	0.048	0.029
crude oil	0.076	0.042
refined oil	0.003	0.0019
Peanuts[2/]		
nuts	0.27	0.27
hulls	0.9	0.9
forage	3.4	3.4
vines	3.4	3.4
Soybeans		
grain	0.21	0.21
hulls	0.32	0.32
meal	0.36	0.26
crude oil	0.19	-
refined oil[3/]	0.05	0.04
protein concentrates	0.08	0.07
protein isolates	0.05	0.04
soapstock	0.52	0.38
forage	2.6	2.6
hay	2.0	2.0
Sorghum		
grain	0.035	0.035
forage	1.4	1.4
fodder&stover	0.65	0.65

1/ not regulated

2/ If 8 lb ai/A single application for use on peanuts is to remain registered under Section 24(c), then maximum residues are tentatively estimated at 0.87 ppm in peanuts, 0.27 ppm in peanut hulls, 4.8 ppm in peanut hay, and 12 ppm in peanut vines

3/ refined, deodorized oil for human consumption

5a. No data have been submitted reflecting the maximum Section 3 or maximum 24(c) use on corn. These data are still needed. Alternatively sequential treatments and late postemergence treatments may be removed from the labels.

5b. Validation data as described above in Conclusion 4 are needed for corn residue data submitted previously and for corn residue data included in this submission. This applies to data in Accession Nos. 260643 (MSL-5118, MSL-4534), 257271 (MSL-4636), 262999 (MSL-5603), and 264946 (MSL-5943). Additionally, chromatograms of samples fortified at the limit of quantitation are needed for Accession No. 262999 (MSL-5603). For the reanalysis of corn grain (MSL-4534, Accession No. 260643, an expanded standard curve is still needed, to demonstrate linearity in the range of the analytical results.

5c. The geographic representation of the corn data is inadequate. Additional grain samples are needed from IL/IN. Additional corn on the cob (K+CWHR) samples are needed from FL, NY, OH/PA, and OR/WA/ID, assuming the label will be amended to allow only one early application. To maintain registration of sequential treatments and late post emergence layby treatments, data on corn grain, forage and fodder are needed from IL/IN/IA, MN/WI, NE, and OH/MI; and corn on the cob (K+CWHR) data are needed from FL, NY, OH/PA, and OR/WA/ID.

5d. Residue data were submitted for the use of Lasso Microtech. Lasso Microtech is not registered for use on corn. We do, however, that residues of alachlor DEA and HEEA metabolites are significantly higher when the microencapsulated formulation is used.

5e. Tolerances for fresh corn (including sweet corn K+CWHR) and corn grain would be adequate if all sequential treatments and the 24(c)'s for late postemergence layby application are removed from the labels. In this case, the corn grain tolerance could possibly be lowered to 0.05 ppm.

5f. The tolerance for corn forage is inadequate and must be raised. A tolerance of 1 ppm would be appropriate, provided that sequential treatments and the 24(c)'s for late postemergence layby application are removed from the labels.

5g. No food or feed additive tolerances are needed for corn processed products. The rac tolerance will cover the slight concentration in corn meal. Alachlor residues concentrate in crude oil, but are reduced in refined oil to a level below that of corn grain. Alachlor residues also concentrate in corn soapstock; however, corn soapstock is not regulated.

5h. Validation data as described above in Conclusion 4 are needed for sorghum residue data included in this submission. This applies to data in Accession No. 263002 (MSL-5702, MSL-5534). Chromatograms of samples fortified at the limit of quantitation are needed for sorghum commodities.

5i. Tolerances for sorghum grain and fodder appear to be adequate. However, an increased tolerance is needed for sorghum forage. A tolerance of 2 ppm may be adequate. These conclusions are tentative, pending submission of adequate storage stability data for six years storage (or the actual time the samples were stored) adequate validation data, and contingent on the addition of a label restriction prohibiting sequential applications of alachlor to sorghum.

5j. We note that the highest residues found in sorghum samples were in samples with the longest PHI°s. Lasso Microtech is not registered for use on sorghum, and residue data from the use of Lasso Microtech were not considered in estimating residues in sorghum. We note that residues from the use of Lasso Microtech are comparable to those from the use of Lasso EC.

