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

July 18, 1994

MEMORANDUM

SUBJECT: Dichlorvos (084001) Reregistration Case No. 0310
Processing studies on field corn, wheat, rice, cottonseed and soybeans. [MRID 42993501, CB No. 13296; DP Barcode D199979]

Livestock Feeding Studies: Dairy Cow and Hen [MRIDs 43037401, 43047901, CB No. 13294, DP Barcode D199975]

Food Handling Establishments: Corn Processing, Oat Manufacturing, Oat Processing, Wheat Manufacturing [MRIDs 42775901, 42878801, 42878802, 42910801, 42910901; CB No. 13427, DP Barcode D200905]

Reduction of Residues: Half-Life Determination in Packaged and Bagged Commodities. [MRID 42858201, CB No. 13295, DP Barcode D199976]

Reduction of Residues: Uncooked and Cooked/Processed Commodities: meat, eggs, dry beans, milk, cocoa beans, coffee beans, and tomato paste. [MRID 42910701; CB No. 13006; DP Barcode: D197522]

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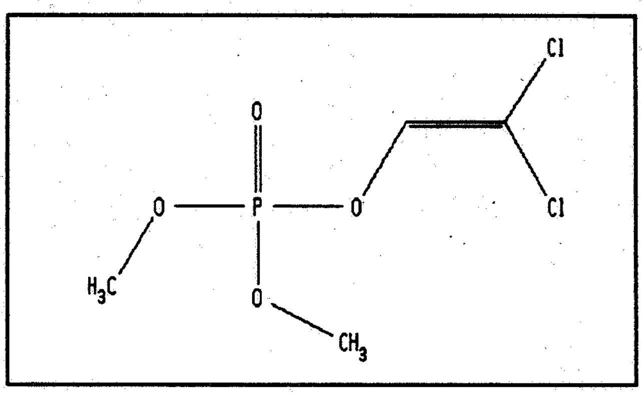
Amvac Chemical Corporation, Inc. has submitted a number of studies to support the reregistration of dichlorvos. These studies were conducted in response to requirements in the Dichlorvos Guidance Document (9/87) with time extensions granted in SRRD letter of 8/7/91, and Dichlorvos Special Review DCI of

9/20/91. In the summary of MRID 42910701, Amvac states they **are not** supporting the use of Dichlorvos in meat slaughter and/or packing plants, or on fresh fruits and vegetables (including tomatoes).

Dichlorvos (DDVP) is on List A. A Registration Standard was issued in 9/87. The Residue Chemistry Chapter was completed 1/28/86. Tolerances have been established for dichlorvos on numerous raw agricultural commodities (40 CFR 180.235). However, the agricultural uses of dichlorvos are not being supported for reregistration. Dichlorvos is also used for fumigation of food storage facilities. The tolerances in 40 CFR 180.235 cover those uses, along with the food additive tolerances in 40 CFR 185.1900. EPA has proposed to revoke the food additive tolerances for dichlorvos (58 FR 59663, 11/10/93), which were to be effective 3/10/94. However, a request for a hearing has been received, which stays the revocation of the food additive tolerances. The structure of dichlorvos is shown below in Figure 1.



CONCLUSIONS

Analytical Methodology

1. Samples from studies reviewed in this document were analyzed by adequate analytical methods with limits of quantitation demonstrated to be 0.01 ppm.

Storage Stability

2. No storage stability data were included in any of the studies reviewed in this document. However, storage stability data are available to support the studies reviewed in this document.

Processing studies on field corn, wheat, rice, cottonseed and soybeans.

3a. The processing studies for corn wet and dry milling, wheat milling, rice milling and cottonseed are adequate. The soybean processing study is adequate, except that data are still needed for soybean aspirated grain fractions (also called grain dust).

3b. Residues of dichlorvos did not concentrate in corn wet milled or dry milled fractions, wheat, rice or cottonseed processed commodities. Residues of dichlorvos did concentrate in soybean hulls, corn grain dust, wheat grain dust, and rice grain dust. A Feed Additive tolerance is needed for soybean hulls. We note that Delaney considerations may preclude the setting of any 409 tolerance. A tolerance under Section 408 is needed for corn aspirated grain fractions, wheat aspirated grain fractions (also called grain dust). Rice aspirated grain fractions are no longer being regulated. Data are still needed for soybean aspirated grain fractions (grain dust).

Livestock Feeding Studies: Dairy Cow and Hen

4. Non-detectable residues (<0.01 ppm) were found after oral dosing at approximately 10x the dietary burden, tolerances are not needed to cover secondary residues of dichlorvos in livestock tissues, milk, and eggs. However, dermal uses are allowed and may result in residues in livestock tissues, milk, and eggs. This conclusion can also be extended to swine, even though no feeding study was submitted for swine.

Livestock Dermal Studies: Swine

5a. The required swine dermal study was not submitted and is required.

> Swine must be mist sprayed with 1 fluid ounce of a 1% ai finished spray per day for 28 consecutive days and sacrificed within 24 hours after the final treatment. Residues must be determined in muscle, liver, kidney, fat, and skin.

Dermal uses in swine could result in residues on skin, which is an edible commodity. For this reason, dermal studies on ruminants and/or poultry cannot be translated to swine.

5b. Existing ruminant and poultry dermal studies are acceptable.

Food Handling Establishments: Corn Processing, Oat Manufacturing, Oat Processing, Wheat Manufacturing

6a. The food handling establishment studies in the corn processing facility, the oat processing facility, the oat manufacturing facility, and the wheat manufacturing facility are adequate.

6b. Residues of dichlorvos reported in the products from corn processing were all less than the current tolerance of 0.5 ppm.

6c. Finite residues of dichlorvos are found in all fractions produced at the oat processing facility. Reported residues were lower than the 4 ppm tolerance needed to cover residues from treatment of raw oats.

6d. Dichlorvos residues in the final product from the oat manufacturing facility, flaked oats, are less than 1 ppm and should be adequately covered by the 4 ppm tolerance needed for raw oats. We note that the exposed samples had residues up to 30 ppm.

6e. Dichlorvos residues reported in the components of the baking mix and the final blended mix were all <0.5 ppm, and should be adequately covered by the 4 ppm tolerance needed to cover dichlorvos residues in processed packaged and bagged commodities. We note that Delaney considerations may preclude the setting of this tolerance. In exposed samples, residues of dichlorvos could be up to 10 ppm.

Reduction of Residues: Half-Life Determination in Packaged and Bagged Commodities.

7. Decline in dichlorvos residues was reported only for packaged dry beans and sugar. The registrant(s) may choose to submit additional information concerning the typical length of time commodities remain in storage following treatment with dichlorvos. Submission of this information may allow for a more accurate exposure estimate for packaged and bagged dry beans and sugar. This information would include typical total storage times, frequency of applications, and rates of application (g/1000 ft^3).

Reduction of Residues: Uncooked and Cooked/Processed Commodities: meat, eggs, dry beans, milk, cocoa beans, coffee beans, and tomato paste.

8. The submitted Reduction in Residue/Cooking study is adequate. All Commodities tested lost dichlorvos during cooking . We agree with the registrant's conclusion that the loss of dichlorvos seemed to be correlated with time and temperature of cooking (longer time and higher temperature produced greater loss of dichlorvos). These data on reductions during cooking can be translated to other similar food products.

