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EXPEDITE

MEMORANDUM

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

SUBJECT: Maneb (014505) Dietary exposure to Maneb and ETU;
Storage Stability, Residue, and Processing Data
submitted in response to the Maneb Special Review
(Storage Stability) Data Call In Notice of 3/31/87
Pennwalt letter of 2/29/88: Validation of previously
submitted animal feeding studies. [MRID Nos. 405401-01
to -24, 405542-01 to -04, 405873-01 to -07, RCB Nos.
3530, 3531, 3553, 3555]
3552

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The purpose of this memo is to estimate residues of maneb and ETU in human food items based on available residue and processing data, and animal feeding studies. The residue estimates will then be used to estimate dietary exposure and risk using the Tolerance Assessment System (TAS). Chronic exposure and risk will be estimated for maneb and ETU. Acute exposure and risk will be estimated for ETU.

Pennwalt Corporation has submitted 35 volumes of residue data, processing data, and storage stability data in response to the Special Review (Storage Stability) Data Call In Notice of 3/31/87. Pennwalt's letter of 2/29/88 contains a summary of storage stability data for animal commodities and sample storage lengths and conditions for the animal feeding studies.

The Storage Stability Data Call In Notice of 3/31/87 required residue data on all crops having tolerances for maneb under 40 CFR 180.110. Process conversion residue studies were required for all processed fractions of apples, green beans, potatoes, tomatoes, grapes and sugar beets. New animal feeding studies were required. Storage stability data were required on four crops (apples, lettuce, spinach, and tomatoes); all

processed commodities; and all meat/poultry commodities. Fortified storage stability studies were required. Additionally, storage stability data for weathered samples was required for the parent compound, maneb. All studies were required to be submitted by 3/1/88. Additional residue chemistry data were required by the Maneb Comprehensive Data Call In Notice of 4/1/87. A Registration Standard for Maneb is in preparation (W. Hazel, personal communication, 4/1/88). The Residue Chemistry Chapter for the Maneb Registration Standard and several updates have been completed (8/25/86, 3/31/87, and 3/31/87). A Special Review was initiated for maneb and the other EBDC fungicides on 7/10/87. An earlier Special Review (RPAR) of the EBDC fungicides was concluded on 10/14/82 with the publication of the EBDC Decision Document. The EBDC fungicides were being reassessed as part of a settlement agreement negotiated with the National Resources Defense Council (NRDC). Residue Chemistry data necessary for the reassessment were required in Data Call In Notices dated 10/19/84 and 4/30/85.

A bibliography of available residue data is included in this review as Attachment I.

We have made estimates of maneb and ETU residues, based on the available residue and processing data. Our residue estimates are tabulated below. These residue estimates and the percent crop treated information from BUD in their memo of 5/27/88 (E. N. Pelletier, SSB; and G. Ballard, EAB) will be used by the TAS staff in estimating dietary exposure. For meat, milk, poultry, and eggs, the residue estimates will be adjusted by the percent crop treated for apples, since maneb residues in apple pomace comprise 80-98% of the total dietary burden of maneb.

The data submitted in response to the 3/31/87 Storage Stability Data Call In Notice were not reviewed for compliance with the 4/1/87 Comprehensive Data Call In Notice. No comments are made regarding geographic representation. The registrant's calculations could not be verified because no chromatograms were submitted from any of the studies.

SUMMARY OF RESIDUE ESTIMATES

Residue estimates to be used in the Special Review are the best available estimates. We have used the average maneb residues from residue field trial data from studies closest to the maximum rate and minimum PHI. For ETU residues, we have used the average ETU residue from residue field trial data from studies closest to the maximum rate, minimum PHI, and at least the typical number of applications. The ETU residue estimates have been corrected for loss of ETU residue on sample storage when the loss on storage exceeded 20%.

For maneb residues in processed commodities of apples, we have multiplied the best available estimate for the raw agricultural commodity by the concentration factor determined for metiram in the metiram processing studies. For maneb residues in processed commodities of sugar beets, tomatoes, snap beans, and grapes, we have multiplied the best available estimate of maneb residues for the raw agricultural commodity by the concentration factor determined in the maneb processing studies. For potatoes, no processing study was submitted, and no concentration of metiram or conversion to ETU was demonstrated in the metiram potato processing study.

For ETU residue estimates in processed commodities, we have multiplied the maneb residue estimate for the raw agricultural commodity by the percent conversion determined in the metiram or maneb processing study, and added the ETU residue estimate from the raw agricultural commodity.

Residue estimates in animal commodities were determined by calculating the estimated dietary burden if livestock are fed with animal feed items treated with maneb. The average residue from residue field studies was used in the estimation of the dietary burden. The estimated dietary burden was then compared to the residues found in animal commodities in animal feeding studies.