5k. Peanut field studies reflecting the maximum use on the section 3 labels (two sequential treatments, a pre-plant or pre-emergence treatment followed by an at cracking treatment, each at 4 lbs ai/A) must be submitted. Studies must also be submitted reflecting the maximum 24(c) use in NC (a preplant, preemergent, or at cracking treatment followed by a late postemergence layby treatment, each at 4 lbs ai/A). Alternatively, the second treatment on peanuts and the late postemergence layby treatment may be removed from the labels.

5l. Validation data as described above in Conclusion 4 are needed for peanut residue data submitted previously and for peanut residue data included in this submission. This applies to data in Accession Nos. 257274 (MSL-3980) and Accession No. 363002 (MSL-4636).

5m. Residue data on peanuts are needed from NC/VA from the at cracking treatment in addition to the residue data at the maximum registered rates discussed above in Conclusion 5i. Without data from NC/VA, we cannot conclude that the peanut residue data are geographically representative.

5n. Data on peanut processed fractions are needed. No conclusions can be made at this time regarding alachlor residues in peanut processed fractions. We note that peanut processing data have been submitted to the Agency, but have not been reviewed.

5o. Residues of alachlor metabolites in peanut commodities reported here are considerably higher than residues previously reported (from the preemergent application) and exceed the currently established tolerances, even when a single application of 4 lb ai/A is made at cracking. Higher tolerances must be proposed even if more severe treatments are removed from the labels.

5p. Some of the lowest residues and some of the highest residues were from samples which had received preemergent application. The highest residues were from samples grown in TX, OK, and NM (all of the southwest peanut growing locations). These data showed a significantly smaller percentage of DEA metabolites in the total residue than previous samples. The average percentage of DEA metabolites in the total residue was 20% in peanut hay, 11% in peanut vines, 20% in peanut hulls, and 7% in peanuts. The difference may be due to the at cracking treatment. (Previous data were from preemergent application.) Residues from the use of Lasso Microtech were generally, but not always, higher than residues from the use of Lasso EC.

5q. Monsanto had previously indicated that they planned to restrict feeding of peanut forage and hay. Consequently, peanut forage and hay were not considered as part of the livestock diets for the purposes of the Special Review. Monsanto now indicates that they plan to propose higher tolerances for peanut forage and hay. This may have a significant effect on estimated residues in meat and poultry products.

5r. Validation data as described above in Conclusion 4 are needed for soybean residue data submitted previously. This applies to data in Accession Nos. 260259 and 260260 (MSL-4942 and MSL-5123, Accession No. 258142 (MSL-4535), and Accession No. 257271 (MSL-4636). For the data in Accession No. 260259 and 260260 (RCB No. 284, MSL-5158, MSL-4952, MSL-5123, S. Hummel, 2/14/86), we question whether the limit of detection of the analytical method is actually 0.02 ppm. Additionally, chromatograms of samples fortified at the limit of detection are required.

5s. Residue data reflecting the maximum treatment of alachlor on soybeans are required. Specifically, soybean field studies reflecting two sequential treatments must be submitted. Alternatively, the second treatment on soybeans may be removed from the label.

5t. Processing data for soybean soapstock have not been submitted. However, data on corn soapstock have been received and can be translated. We tentatively estimate that residues will not exceed 0.38 ppm in soybean soapstock

for the purposes of the Special Review. For the purposes of the Registration Standard, we estimate that residues in soybean soapstock will not exceed 0.52 ppm, provided that sequential treatments are removed from the labels. A feed additive tolerance will be needed. If sequential treatments are removed from the label, a tolerance of 0.6 ppm would be appropriate.

5u. Higher tolerances are needed for soybean forage and hay. Tolerances of 3 ppm in forage and 2 ppm in hay would be appropriate, provided that sequential treatments are removed from the label. If sequential treatments are not removed from the label, then additional data and probably higher tolerances will be needed. Additionally, data are needed for ensiled soybeans, another animal feed item. Alternatively, the registrant could propose feeding restrictions.

5v. A Feed Additive tolerance must be proposed for residues of alachlor and its metabolites in soybean hulls and soybean meal. A Food Additive tolerance must be proposed for residues of alachlor and its metabolites in soybean meal. If sequential treatments are removed from the label, tolerances of 0.4 ppm would be appropriate for alachlor residues in soybean hulls and soybean meal.

5w. Residue data for sunflower seeds, cottonseed, legumes are needed, where both DEA and HEEA metabolites of alachlor are analyzed. We note that residue data on these commodities, and processing data, have been received by the Agency, but not reviewed. The registrant should be reminded that complete sample history and sample chromatograms are required to validate all residue data.