RECOMMENDATIONS

We recommend that the registrant be informed that the submitted studies are adequate, with the exception of the soybean processing study. Data are still needed for soybean aspirated grain fractions (formerly called grain dust). The registrant has not submitted the required swine dermal study. This study is needed, and the registrant should be advised to submit it.

The registrant should be informed that a feed additive tolerance is needed for soybean hulls. We note that Delaney considerations may preclude the setting of any 409 tolerance. Tolerances under Section 408 are needed for corn aspirated grain fractions and wheat aspirated grain fractions (also called grain dust).

Detailed Considerations

BACKGROUND

The Dichlorvos Guidance Document (9/87) required processing data for field corn, wheat, rice, peanuts, cottonseed, soybean, and tomatoes bearing measurable weathered residues of dichlorvos.

The Dichlorvos Guidance Document (9/87) required feeding studies on ruminants, poultry, and swine, and a dermal study on swine.

The Dichlorvos Guidance Document (9/87) required a petition for a food additive regulation, along with data from Food service establishments (restaurants and groceries) treated via space treatment (PrL). The DCI noted that final disposition of the food additive regulation is dependent upon the Agency's position regarding the Delaney Clause issues.

The Dichlorvos Guidance Document (9/87) required reduction of residue (cooking) data on cooked meat and eggs, and pasteurized milk; cocoa butter and chocolate; coffee beverage as consumed; prepared from uncooked meat, eggs, milk, cocoa beans, and coffee beans bearing measurable residues.

The Dichlorvos DCI of 9/20/91 required reduction of residue data for cooked dried beans and processed coconut oil and degradation data for packaged or bagged raw agricultural commodities and processed foods.

ANALYTICAL METHODOLOGY

Analysis of samples for residues of dichlorvos were conducted using analytical methods developed by Horizon Laboratories, Inc. A copy of the methods used were included in each of the studies (complete copy or by reference).

Analytical methods used were:

"Method for the Analysis of DDVP Residues (Version 1.0, for Certain Dry Goods, Prepared Food Entrees, Tea, and Cocoa Beans," Horizon Laboratories.

"Method for the Analysis of DDVP Residues (Version 3.0, for Cake Mixes, Flour, Sugar, Dried Eggs, Dried Milk, and Shortening)," Horizon Laboratories Report HL10038, February 1993.

"Method for the Analysis of DDVP Residues, (Version 4.0, for Cookies, Cocoa Beans, Flour, Cereal, and Crackers)", Horizon Laboratories Report HL10039, February, 1993.

"Method for the Analysis of Hamburger Samples," Horizon Laboratories.

Some minor changes to the methods were used, depending on the commodities analyzed.

The analytical method used involves extraction with acetonitrile:water (4:1, v/v). After filtration to remove solids, the volume of extract is adjusted to a known level with acetonitrile. The acetonitrile extracts are diluted with brine solution and partitioned (3X) with methylene chloride. The methylene chloride extracts are dried with anhydrous sodium sulfate. The extracts are taken to dryness using a rotary evaporator and reconstituted in gel-permeation chromatography (GPC) solvent, methylene chloride: cyclohexane (1:1). An aliquot of sample extract is "cleaned-up" using GPC with a S-X3 Bio-Beads column. The GPC eluates are rotary evaporated just to dryness and brought to volume using isooctane. Dichlorvos in the final extract is analyzed using a GC equipped with a 30M 5% phenylmethylsilicone (Restek RT-5) 0.53 mm id capillary column, a flame photometric detector in phosphorous mode, and temperature programming. Levels of dichlorvos are quantitated using external standards and regression analysis. The method LOQ was established as 0.01 ppm for all commodities tested.

Table 2. Analytical method recovery data for various commodities.

Commodity	Fortification	% Recovery
Raw Hamburger	56.6 ug 566 ug	91.0 91.4
Cooked Hamburger	5.66 ug 113 ug	104 94.6
Raw Eggs	56.6 ug 566 ug	89.2 85.0
Cooked Eggs	5.66 ug 113 ug	119 106
Raw Pinto Beans	52.4 ug 524 ug	79.7 72.4
Cooked Beans	5.24 ug 105 ug	92.6 93.4
Bean Cooking Water	0.159 ug 3.56 ug	82.8 90.3
Raw Whole Milk	2.83 ug 28.3 ug	98.8 71.8
Pasteurized Milk	0.283 ug 5.66 ug	-- 118.9
Raw Cocoa Beans	113 ug 1130 ug	122.0 101.9
Roasted cocoa Beans	5.66 ug 113 ug	120.9 119.6
Roasted Coffee Beans	11.3 ug 113 ug	95.2 101.2
Brewed Coffee	0.113 ug 2.264 ug	109.8 101.3
Tomato Juice	56.6 ug 566 ug	109.8 102.6
Tomato Paste	5.66 ug 113 ug	123.9 110.6

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Table 2, continued

Recoveries of Dichlorvos in Various Matrices			
Commodity	Number of Samples	Fortification Level (ppm)	% Recovery
Dried Beans	3	0.01-0.25	87 ± 13.6
Field corn	2	0.01-0.25	87 ± 4.2
Walnuts	2	0.01-0.25	86 ± 19.8
Soybeans	2	0.01-0.25	82 ± 12
Oats	2	0.01-0.25	76 ± 4.9
Flour	6	0.01-10.48	96 ± 4.2
Sugar	7	0.01-0.524	87 ± 4.9
Peanuts	6	0.01-10.48	95 ± 5.5

Recoveries of Dichlorvos in Processed Commodities			
Commodity	Number of Samples	Fortification Level (ppm)	% Recovery
Whole Corn	1	3.00	79
Crude corn oil	2	0.01-5.0	100
Corn Starch	2	0.01-6.0	86 ± 7.8
Corn Grits	2	0.01-6.0	92 ± 12.0
Corn Meal	2	0.01-6.0	76 ± 4.9
Corn Flour	1	6.0	85
Corn Grain Dust	2	0.01-6.0	81 ± 1.4
Whole Soybeans	1	0.25	77
Soybean Meal	3	0.01-50.0	82 ± 10.2
Soybean Hulls	4	0.01-100	102 ± 12.9
Soybean Soapstock	2	0.01	96 ± 6.4
Soybean Crude Oil	1	5.0	100
Soybean Refined Oil	2	0.01-20.0	102 ± 2.1

Recoveries of Dichlorvos in Processed Commodities			
Commodity	Number of Samples	Fortification Level (ppm)	% Recovery
Whole wheat	4	0.05-21.9	99 ± 8.5
Wheat Bran	3	0.01-20.1	104 ± 15.1
Wheat Flour	2	0.05-2.6	84 ± 12.0
Wheat Middlings	4	0.01-5.25	88 ± 7.4
Wheat Shorts	5	0.01-5.25	100 ± 14.7
Wheat Grain Dust	2	0.06-22.1	114 ± 19.1
Whole Rice	2	0.06-21.9	100 ± 10.6
Rice Hulls	2	0.01-20.1	83 ± 5.7
Rice Bran	2	0.01-21.9	100 ± 27.6
Polished Rice	2	0.05-4.9	113 ± 15.6
Rice Grain Dust	2	0.05-21.8	107 ± 43.8
Whole Cottonseed	4	0.01-96.3	86 ± 21.1
Cottonseed Meal	2	0.01-21.9	94 ± 0.7
Cottonseed Hulls	2	0.01-65.6	80 ± 7.8
Cottonseed Soapstock	2	0.01-1.09	74 ± 2.8
Cottonseed Crude Oil	2	0.01-0.27	78 ± 4.9