6. Residues in meat, milk, poultry, and eggs cannot be estimated at this time. Substantially higher residues have been reported on a number of commodities which are feed items. Additional data have been received on additional feed items, but not reviewed. Residue data are unavailable for maximum registered uses of corn, soybeans, and peanuts.

RECOMMENDATIONS

We recommend that the registrant be informed of these deficiencies and advised to correct them. We recommend that our review be forwarded to the registrant. Copies of the Federal Register notice (51 FR 34249) and the Multiresidue Protocols should also be forwarded to the registrant.

ATTACHMENT: FR Notice and Multiresidue Protocols:
attached to copies to addresses

cc: R. F., circu, S. Hummel, alachlor S.F., Alachlor S.R.F.,
TOX, G. Burin (SIS), PMSD/ISB
RDI:EZ:01/30/87:RDS:01/30/87
TS-769:RCB:SVH:svh:RM810:CM#2:01/30/87

[OPP-36127 (FRL-3086-9)]

Pesticide Assessment Guidelines Subdivision O-Addendum; Availability of Final Guidance Document for Analytical Methods for Multiresidue Protocols

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of availability.

SUMMARY: This addendum on Residue Analytical Methods is primarily for the regulated industry and provides four specific Food and Drug Administration (FDA) Pesticide multiresidue method protocols for testing each pesticide under the Residue Chemistry Data Requirements in 40 CFR 158.125(b)(15). This document is now available to the public and can be purchased through the National Technical Information Service (NTIS). The NTIS order number and price for the document are provided.

ADDRESS: Address orders to: National Technical Information Service, ATTN: Order Desk, 5285 Port Royal Road, Springfield, VA 22161, (703-487-4650).

Orders for the Pesticide Assessment Guidelines Addendum for Residue Analytical Methods Multiresidue Protocols may be placed by telephone to the NTIS order desk and charged against a deposit account or American Express, VISA, or MasterCard or sent by mail with check, money order, or account number.

FOR FURTHER INFORMATION CONTACT: By mail:

Francis D. Griffith, Jr. Hazard Evaluation Division (TS-769C), Office of Pesticide Programs, Environmental Protection Agency, 401 M St., SW. Washington, DC 20460.

Office location and telephone number: Rm. 804 Crystal Mall—Building #2, 1921 Jefferson Davis Highway, Arlington, Virginia (703-557-7484).

SUPPLEMENTARY INFORMATION: The purpose of this Federal Register Notice is to inform pesticide registrants of the availability of pesticide multiresidue protocols for use in meeting the data requirements in 40 CFR 158.125(b)(15). These protocols are now available as an addendum to the Pesticide Assessment Guidelines Subdivision O-Residue Chemistry. Use of these testing schemes, Protocols I-IV, may indicate multiresidue methods are more suitable for the identification and determination of pesticide residues than those methods designated for the individual pesticides found in the Pesticide Analytical Manual Volume II (PAM-II).

The data developed under these Protocols will be published as entries in appropriate tables in the Pesticide Analytical Manual, Volume I. The data are for the use of any agency responsible for enforcing tolerances or monitoring residues and thus are not to be claimed as Confidential Business Information (CBI).

Data submitters who use these multiresidue protocols should note the following:

1. Data should be gathered using the FDA multiresidue method Protocols I, II, III, and/or IV. The parent compound and all metabolites covered in the tolerance should be tested. These tests should be performed only by qualified laboratory personnel and followed as specified in the current edition of the Pesticide Analytical Manual Volume I.

2. Data should be obtained from representative commodities from those

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crops and/or animal products within the pesticide petition under review. If tolerances are being requested on many crops in a group of related crops, only one crop in the group need be tested. Fortified samples, in duplicate, are to be taken through each protocol and results reported as specified. Untreated control samples, in duplicate, are to be treated in the same manner.

These guidelines apply to new pesticides and to all pesticides undergoing the re-registration process. For older pesticides, data on methodology specified in this Federal Register notice may have been published in the Pesticide Analytical Manual. If such data are currently available, they will be acceptable.

Document title, prices, and order number are as follows:

Document title	NTIS Order No	Price (hard copy)	Price (microfiche)
Pesticide Assessment Guideline Subdivision O-Addendum Residue Chemistry Data Requirements For Analytical Methods in 40 CFR 158.125–Multiresidue Protocols	PB 86 203734/AS	$9.95	$5.95

For this document, your order should specify the title, the corresponding NTIS order number, and whether hard copy or microfiche is desired. The NTIS order number is the same for both microfiche and hard copy, but the price differs for each form. Send orders to the address provided above.

Dated: September 18, 1986.

John W. Melone,

Director, Hazard Evaluation Division.

[FR Doc. 86-21821 Filed 9-25-86; 8:45 am]

BILLING CODE 6560-50-M

Multiresidue Method Testing

Analytical methods capable of determining many pesticide residues in a single analysis have long provided the basis for the U.S. Food and Drug Administration's programs to determine residue levels in the U.S. food supply. Through the years, as the several multiresidue methods have been added to FDA's programs, a concomitant effort has been made to test as many potential residues as possible through these methods. All the data collected from tests run according to specified protocols have been compiled and distributed.

Specific directions for each multiresidue method used by FDA are published in the agency's Pesticide Analytical Manual Vol. I (PAM I) as stated in 40 CFR 180.6(d) and 180.101(c). Compilation of data on the analytical behavior of pesticides and related chemicals are also published in PAM I. The data compiled in this way include: relative retention times of the compounds on a variety of gas-liquid chromatographic (GLC) columns; responses of various GLC detectors to the compounds; recovery of the compound through complete methods, and sometimes through important steps within the methods. The large amount of effort spent on the testing of multiresidue methods and compilation of results is justified by the advantages such compilations offer the analytical chemist. When analytical behavior data for numerous compounds through the method in use is known, the analyst is better equipped to recognize the residues that are present in a sample of unknown treatment history. In situations where the likelihood of some particular residue is known, the data lists for several methods can be consulted to help choose which method should be used.

Regulatory agencies which must assess the incidence of residue occurrence are also assisted by data compilations. The absence of many chemicals from the sample can be ascertained when it is known that the compounds could have been detected had they been present.

It has been found advisable to define protocols to follow in developing data on multiresidue method behavior. In order to compile data into usable formats, it is imperative that all contributing laboratories perform the tests in the same way. The goal in these method-testing exercises is not to find the optimum conditions for the one compound currently being tested, but to be able to describe how the compound will behave when determined by the precisely-defined method.

To this end, four protocols follow. Each references the PAM I method(s) involved, the types of compounds to which it applies, and the PAM I table(s) in which previously-collected data are published. The data development section of each

protocol provides the directions for setting instrument parameters and for testing the compounds through the parts of the method.

Follow the steps of these protocols, in the order written, to develop data which can be compiled with that from other laboratories. These data will be included in PAM I tables and distributed to the many laboratories around the world which use these methods.

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Protocol I

Background

Methods: PAM I 211.1, 212.1, 252

Compound Type: Generally, non-polar compounds capable of detection by electron capture or phosphorus-selective GLC detectors. A wide variety of compounds are recovered through these methods; do not assume too readily that the compound is too polar to be recovered. [Note that the protocol is set up to test for recovery through the Florisil cleanup column first, so that time will not be wasted testing through the complete method compounds which are not eluted from Florisil.]

PAM I Tables: Appendix (all data)

Table 201-A (recoveries from Florisil and through complete methods)

Tables 331-A, 331-F, 331-G, 334-A (GLC data)

Data Development

I. Instrumentation

A. GC column

1. Required column: 5% OV-101 or equivalent
2. Additional columns of interest:
   a. 3% OV-225
   b. 2% DEGS (ANALABS)
   c. 3% OV-17

B. GC detectors

1. Electron Capture (^{63}Ni constant current)
2. Hall 700 A (halogen)
3. Flame Photometric Detector (phosphorus)

C. GC parameters

1. Adjust column temperatures, 5% OV-101, so that relative retention to chlorpyrifos (RRc) of p,p'-DDT is 3.10 ± 0.03 (or RRc of ethion is 2.56 ± 0.03) (see PAM I 331A for RRc data).

   For other columns of interest, see the following tables for operating conditions and RRcs:

a. Table 331-F - OV-225 column
b. Table 334-A - DEGS column
c. Table 331-G - OV-17 column

2. Detector sensitivity: Select electrometer attenuation to produce 50% full scale deflection (FSD) for injection of 1.5 ng chlorpyrifos.