Recoveries of Dichlorvos in Meat, Milk, Poultry, and Egg Commodities			
Commodity	Number of Samples	Fortification Level (ppm)	% Recovery
Dosing Capsules	4	402-409 ug	101-109%
Milk	26	0.01-0.20	70-100%
Cattle muscle	2	0.01-0.10	80-89
Cattle kidney	2	0.01-0.10	80-83
Cattle liver	2	0.01-0.10	77-80
Cattle fat	2	0.01-0.10	80-85

Dosing capsules	10	0.05-1.0	107-113
Eggs	24	0.01-0.25	73-115
Hen thigh muscle	2	0.01-0.04	70-78
Hen breast	2	0.01-0.05	80-98
Hen kidney	2	0.01-0.05	90
Hen liver	2	0.01-0.05	78-100
Hen fat	2	0.01-0.05	84-90

Recoveries of Dichlorvos in Commodities from Food Processing and Manufacturing Facilities			
Commodity	Number of Samples	Fortification Level (ppm)	% Recovery
Whole corn	3	0.01-0.25	70-120%
Ground Corn	6	0.01-5.0	74-110%
Uncleaned Oats	2	0.01-0.25	98-100
Cleaned Oats	2	0.01-0.25	93-100
Fine Groats	4	0.01-0.25	78-98
Oat hulls	2	0.01-0.25	80-84
Steel Cut Oats	9	0.01-20.0	70-100
Flaked Oats	4	0.01-30.0	76-100
Sugar	2	0.005-0.13	89-101
Flour	2	0.01-0.26	85-93
Dried Milk	2	0.01-0.26	97-116
Dried Eggs	2	0.01-0.26	91
Shortening	2	0.03-0.26	101-115
Blended mix	9	0.01-10.5	70-87

The registrant provided adequate recovery data for the analytical method. A 0.01 LOQ for most of the commodities was adequately demonstrated. Sample calculations were included in each of the reports. Quantitation was by linear regression analysis.

STORAGE STABILITY

Processed commodities. The registrant states that residues of dichlorvos were expected to be stable from the time of sampling through analysis. No storage stability data were provided with the submission.

In most cases samples were stored for a month or less after processing, however, some samples were stored for just under four months. Samples were analyzed within seven days of extraction. The Dichlorvos Residue Chemistry Chapter of 1/86 states that dichlorvos residues in on plant samples are stable for up to 90 days in frozen storage. A storage stability study on peanut processed commodities was recently reviewed (6/2/94, S. Hummel). These data will be translated to the commodities tested in this study.

Livestock Feeding Studies: Dairy Cow and Hen (MRID 43037401). Stability of dosing capsules was demonstrated. Evening milk samples were stored in a refrigerator until they were composited with the morning milk sample. Samples of milk, eggs, and tissues were placed on dry ice and shipped to ABC Laboratories. At ABC Laboratories, samples were stored at -20 C ± 10 C until processing for analysis. Length of sample storage was not stated in the report. Dates of QA inspections were provided and appeared to be close to the dates of the various parts of the study. Samples appeared to have been stored for one month prior to extraction. Another 2 months passed before QA inspection of the data, so the extracts may have been stored 2 months prior to analysis.

Food Handling Establishments: Corn Processing, Oat Manufacturing, Oat Processing, Wheat Manufacturing. The report states that samples were expected to be stable from the time of sampling through analysis. Samples were placed immediately in coolers with dry ice or blue ice until moved to a freezer within a few minutes. Samples were received frozen at the laboratory within a day of sample collection. Most samples were analyzed within one month of receipt at the laboratory; all samples were analyzed within two months of receipt of the laboratory. Samples from the Wheat Manufacturing Study were analyzed two months after collection.

For a second study of fine groats in an oat processing plant, samples were placed in plastic freezer bags and frozen at 4 F. Some samples arrived at the laboratory cold, but not frozen. Two samples arrived at the laboratory at ambient temperature.

Reduction of Residue: Residue Decline Study - Packaged and Bagged Commodities (MRID 42858201). The registrant states that residues of dichlorvos were expected to be stable from the time of sampling through analysis. No storage stability data were provided with the submission.

Samples were placed in frozen storage within 1.5 hours of sample collection, and were stored at -20 C until analysis. In most cases samples were stored for a month or less; however, some samples were stored for three months. Samples were typically analyzed within seven days of extraction. The Dichlorvos Residue Chemistry Chapter of 1/86 states that dichlorvos residues in on plant samples are stable for up to 90 days in frozen storage. These data will be translated to the commodities tested in this study. Additionally, any decline in residues in frozen storage would have affected all samples equally and would not affect determination of decline rates.

Reduction of Residue: Cooking Studies (MRID 42910701). Samples fortified with dichlorvos were used for all cooking studies except for pinto beans. All samples were analyzed before and after cooking. The length of sample storage was not stated in the report, although, since samples were spiked with dichlorvos before cooking, it appeared that the analyses were completed immediately after cooking. No storage stability data are needed to support this study.

PROCESSING STUDIES

The Dichlorvos Guidance Document (9/87) required data depicting dichlorvos residues in

i. crude and refined oil, starch, grits, meal, flour, and grain dust processed from field corn;

ii. bran, flour, middlings, shorts, and grain dust processed from wheat;

iii. hulls, bran, polished rice and grain dust processed from rice;

iv. meal, crude and refined oil, and soapstock processed from peanuts;

v. meal, hulls, soapstock, and crude and refined oil processed from cottonseed;

vi. meal, hulls, crude and refined oil, and grain dust processed from soybean;

vii. wet and dry pomace, puree, catsup, juice, and tomato paste processed from tomatoes bearing measurable weathered residues of dichlorvos.

In response, Amvac Chemical Corporation has submitted processing studies on field corn, wheat, rice, cottonseed and soybeans (1993, MRID 42993501). Dichlorvos was applied to the raw commodities at an exaggerated rate of 23.6 g ai/1000 ft^3 (approx. 10x). The exaggerated rate was used to obtain samples with finite residues. Samples were processed at Texas A&M, shipped to ABC Laboratories for storage, and analyzed at ABC Laboratories or Horizon Laboratories.

Treatment. The five commodities were placed in a 0.8 ft x 4 ft x 4 ft container lined with plastic to a depth of 4 to 6.5". The plastic lined containers were placed in a circle around the pesticide applicator. A single application of dichlorvos was made at a rate of 34.6 g ai/1000 ft^3. The air temperature was 61 - 68 F at the time of application and 50 F at the time of ventilation. The area was ventilated 5.5 hours after the application was completed. Samples were collected approximately 6 hours after the application was completed. The raw commodities were thoroughly mixed and then sampled, and placed immediately in a portable freezer on a truck (within 4 minutes). The samples were delivered to the processing facility one day later. After processing, the samples were shipped on dry ice to ABC laboratories, where they were stored frozen at -20 C. Cotton, wheat, and rice samples were then shipped to Horizon Laboratories for analysis. Other samples were analyzed at ABC Laboratories.