See the following PAM I sections for parameters for the various detectors:

a. Section 311.4 - Electron capture
b. Section 315 - Hall 700 A (halogen)
c. Section 314 and Table 331-G - Flame photometric

II. GC analytical behavior of new compound

A. Dissolve reference standard material in pesticide-grade solvent (iso-octane preferred) to prepare stock standard solution.

B. Inject aliquots containing up to 1000 ng into GC system to determine the amount of standard required to cause 50% FSD at the prescribed parameters.

C. Calculate RRc of new compound for all GC column/detector systems used.

III. Recovery of new compound through cleanup column

A. Determine recovery through Florisil column, PAM I 211.14d and 252.12b. Use only Florisil which has been shown to permit elution of heptachlor epoxide in 6% EE/PE or eluate 1 and endrin in 15% EE/PE or eluate 2. Add 10-100 ug of analyte in 1-10 ml hexane solution to each Florisil column experiment in duplicate. If recoveries are less than 30%, report recoveries through Florisil and terminate work on this compound through this method.

B. If new compound elutes in 6% EE/PE or eluate 1, rerun Florisil column experiment in the following manner.

(1) Elute Florisil column with 250 mL petroleum ether.
(2) Proceed with 6% EE/PE or eluate 1.

Report percent recovery and eluate(s) which contains analyte.

IV. Recovery of new compound through complete methods

A. Select one representative fatty and one nonfatty food

sample. Analyze food first to assure that there are no residues in the sample which might interfere with the fortification test. Simultaneously, analyze a reagent blank for further information on the source of possible interferences.

Fortify 100 g samples in duplicate at approximately 0.05 ppm. Analyze duplicate fortified samples as described in PAM I 211.1 and 212.1 for fatty foods and nonfatty foods, respectively.

B. Fortify 100 g samples in duplicate at the tolerance level or, if no tolerance exists, at approximately 0.5 ppm. Analyze duplicate fortfied samples.

C. If the compound is recovered in experiments IV. A and B above, and if it was recovered in III. A using the Florisil elution system PAM I 252, then repeat IV A and B using the PAM I 252 elution system.

V. Report all results in a format which parallels this protocol. Include results of checks made on instrument parameters, as described in I.C.

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Protocol II

Background

Method: PAM I 232.3

Compound Type: Organophosphorus pesticides and their polar metabolites. Also certain organonitrogen compounds, if the GLC detector used responds to nitrogen.

PAM I Tables: Appendix (all data)

Table 201-H (recoveries through complete method)

Table 334-A (DEGS column RRcs)

Tables 331-F, 331-G (GLC data)

Table 333-A (relative retention times on DC-200 column, equivalent to OV-101; detector response data for alkali flame (KCl thermionic) detector, rather than FPD.)

Data Development

I. Instrumentation

A. GC column

1. Required column: 4 ft x 2 mm (i.d.) 2% DEGS - (precoated packing, available from Analabs, Inc., Cat. No. GCM-035)
2. Additional columns of interest:
   a. 3% OV-225
   b. 3% OV-17
   c. 5% OV-101

B. GC detectors

1. Flame photometric detector, phosphorus mode (FPD-P). This is the preferred detector for the determination of new compound data.

2. Alkali flame detector or N/P detector. (These detectors should be used only if FPD-P detector is not available.)

C. GC parameters

1. Operate DEGS column at 180°C; adjust temperature as needed to produce RRcs for parathion and monocrotophos

as reported in PAM I Table 334-A.

For other columns of interest, see the following tables for operating conditions and RRcs:

a. Table 331-F - OV-225 column
b. Table 331-G - OV-17 column
c. Table 331-A - OV-101 column

2. Detector sensitivity: Select electrometer attenuation so that injection of 1.5 ng chlorpyrifos produces 50% full scale deflection (FSD) on recorder or printer/plotter.

See the following PAM I sections for parameters for the various detectors:

a. Table 331-G - FPD
b. Section 313 - KClTD
c. Section 316 - N/P

II. GC analytical behavior behavior of new compound

A. Dissolve reference standard material in pesticide-grade acetone to prepare stock solutions and all subsequent dilutions. Also prepare acetone solutions of chlorpyrifos, parathion, and monocrotophos for accompanying work.

B. Determine amount (ng) of new compound which produces 50% FSD.

C. Calculate RRc of new compound for all GC columns/detector systems used.

III. Recovery of new compound through cleanup column

Determine recovery of compound, in duplicate, through PAM I 232.34 column chromatography. Add 5-50 ug of compound to cleanup column and elute as instructed. If recovery is less than 30%, do not proceed to test compound through entire method. Report recoveries through clean-up column alone.

IV. Recovery of new compound through complete method

A. Select a representative nonfatty food sample. Analyze food by this method to assure that there are no residues in the sample which might interfere with the fortification test. Simultaneously, analyze a reagent blank for further information on the source of possible interferences.

Fortify 100 g samples, in duplicate at 0.05-0.10 ppm. Analyze the duplicate fortified samples as described in PAM I 232.3.

B. Fortify 100 g samples in duplicate at the tolerance level or, if no tolerance exists, at 5 x level of A above. Analyze duplicate fortified samples.

V. Report all results in a format which parallels this protocol. Include results of checks made on instrument parameters, as described in item I.C.

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Protocol III

Background

Method: PAM I 232.4

Compound types: Applicable to all nonionic types of pesticides; detection of particular compounds is dependent on availability of the various element-selective detectors which can be used.

PAM I Tables: Appendix (GLC data)

Table 201-I (recoveries through the complete method)

Tables 331-A, 331-F, 331-G, 334-A (GLC data)

Data Development

I. Instrumentation

A. GC columns

1. Organochlorine compounds

a. Required column: 5% OV-101 or equivalent
b. Additional columns of interest:
(1) 3% OV-17
(2) 3% OV-225

2. Organophosphorus/organonitrogen compounds

a. Required column: 4' x 2 mm (i.d.) 2% DEGS (precoated packing, available from Analabs, Inc. Cat. No. GCM-035)
b. Additional columns of interest:
(1) 3% OV-225
(2) Ultrabond 20 SE (precoated packing available from Ultra Scientific Cat. No. RGC-023A)
(3) 3% OV-17
(4) 5% OV-101

B. GC detectors

1. Organochlorine compounds

a. Preferred detector: Hall 700 A (halogen)

b. Other detector: electron capture (^{63}Ni constant current). If an electron capture detector must be used, the analytical methodology must include Florisil clean-up (PAM I 212.2) prior to GC determination. (PAM I 311.4).

2. Organophosphorus compounds

a. Preferred detector: flame photometic detector phosphorus mode (FPD-P).

b. Other detectors: alkali flame detectors (KClTD or N/P).

3. Organonitrogen compounds

a. Alkali flame (KClTD or N/P)

b. Hall 700 A (nitrogen)

C. GC parameters

1. Column temperatures

a. OV-101: operate at 200°C. Adjust temperature, if necessary, to give RRc for p,p'-DDT = 3.10 ± 0.03. See PAM I 331-A for additional RRc.

b. DEGS: operate at 180°C. Adjust temperature, if necessary, to give RRc for parathion and monocrotophos as noted in PAM I, Table 334-A.

c. OV-17. See Table 331-G for conditions.

d. OV-225. See Table 331-F for conditions. Note that this column cannot be used with electrolytic conductivity detectors or N-selective detectors.

2. Detector sensitivity: Select electrometer attenuation so that injection of 1.5 ng chlorpyrifos produces 50% full scale deflection (FSD) on recorder or printer/plotter.

See the following PAM I sections for parameters for the various detectors:

a. Section 315 - Hall 700 A
b. Tables 334-A, 331-G - FPD-P
c. Section 311.4 - ^{63}Ni electron capture
d. Section 313 - KClTD
e. Section 316 - N/P

II. GC analytical behavior of new compound

A. Dissolve reference standard material in acetone or iso-octane, pesticide-grade, to prepare stock solutions. Make all dilutions of the stock solution with acetone.

B. Determine amount (ng) of new compound which causes 50% FSD. Do not exceed 1000 ng injected.

C. Calculate RRc of new compound for all GC column/detector systems used.

III. Recovery of new compound through complete method

A. Select a representative nonfatty food sample. Analyze food by this method to assure that there are no residues in the sample which might interfere with the fortification test. Simultaneously, analyze a reagent blank for further information on the source of possible interferences.

Fortify duplicate (100 g) samples at 0.05-0.1 ppm. Analyze duplicate fortified samples as described in PAM I 232.4.

B. Fortify duplicate (100 g) samples at tolerance level for compound or, if no tolerance exists, at 5x level of (A). Analyze duplicate fortified samples.