At Texas A&M, the samples were processed by batch simulating industrial practice as closely as possible.

Corn Wet Milling: Samples were dried and cleaned by aspiration and screening. The aspirated fractions were collected as grain dust. The corn was then steeped in water and milled into germ, hull, coarse gluten starch, gluten and starch. After drying the germ was heat conditioned, flaked and the crude oil expelled. Remaining crude oil was extracted with hexane. The presscake was desolventized, and the crude oil combined and refined.

Corn Dry Milling: Samples were dried and cleaned by aspiration and screening. The cleaned corn was moisture adjusted and milled, producing hull, grits, meal, flour, and germ. Crude oil was obtained from the germ as above.

Wheat milling: Samples were dried, and cleaned by aspiration and screening. The grain dust was collected. The cleaned wheat was moisture adjusted and broken four times in corrugated roller mills. After the bran was separated, the sample was milled into flour.

Rice Milling: The samples were cleaned by aspiration and screening. The grain dust was collected. Abrasive milling removed the hull. The samples were aspirated to separate the hull and unhulled rice from the brown rice. The bran was abrasively removed from the brown rice and separated by screening, producing white milled rice and bran.

Cottonseed: The seed was saw-delinted. The delinted seed was mechanically cracked and screened to separate the hull from the kernel. The kernels with some remaining hull was heated, flaked, expanded into collets, and the crude oil extracted with hexane. The collets were desolventized. The crude oil was refined.

Soybeans: Samples were cleaned by aspiration and screening. Insufficient grain dust was generated for collection. The hull was mechanically cracked, and aspiration used to separate the hull and kernel. The kernels were heat conditioned, flaked, expanded into collets and the crude oil solvent extracted. The spent collets were desolventized and the crude oil refined.

Results. The results of the processing studies are tabulated below.

Dichlorvos Processing Studies		
Commodity	Residue	Proc Factor
Corn Wet Milling		
Whole corn	2.74	
Crude Oil	0.03	0.011
Refined Oil	<0.01	0.004
Starch	<0.01	0.004
Grain Dust	17.8	6.496
Corn Dry Milling		
Whole corn	2.98	
Crude Oil	3.68	1.235
Refined Oil	0.41	0.138
Grits	1.58	0.530
Meal	0.63	0.211
Coarse Meal	1.65	0.554
Flour	1.74	0.584

Dichlorvos Processing Studies		
Commodity	Residue	Proc Factor
Wheat Milling		
Whole Wheat	15.64	
Bran	15.05	0.962
Flour	1.60	0.102
Middlings	4.27	0.273
Shorts	5.00	0.320
Grain Dust	19.81	1.267
Rice Milling		
Whole Rice	4.26	
Hulls	14.16	3.324
Bran	1.88	0.441
Polished Rice	0.02	0.005
Grain Dust	16.73	3.927
Cottonseed		
Whole Cottonseed	60.04	
Meal	0.45	0.007
Hulls	27.73	0.462
Soapstock	<0.01	0.000
Crude Oil	15.13	0.252
Refined Oil	1.23	0.020
Soybeans		
Whole Soybeans	16.10	
Meal	0.37	0.023
Hulls	55.10	3.422
Soapstock	<0.01	0.001
Crude Oil	9.90	0.615
Refined Oil	<0.01	0.001

Comments

The processing studies for corn wet and dry milling, wheat milling, rice milling and cottonseed are adequate. The soybean processing study is adequate, except that data are still needed for soybean aspirated grain fractions (also called grain dust).

Residues of dichlorvos did not concentrate in corn wet milled or dry milled fractions, wheat, rice or cottonseed processed commodities. Residues of dichlorvos did concentrate in soybean hulls, wheat grain dust, and rice grain dust. A Feed Additive tolerance is needed for soybean hulls. We note that Delaney considerations may preclude the setting of any 409 tolerance. Tolerances under Section 408 are needed for corn and wheat aspirated grain fractions (also called grain dust). Rice aspirated grain fractions are no longer being regulated. Data are still needed for soybean aspirated grain fractions (grain dust).

MEAT, MILK, POULTRY, AND EGGS

The Dichlorvos Guidance Document (9/87) required data depicting dichlorvos residues in the fat, muscle, liver, and kidney of ruminants sacrificed 24 hours after 28 consecutive days of ingestion of 1.3 ppm (1x), 3.8 ppm (3x), and 13 ppm (10x) of dichlorvos in the total diet (dry weight basis). Residues must also be determined in milk collected twice daily throughout the feeding period. Residues of dichlorvos must also be determined in fat, muscle, liver, and kidney of poultry sacrificed 24 hours after 28 consecutive days of ingestion of 1.6 ppm (1x), 4.8 ppm (3x), and 16 ppm (10 x) of dichlorvos in the total diet (dry weight basis). Residues must also be determined in eggs collected twice daily throughout the feeding period. Further, residues of dichlorvos must also be determined in the muscle, liver, kidney, and fat of swine fed 28 consecutive days with 2 ppm (1x), 6 ppm (3x), and 20 ppm (10x) of dichlorvos in the total diet (dry weight basis) and orally dosed once at 6 mg/lb body weight (anthelmintic use) on day 28. Animals must be sacrificed 24 hours after the final dose.

Swine must be mist sprayed with 1 fl oz of a 1% ai finished spray per day for 28 consecutive days and sacrificed within 24 hours after the final treatment. Residues must be determined in muscle, liver, kidney, fat, and skin. If residues of concern other than dichlorvos are found in the required animal metabolism studies, additional studies regarding the magnitude of such residues in cattle and poultry following direct treatment at maximum label rated are required.

In response, Amvac Chemical Corporation, Inc., submitted feeding studies for dairy cattle (1993, MRID 43037401) and laying hens (1993, MRID 43047901).

Dairy Cattle

Treatment and Sampling. Dairy cattle (1993, MRID 43037401) were orally dosed for 28 days at three different levels, 2, 6, and 20 ppm in the feed, stated to be 1x, 3x, and 10x. Freezer stability of the dosing material was demonstrated. Milk samples were collected in the evening and morning of days 1, 2, 3, 4, 7, 10, 14, and 28, and composited by day. Cows were sacrificed within 15 hours after the last dose. Muscle, fat, kidney, and liver samples were collected and homogenized. The fat sample was equal amounts of perirenal and omental fat. The muscle sample contained equal amounts of semimembranosus, triceps, and longissimus dorsi muscle tissue. The composite milk sample was placed in a half gallon container, placed on dry ice, and transported to ABC Laboratories. Tissue samples were placed in plastic bags on dry ice to await transport to ABC Laboratories. At ABC laboratories, samples were stored at -20 C ± 10 C while awaiting processing and analysis. Length of sample storage prior to analysis was not stated. Dates of dosing, sacrifice, shipping, and analysis were not stated. One month passed between QA inspections of data relating to sacrifice and extraction. An additional two months passed before QA inspection of data.

Results. No detectable residues were found in any milk or tissue sample (ND = <0.01 ppm). Representative undated chromatograms were included in the report.