IV. Report all results in a format which parallels this protocol. Include results of checks made on instrument parameters, as described in item I.C.

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Protocol IV

Background

Method: PAM I 242.2 and JAOAC (1980) 63 1114-1124

Compound types: Applicable to a variety of compound types; detection is dependent on availability of the particular detection step required for specific compounds, i.e.,

N-methylcarbamates: HPLC and post-column fluorescence labeling, with fluorescence detection

Naturally fluorescent pesticides: HPLC and fluorescence detection

Volatile and thermally stable pesticides: PAM I GLC detection methods

PAM I Tables: Table 201-J (recoveries through several applications of complete method)

Tables 330 (GLC data: tables for each column/detector combination).

[Also see JAOAC (1980) 63 1114-1124 for retention times of compounds through HPLC column.]

Data Development

I. Instrumentation

A. HPLC

1. N-methylcarbamates: Set up HPLC with post-column fluorescence labeling and fluorescence detector, as described in JAOAC (1980) 63 1114-1124. Check for proper operation using carbofuran as described in the reference.

2. Fluorescent pesticides: Set up HPLC and fluorescence detector, as described in J. Chromatogr. (1983) 255 497-510 and JAOAC (1983) 66 234-240. Check for proper operation using carbofuran as described in the references.

B. GLC. PAM Vol. I Chapter 3. If GLC is investigated, at a mimimum, OV-101 and DEGS liquid phases should be examined at standard conditions and operating para-

meters. Use chlorpyrifos as the reference compound. Use appropriate selective GLC detectors at standard operating parameters. (See Protocols I, II, and III for details on GLC operations.)

II. Instrument analytical behavior of new compound. (These directions refer to the two HPLC operations described above. See Protocols I, II, and III for details on collecting GLC data.)

A. Dissolve reference standard material in methanol to prepare stock solutions. Dilute with methanol for HPLC working standards. [Note: For GLC working standards, dilute stock solutions with whatever solvent is appropriate for the GLC system.]

B. Determine amount (ng) of compound which causes the detector to produce a 50% FSD recorder response. Note the peak shape of the compound to determine adequacy of chromatography.

C. Determine linear response range of the detector to the compound.

D. Determine stability of compound in methanol:

Short term stability study: Inject quantity of compound which produces 1/2 FSD response; repeat every 40 minutes for 8 hours.

Long term stability study: Inject quantity of compound which produces 1/2 FSD response; repeat once every day for eight days. Normalize response to carbofuran reference standard injected each day.

E. Calculate the retention time of the compound relative to carbofuran on the HPLC system of JAOAC (1980) 63 1114-1124 or JAOAC (1983) 66 234-240, as appropriate.

III. Recovery of new compound through cleanup column:

Initially determine that charcoal-silanized Celite column has proper elution characteristics as per carbamate method (JAOAC (1980) 63, 1114-1124). Pass 25 ug of pesticide through newly prepared column as per carbamate method. After collection of eluant (20 mL methylene chloride + 125 mL toluene-acetonitrile) in round bottom flask, momentarily stop flow, remove bottom flask and replace with a second round bottom flask. Elute column with an additional 100 ml toluene-acetonitrile. Evaporate solvents in both round bottom flasks to dryness as per method. Dissolve residue in first flask to appropriate volume with appropriate solvent for determination. Dissolve residue in 2nd flask with 5 mL of solvent and determine percent of total added

pesticide carried over into second flask. Continue recovery studies with food products, IV, only if combined recoveries from charcoal column are greater than 50%. If 10% or more of pesticide elutes in 2nd flask, collect a separate additional 100 mL eluting solution in recovery studies with food products.

IV. Recovery of new compound through complete method

A. Select a representative food sample. (This method has been found applicable to both fatty and nonfatty food.) Analyze food by this method to assure that there are no interferences. Simultaneously, analyze a reagent blank for further information on the source of possible interferences.

Fortify 150 g of chopped food product, while it is in homogenizer, at appropriately 0.05 ppm. Analyze duplicate fortified samples.

B. Fortify 150 g samples at a level near the tolerance or at 5 X the level in A if there is no tolerance. Analyze duplicate fortified samples.

V. Report all results in a format which parallels this protocol. Include the results obtained with reference compounds to establish appropriate instrument parameters, as described in items I. A. and B.

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