Laying Hens

Treatment and Sampling. Laying hens (1993, MRID 43047901) were dosed orally for 42 days at three different levels, 2, 6, and 20 ppm in the feed, stated to be 1x, 3x, and 10x. Freezer stability of the dosing material was demonstrated. Egg samples were collected twice daily, and were sampled on days 1, 2, 3, 4, 7, 10, 14, 21, 28, 35, and 42, and composited by day. Eggs collected in the evening were refrigerated overnight and composited with morning eggs. Egg shells were discarded. Hens were sacrificed within 21 hours after the last dose. Muscle (breast and thigh), peritoneal fat, kidney, and liver samples were collected and homogenized. The composite egg sample and tissue samples were placed in plastic jars placed on dry ice, and transported to ABC Laboratories. At ABC laboratories, samples were stored at -20 C ± 10 C while awaiting processing and analysis. Length of sample storage prior to analysis was not stated. Dates of dosing, sacrifice, shipping, and analysis were not stated. Less than one month passed between QA inspections of the data relating to sacrifice and extraction. An additional 3 months passed before QA inspection of the Draft Report. (No QA inspection of the data was reported.)

Results. No detectable residues were found in any egg or tissue sample (ND = <0.01 ppm). Representative undated chromatograms were included in the report.

Comments

Since non-detectable residues (<0.01 ppm) were found after oral dosing at approximately 10x the dietary burden, tolerances are not needed to cover secondary residues of dichlorvos in livestock tissues, milk, and eggs. This conclusion can also be extended to secondary residues of dichlorvos in swine, even though no feeding study was submitted for swine.

Livestock direct dermal uses are also registered, and could potentially result in residues of dichlorvos in livestock commodities. Existing ruminant and poultry dermal studies discussed in the Residue Chemistry Chapter of the Registration Standard (2/26/86) are acceptable. No detectable residues are expected from the registered dermal uses on ruminants and poultry.

The required swine dermal study was not submitted and is required. The following has been required.

> Swine must be mist sprayed with 1 fluid ounce of a 1% ai finished spray per day for 28 consecutive days and sacrificed within 24 hours after the final treatment. Residues must be determined in muscle, liver, kidney, fat, and skin.

Dermal uses in swine could result in residues on skin, which is an edible commodity. For this reason, dermal studies on ruminants and/or poultry cannot be translated to swine.

FOOD HANDLING ESTABLISHMENTS

The Dichlorvos Guidance Document (9/87) required a petition for a food additive regulation to cover residues of dichlorvos from the use in food areas of food handling establishments, restaurants, or other areas where food is prepared or processed. The following data were required:

> Food service establishments (restaurants and groceries) must be treated via space treatment (PrL), food manufacturing establishments (two types) must be treated via space treatment (PrL). Treatments must be made at maximum registered rates. From these applications, residues of concern from direct deposition of spray droplets on food, volatilization and subsequent absorption by foods, and all

other possible modes of exposure of foods and residue transfer routes as outlined in the EPA Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, 171-04(C)(5) must be determined. Representative food samples must be examined for residues of concern from these possible modes of exposure, the food must include an oily food (e.g., butter), baked cereal products, beverages, raw and processed meat, and fresh fruits, and vegetables (lettuce). Tests must also include conditions of possible misuse of dichlorvos formulations, e.g., applying an exaggerated rate of direct application of dichlorvos to exposed foods (refer to EPA Pesticide Guidelines for details of the type of data required). Final disposition of the food additive regulation is dependent upon the Agency's position regarding the Delaney Clause issues.

Amvac states that they will support use of dichlorvos on products stored in warehouse and/or processing plant environment. They state that exposed products may include bulk stored grains, sugar, flour, beans, finished baking goods, grocery products, etc. They further state they **are not** supporting the use of dichlorvos in meat slaughter and/or packing plants, or on fresh fruits and vegetables (including tomatoes).

In response, Amvac Chemical Corporation submitted four studies on Magnitude of Residue for Dichlorvos in Food Handling Establishments: Corn Processing Facility (MRID 42775901); Oat Processing Facility (MRID 42768702), with a supplement for Animal Feed Streams in an Oat Processing Facility (MRID 42878801); Oat Manufacturing Facility (MRID 42910801); and Wheat Manufacturing Facility (MRID 42910901). Details about the locations were included in Confidential Appendices to the Studies.

Corn Processing Facility (MRID 42775901) The test site was an established grain processing mill. Whole corn is processed into ground corn at the facility. The ground corn is then stored in bins at the facility. Prior to this study, the facility had received 14 treatments with dichlorvos at the rate of 1 oz/1000 ft^3 within the past year at intervals of 2 to 6 weeks. The ambient air temperature inside the facility was maintained at 60 F. All personnel (except those in protective gear) were removed from the facility for approximately 7.5 hours after application (approximately 1 hour after venting) until detection devises indicated that the levels of dichlorvos inside the facility had declined to a safe level.

Treatment. Dichlorvos was applied at a rate of 2.27 g ai/1000 ft^3 commercial fogging equipment. The application took 2 hours. The ventilation system was turned off from the beginning of the application to 7.5 hours later.

Sampling. Pre-treatment samples were collected 4 days prior to application. A scoop was used to collect whole corn samples. A dredge which automatically opened was used to collect ground corn samples from the surface of the bin. Samples were placed in metal cans and in coolers with dry ice, transferred to a freezer within a few hours, and shipped to the laboratory within 1 day. During transit, samples were on dry ice or in portable freezers. At ABC laboratories, samples were stored frozen at -20 C until analysis. Typical treatment samples were collected 8-9 hours after termination of application, and were representative of 1, 3, and 6 turnovers of the material through the processing equipment (1 turnover = time to move through the processing equipment). Exposed samples were collected 6, 15, and 27 hours after termination of application.

Results.

Dichlorvos residues in whole corn samples collected at the first turnover period were 0.01 ppm and <0.01 ppm; at the third turnover period, 0.01 ppm; and at the sixth turnover period, <0.01 ppm. Dichlorvos residues in ground corn samples collected at the first turnover period were 0.14 and 0.06 ppm; at the third turnover period, 0.04 ppm and 0.02 ppm; and at the sixth turnover period, 0.02 ppm.

In the exposed ground corn samples collected 6 hours after application termination, residues of dichlorvos were <0.01 ppm.

Comments

The food handling study for the corn processing facility is adequate. Residues reported were all less than the current tolerance of 0.5 ppm.

Oat Processing Facility (MRID 42768702), with a supplement for Animal Feed Streams in an Oat Processing Facility (MRID 42878801). Prior to this study, the facility had received 14 treatments with dichlorvos at the rate of 1 oz/1000 ft^3 within the past year at intervals of 2 to 6 weeks. The ambient air temperature inside the facility was maintained at 60 F. All personnel (except those in protective gear) were removed from the facility for approximately 7.5 hours after application (approximately 1 hour after venting) until detection devises indicated that the levels of dichlorvos inside the facility had declined to a safe level.

Treatment. Dichlorvos was applied at a rate of 2.27 g ai/1000 ft^3, using commercial fogging equipment. The application took 2 hours. The ventilation system was turned off from the beginning of the application to 7.5 hours later.

Sampling. Six types of samples were collected and were representative of the different processing phases at the facility. These types of samples were unclean oats, cleaned oats, fine groats (used as animal feed), whole groats, oat hulls, and steel cut oats (intermediate product, which is then manufactured into a final product at an oat manufacturing plant). Pre-treatment samples were collected 4 days prior to application, during the last routine processing period prior to shutdown, cleanup and application of dichlorvos. Samples were collected in duplicate. A scoop inserted into the material stream was used to collect samples at various points in the processing. At least six scoops of material were included in each 2 lb sample. Samples were placed in metal cans and in coolers with dry ice, transferred to a freezer within a few hours, and shipped to the laboratory within 1 day. During transit, samples were on dry ice or in portable freezers. At ABC laboratories, samples were stored frozen at -20 C until analysis. Typical treatment samples were collected 8-9 hours after termination of application, and were representative of 1, 3, and 6 turnovers of the material through the processing equipment. One turnover was defined as the time it takes the commodity to move through the processing equipment. Fine groats are handled differently in the facility; three samples were collected at different times during normal operation. Exposed commodity samples were collected 6, 15, and 27 hours after termination of application. The exposed commodity was not identified. Exposed samples were considered atypically treated because they were in open containers in the facility. The sample collected 6 hours after application was exposed during the application of dichlorvos. The samples collected 15 hours after application were placed in the facility 6 hours after application and exposed to any remaining dichlorvos for 9 hours. The samples collected 27 hours after application were placed in the facility 15 hours after application and exposed to any remaining dichlorvos for 12 hours.

Results. Residues of dichlorvos were reported for each commodity collected at three different times. Residues of dichlorvos were reported for exposed commodities at three different locations. The results of the study are tabulated below.

Type of Sample	Residue of Dichlorvos (ppm) at Equipment Turnover Number		
	1	3	6
Uncleaned Oats	<0.01	<0.01	<0.01
Cleaned Oats	0.16, 0.63	0.03, 0.04	0.04, 0.14
Fine Groats	2.47, 2.17	3.68, 6.08	8.10, 3.30
Kiln Inlet Groats	0.63, 0.36	0.16, 0.14	0.09, 0.08
Oat Hulls	1.34, 0.60	0.47, 0.36	0.35, 0.43
Steel Cut	1.01, 0.95	0.43, 0.49	0.53, 0.54

Dichlorvos Residues in Exposed Commodity Samples

Commodity Location	Dichlorvos Residue (ppm) at Time after Exposure (hours)		
	6	9*	12*
31	4.20, 4.13	0.38, 0.43	0.42, 0.38
32	6.60, 10.40	0.16, 0.19	0.12, 0.08
34	4.13, 2.85	0.42, 0.79	0.53, 0.48

* The 9 hour and 12 hour samples were not present until during the dichlorvos application, but were placed in the facility when the 6 hour and 9 hour samples were collected, respectively. Residues of dichlorvos from the 9 hour and 12 hour samples were a result of deposition or redeposition of dichlorvos from other commodities, equipment, air, or surfaces in the facility.

Comments

The oat processing facility study is acceptable. Finite residues are found in all fractions produced at the facility. Except for fine groats, reported residues were lower than the 4 ppm tolerance needed to cover residues from treatment of raw oats.

Additional Oat Processing Facility Study

An additional study was conducted to investigate residues in fine groats. Fine groats are used for livestock feed and consist of approximately 30% whole groats, 50% dust, and 20% flakes.

Treatment. The same facility was treated at the rate of 1.8 g/1000^3, 12 days after an earlier application.

Sampling. Samples of fine groats were collected from the process stream at various times after treatment with dichlorvos. Samples were also collected from trucks leaving the plant with animal feed (fine groats, better mixed). Samples were placed in plastic freezer bags which were frozen at 4 F until shipped to the laboratory. Some samples were received at the laboratory cold, but without sufficient dry ice to freeze the entire shipment. Two of the truck samples were shipped without dry ice and were received in the laboratory at ambient temperature.

Results. The report indicates that residues of dichlorvos in the dust from the facility varied in a sinusoidal pattern. They theorize that when the material moves faster through the plant, there is less time to absorb dichlorvos, and when it moves more slowly through the plant, the residues of dichlorvos are higher.

Residues of dichlorvos in fine groats are tabulated below by time of sampling. Residues of dichlorvos in fine groats before treatment with dichlorvos were reportedly 0.11 - 0.24 ppm (probably resulting from past treatment with dichlorvos 12 days earlier). The registrants point out that, while the residues of dichlorvos in the process stream varied widely, the residues in the trucks of animal feed leaving the plant were all less than the tolerance of 0.5 ppm.

Residues of Dichlorvos in Fine Groats vs. Time of Sampling

Sampling time (hours after treatment)	Dichlorvos Residue (ppm)
6:25	1.58
6:30	1.44
8:30	1.46
8:31	1.33
10:30	0.96
10:32	0.80
12:30	1.01
12:32	0.89
14:30	1.22
14:32	1.01

Sampling time (hours after treatment)	Dichlorvos Residue (ppm)
16:30	0.60
16:32	1.40
18:30	0.48
18:32	0.53
20:30	0.37
20:35	0.20
22:30	0.51
22:35	0.56
Truck 6	0.44
Truck 30	0.31
Truck 33	0.22
Truck 34	0.10

Comments

The submitted study shows variations in the dichlorvos residues in fine groats with time. We note that the animal feed product leaving the processing plant had residues less than the current tolerance of 0.5 ppm. All dichlorvos residues in fine groats were less than 2 ppm and should be adequately covered by the 4 ppm tolerance needed for raw oats.

Oat Manufacturing Facility (MRID 42910801). The facility used was a commercial oat manufacturing facility. Prior to this study, the facility had received 14 treatments with dichlorvos at the rate of 1 oz/1000 ft^3 within the past year at intervals of 2 to 6 weeks.

The ambient air temperature inside the facility was maintained at 60 F. All personnel (except those in protective gear) were removed from the facility for approximately 7.5 hours after application (approximately 1 hour after venting) until detection devises indicated that the levels of dichlorvos inside the facility had declined to a safe level.

Treatment. Dichlorvos was applied at a rate of 2.27 g ai/1000 ft^3, using commercial fogging equipment. The application took 2 hours. The ventilation system was turned off from the beginning of the application to 7.5 hours later.

Sampling. Samples were collected prior to application and at various times representative of the time needed for that material to pass through the processing equipment. Samples of fine groats (animal feed), steel cut oats samples (prior to steaming), and flaked oat samples were collected. Additional samples of flaked oats were placed in open containers at three locations to measure atypical exposure of an exposed commodity. One exposed sample was present during treatment and for six hours after treatment. One exposed sample was placed in the facility 6 hours after treatment and left exposed for 9 hours. One exposed sample was placed in the facility 15 hours after treatment and left exposed for 12 hours.

Pre-treatment samples were collected 4 days prior to application, during the last routine processing period prior to shutdown, cleanup and application of dichlorvos. Samples were collected in duplicate. A scoop inserted into the material stream was used to collect samples at various points in the processing. At least six scoops of material were included in each 2 lb sample. Samples were placed in metal cans and in coolers with dry ice, transferred to a freezer within a few hours, and shipped to the laboratory within 1 day. During transit, samples were on dry ice or in portable freezers. At ABC laboratories, samples were stored frozen at -20 C until analysis. Typical treatment samples were collected 8-9 hours after termination of application, and were representative of 1, 3, and 6 turnovers of the material through the processing equipment. One turnover was defined as the time it takes the commodity to move through the processing equipment. Fine groats are handled differently in the facility; three samples were collected at different times during normal operation. Exposed commodity samples were collected 6, 15, and 27 hours after termination of application. The exposed commodity was not identified.

Results. The registrants state that the first 400 lb of oats passing through the facility is collected for animal feed, and thus all samples collected during the time period of this study would be routinely collected for animal feed. Residues of dichlorvos in pre-application samples were non-detectable (<0.01 ppm).

Type of Sample	Residue of Dichlorvos (ppm) at Different Sampling Times		
	1	2	3
Steel Cut Oats (steamer)	0.42, 0.07	0.02, 0.03	0.03, 0.03
Fine Groats	0.14, 0.10	12.2, 8.63	--
Flaked Oats	0.97, 0.86	0.37, 0.37	0.42, 0.37

Dichlorvos Residues in Exposed Commodity Samples

Commodity Location	Dichlorvos Residue (ppm) at Time after Exposure (hours)		
	6	9*	12*
22	4.65, 3.19	1.12, 2.14	--
33	16.1, 5.63	0.60, 0.87	0.80, 1.16
25	19.6, 28.9	1.59, 1.16	1.29, 0.80

* The 9 hour and 12 hour samples were not present until during the dichlorvos application, but were placed in the facility when the 6 hour and 9 hour samples were collected, respectively. Residues of dichlorvos from the 9 hour and 12 hour samples were a result of deposition or redeposition of dichlorvos from other commodities, equipment, air, or surfaces in the facility.

Comments

Dichlorvos residues in the final product from the oat manufacturing facility, flaked oats, are less than 1 ppm and should be adequately covered by the 4 ppm tolerance needed for raw oats. We note that the exposed samples had residues up to 30 ppm.

Wheat Manufacturing Facility (MRID 42910901). The site chosen was a manufacturing facility where baking mixes are manufactured. In the six months prior to the test, the facility received 10 applications of 5% dichlorvos at the rate of 0.5 oz/1000 ft^3 (0.7 g ai/1000 ft^3) at two to five week intervals. Ingredients mixed at the facility include flour and sugar, dried eggs, dried milk, and shortening. The ingredients are contained in enclosed systems during the weighing and mixing process.

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Treatment. The facility received an application of dichlorvos 5% PrL at the rate of 2.4 g ai/1000 ft^3. The air temperature was 72-78 F.

Sampling. Pre-treatment samples were collected one day prior to application. Treated samples were collected starting 6 hours after termination of application through 14 hours after termination of application. Samples were placed in metal cans with resealable lids, placed in coolers, frozen, and transported to the laboratory 2 days later. Flour and sugar samples were collected from a scale using a minimum of 6 scoops of material. A second replicate was collected immediately afterward. Milk samples were collected from previously opened bags of dried milk. Egg samples were collected from previously opened boxes of dried eggs. A minimum of six scoops were removed from the bag for each sampling interval. Shortening was sampled from a bulk tank adjacent to the mixer using a dipper. Samples of shortening were also collected at the spigot over the mixer. Samples of finished mix were collected from the first and third batches of blended mix.

The exposed commodity used for this test was a blended mix produced the day before application. The exposed commodity samples were collected 6.5 hours to 27 hours after termination of application.

Results. Residues reported in preapplication samples were non-detectable (<0.01 ppm) for all commodities.

Type of Sample	Residue of Dichlorvos (ppm) at Equipment Turnover Number	
	1	3
Flour	0.075, 0.055	0.055, 0.027
Sugar	0.094, 0.069	0.022, 0.027
Dried milk	0.052, 0.047	0.10, 0.073
Dried eggs	0.034, 0.039	0.093, 0.12
Shortening (tank)	<0.032	<0.032
Shortening (mixer)	<0.032, 0.034	<0.032, 0.036
Blended mix (mixer)	0.38, 0.30	0.19, 0.17
Blended Mix (tram)	<0.01	<0.01
Blended Mix (packaged)	0.017-0.17	0.014-0.019

Dichlorvos Residues in Exposed Baking Mix Samples

Commodity Location	Dichlorvos Residue (ppm) at Time after Exposure (hours)		
	6	9*	12*
1	5.42, 4.99	1.15, 1.13	0.67, 0.60
2	9.63, 7.75	0.56, 0.59	0.22, 0.17
3	4.61, 4.66	1.13, 1.18	0.42, 0.35

* The 9 hour and 12 hour samples were not present until during the dichlorvos application, but were placed in the facility when the 6 hour and 9 hour samples were collected, respectively. Residues of dichlorvos from the 9 hour and 12 hour samples were a result of deposition or redeposition of dichlorvos from other commodities, equipment, air, or surfaces in the facility.

Comments

Dichlorvos residues reported in the components of the baking mix and the final blended mix were all <0.5 ppm, and should be adequately covered by the 4 ppm tolerance needed to cover dichlorvos residues in processed packaged and bagged commodities. We note that Delaney considerations may preclude the setting of this tolerance. In exposed samples, residues of dichlorvos could be up to 10 ppm.

REDUCTION OF RESIDUE (DEGRADATION DATA)

The Dichlorvos DCI of 9/20/91 required reduction of residue data depicting anticipated residues in packaged or bagged raw agricultural commodities and processed foods. Degradation data were required reflecting aerosol application of dichlorvos from a pressurized liquid formulation at 50 g ai/50,000 ft^3 to packaged or bagged dried beans, peanuts, oats, corn, soybeans, and tree nuts collected 6 hours after aerosol treatment.

In response, Amvac Chemical Corporation, Inc., submitted a study entitled, "Reduction of Residues - Dichlorvos Half-life in Non-perishable Raw Agricultural Commodities and Processed Foods: Warehouse Storage of Packaged and Bagged Commodities (1993, MRID 42858201).

The purpose of this study was to determine the half-life of dichlorvos residues in or on packaged and bagged commodities following four weekly dichlorvos treatments at 2 grams/1000 ft^3

(maximum labeled use rate). Eight commodities were selected as representative of packaged and bagged commodities routinely stored in a warehouse, dried beans, field corn, flour, oats, peanuts, soybeans, sugar, and walnuts.

This study was conducted in conjunction with the magnitude of the residue study on packaged and bagged commodities described in our review of 6/2/94 (S. Hummel). It was conducted in the same simulated warehouse at the same time.

The half-life for dichlorvos residues was obtained using data from specific sampling intervals and assuming first order kinetics.

Treatment. Individual consumer sized packages were removed from the outer packaging to maximize the potential for exposure. The test facility, a simulated warehouse facility, and the commodities inside received four sequential applications of Dichlorvos (5% PrL formulation) at weekly intervals, using a commercial fogger. A 5.1% PrL formulation was applied to a space at 1.99 - 2.06 grams ai/1000 ft^3, i.e, 546 ml of formulated product applied over ca. 4 minutes. Ventilation of the testing area was initiated six hours after treatment.

Sampling. Pre-treatment samples were collected prior to application. Duplicate post-treatment samples were collected at approximately 6, 12, 24, 48, 96, and 168 hours following application. For consumer sized packages, two packages of each commodity were removed at each sampling interval and placed into residue bags. Commercial sized packages were sampled by collecting with a grain thief, a clear plastic tube (flour) or specially constructed wire baskets.

Results.

Dried beans - Dichlorvos residues observed at the initial sampling interval (6 hrs post-application) were 1.74 - 2.21 ppm. Dichlorvos residues declined with time to 0.71 - 0.77 ppm, 168 hrs post-application. The half-life calculated was 139 hours (5.8 days). The r-squared value of the regression analysis (ln residue vs. time) was 0.77, indicating a fairly good correlation between sample residue and time.

Field corn - Dichlorvos residues observed at the initial sampling interval (6 hrs post-application) were 0.34 - 0.83 ppm. Dichlorvos residues did not decline with time.

Flour - Dichlorvos residues observed at the initial sampling interval were 5.67 - 7.62 ppm. Dichlorvos residues did not decline with time.

Oats - Dichlorvos residues observed at the initial sampling interval were 0.31 - <u>0.83</u> ppm. Dichlorvos residues did not decline with time.

Peanuts - Dichlorvos residues observed were 1.72 - <u>9.62</u> ppm. Dichlorvos residues did not decline with time.

Walnuts - Dichlorvos residues observed were <0.01 - <u>0.03</u> ppm. Regression analysis indicated no correlation between degradation of dichlorvos residues and time.

Soybeans - Dichlorvos residues observed at the initial sampling interval were 0.10 - <u>0.13</u> ppm. Dichlorvos residues did not decline with time.

Sugar - Dichlorvos residues observed at the initial sampling interval were 0.36 - <u>0.38</u> ppm. Dichlorvos residues declined with time to 0.02 - 0.03 ppm, 168 hrs post-application. The r-squared value obtained from the first order regression analysis using all sample values was 0.922 indicating good correlation between dichlorvos residues and time. The half-life calculated from these data was 44 hrs. (1.8 days).

<u>Comments</u>

The decline data clearly indicate that dissipation of dichlorvos residues in or on packaged and bagged commodities is matrix dependent. Decline in dichlorvos residues was reported only for packaged dry beans and sugar. Information concerning the typical length of time commodities remain in storage following treatment with dichlorvos may allow for a more accurate exposure estimate for packaged and bagged dry beans and sugar. This information would include typical total storage times, frequency of applications, and rates of application (g/1000 ft^3).

<u>REDUCTION OF RESIDUE (COOKING)</u>

The Dichlorvos Guidance Document (9/87) required reduction of residue (cooking) data depicting dichlorvos residues in

i. cooked meat and eggs, and pasteurized milk,
ii. cocoa butter and chocolate;
iii. coffee beverage as consumed

prepared from uncooked meat, eggs, milk, cocoa beans, and coffee beans bearing measurable residues. Residue levels in both the uncooked commodities and the cooked foods were required to be reported.

The Dichlorvos DCI of 9/20/91 required reduction of residue data depicting dichlorvos residues in cooked dried beans and processed coconut oil and bearing weathered measurable residues. Residue levels in both uncooked/unprocessed commodities and in the cooked/processed foods were required. Later, the requirement for data on coconut oil was waived (D. McNeilly, 3/18/92, CB 9368), provided data were available for another oily commodity, such as peanut oil.

In response, Amvac Chemical Corporation, Inc. submitted data (1993, MRID 42910701) for seven test systems:

A. Hamburger Meat: uncooked and cooked (fried in teflon pan without added oil)
B. Chicken Eggs: uncooked and cooked (scrambled, fried, in teflon pan without added oil)
C. Dry Pinto Beans: uncooked and cooked (refried beans, mashed after draining off cooking water, and fried in teflon pan; cooking water analyzed separately)
D. Cow Milk: raw (butterfat content 3.8%) and pasteurized (using low temperature long time procedure (62.8 C for 30 min) rather than high temperature short time procedure (71.7 C for 15 sec)
E. Cocoa Beans: unprocessed whole beans and roasted whole beans processed to chocolate liquor (prepared by finely grinding roasted cocoa nibs; precursor to cocoa butter and chocolate powder)
F. Coffee Beans: roasted whole beans and brews (percolated 8 min after boiling commenced) prepared from roasted whole beans (roasted beans, not green coffee beans) are stored in warehouses)
G. Tomatoes: Tomato juice free of skins and seeds and tomato paste prepared from tomato juice (The reason for starting study using tomato juice rather than the required tomatoes containing weathered residues was not stated.)

In all studies except those on dry pinto beans, fortified samples containing dichlorvos residues were used. For dry pinto beans, incurred residues of dichlorvos were present from another study.

The amount of dichlorvos found in raw and processed samples was measured in ug. Changes in weight during processing were not taken into account. Weights of the cooked commodities were not reported. Percent weight changes were reported. Hamburgers lost 37.1% of their precooked weight. Eggs lost 15.9% of their precooked weight. Weight changes in pinto beans, cocoa beans, and coffee beans were not reported. The tomato juice used had a dry matter content of 4.8%, and the resulting tomato paste, 26%. Results were reported as follows. Uncooked samples were spiked at approximately 50 ug/100 g sample and 500 ug/100 g sample.

Average Recovery of Dichlorvos after Cooking (based on weight of uncooked sample)		
Commodity	**% DDVP Recovery**	**% DDVP Loss**
Cooked Hamburger	30.1	69.9
Scrambled Eggs	62.0	38.0
Cooked Pinto Beans	0.2	99.8
Bean cooking water	0.7	99.3
Pasteurized Milk	92.5	7.5
Chocolate liqueur	0.3	99.7
Brewed Coffee	29.4	70.6
Tomato paste from juice	9.7	90.3

The study authors noted a correlation between percent loss of DDVP and the time and/or temperature of cooking or processing. The percent of dichlorvos lost due to processing was based on the amount (ug found) in the raw sample and the amount (ug found) found in an equivalent amount of the processed sample, so that changes in weight during processing were not taken into account.

Raw Commodity	Processing Conditions		Dichlorvos Lost (%)
	Temperature	Time	
Cocoa Beans	135 C	10 min	99.7%
Dry Pinto Beans	>95 C	90 min	99.1%
Tomato Juice	80 C	40 min	90 %
Ground Roasted Coffee Beans	100 C	8 min	71 %
Raw Hamburger Meat	>100 C	6 min	70 %
Raw Eggs	>100 C	3 min	38 %
Raw Whole Milk	62.8 C	30 min	7 %

<u>Comments</u>

The submitted Reduction in Residue/Cooking study is adequate. All Commodities tested lost dichlorvos during cooking. We agree with the registrant's conclusion that the loss of dichlorvos seemed to be correlated with time and temperature of cooking (longer time and higher temperature produced greater loss of dichlorvos). These data on reductions during cooking can be translated to other similar food products.

cc: RF, circu, SF, Dichlorvos RSF, S. Hummel, PM#?
RDI:FBS:07/14/94:MSM:07/18/94
7509C:SVH:svh:CM#2;Rm804:X57324:07/18/94