Our best available estimates are tabulated below.

Summary of Maneb Residue Estimates

Crop	Average Residues (ppm)	
	Maneb	ETU
Carrots	10	0.023
washed	5	0.023
cooked	5	1.3
Potatoes	0.077	0.003
washed	0.038	0.003
baked flesh	0.038	0.13
baked skins	0.038	0.53
baked whole	0.038	0.17
Wet Peel	0.077	0.003
Dry Peel	0.077	0.003
Potato Chips	0.077	0.003
Potato Granules	0.077	0.003
Sugar Beets	0.52	0.004
White Sugar	0.20	0.004
Molasses	0.20	0.004
Dried Pulp	0.68	0.004
Sugar Beet Tops	42	0.5

Summary of Maneb Residue Estimates, cont

Crop	Average Residues (ppm)	
	Maneb	ETU
Turnips	14	0.29
washed	6.8	0.29
cooked	6.8	2.1
Turnip Tops	48	0.29
washed	29	0.29
cooked	29	6.0
Onions, Green	20.	0.060
washed	10.	0.060
cooked	10.	2.5
Onions, bulb	5.9	0.16
washed	2.9	0.16
cooked	2.9	0.93
Celery	65	0.35
washed	39	0.35
cooked	39	8.1
Lettuce, Leaf	23	0.62
washed	14	0.62
Lettuce, Head	6.8	0.052
washed	4.1	0.052
cooked	4.1	0.86
Spinach	44.	0.092
washed	26	0.092
cooked	26	5.4
Collards	44	0.092
washed	26	0.092
cooked	26	5.4
Mustard Greens	51	0.092
washed	31	0.092
cooked	31	6.2
Broccoli, unwashed	20	0.092
washed	12	0.092
cooked	12	2.5
Kohlrabi	20	0.092
washed	12	0.092
cooked	12	2.5
Brussels Sprouts	20	0.092
washed	12	0.092
cooked	12	2.5
Cabbage, untrimmed	3.0	0.040
Cabbage, trimmed	0.85	0.002
washed	0.51	0.002
cooked	0.51	0.10
Chinese Cabbage	0.85	0.002
washed	0.51	0.002
cooked	0.51	0.10
Cauliflower	0.85	0.002
washed	0.51	0.002
cooked	0.51	0.10

Summary of Maneb Residue Estimates, cont.

Crop	Average Residues (ppm)	
	Maneb	ETU
Kale	22	0.11
washed	13	0.11
cooked	13	2.8
Beans, Succulent	3.1	0.075
Cooked/canned	0.031	0.31
Cooked/frozen	0.22	0.19
Cooked/pureed	0.031	0.23
Cannery waste	4.0	0.14
Beans, Dry	2.5	0.045
washed	0.18	0.045
cooked	0.18	0.24
Succulent Bean Vines	644	1.7
Dry Bean Vines	216	6.2
Peppers	7.1	0.08
washed	5.0	0.08
cooked	5.0	0.41
Tomatoes	4.2	0.002
washed	3.0	0.002
Wet pomace	2.6	0.025
Dry pomace	1.4	0.075
Canned whole	1.4	0.025
Catsup	1.4	0.025
Paste	1.4	0.075
Juice from paste	1.4	0.075
Eggplant-see tomatoes		
Cucumber	0.75	0.060
washed	0.52	0.060
cooked	0.52	0.094
Squash	0.95	0.002
washed	0.66	0.002
cooked	0.66	0.044
Melons	1.6	0.015
washed	1.1	0.015
cooked	1.1	0.089
Pumpkin	1.6	0.015
washed	1.1	0.015
cooked	1.1	0.089
Apples	13	0.210
washed	9.4	0.210
cooked-see applesauce		
Fresh Juice	0.67	0.78
Cooked Juice	0.67	0.64
Wet Pomace	62	2.56
Dry Pomace	174	14
Apple Sauce	1.2	0.64
Apple Baby Food	0.67	0.64

Summary of Maneb Residue Estimates

Crop	Average Residues (ppm)	
	Maneb	ETU
Apricots	34	2.5
washed	24	2.5
cooked	24	2.6
Peaches	69	1.4
washed	48	1.4
cooked	48	1.7
Nectarines	21	0.41
washed	15	0.41
cooked	15	0.50
Grapes	11	0.26
washed	7.6	0.26
cooked	7.6	0.32
Dry Pomace	6.9	0.74
Wet Pomace	6.4	0.42
Thick juice	0.41	5.2
Raisins	3.1	0.86
Raisin Waste	17	1.6
Almonds	0.44	0.010
Almond Hulls	117	0.020
Sweet Corn (K+CWHR)	0.30	0.004
washed	0.02	0.004
cooked	0.02	0.021
Corn Fodder	42	0.10
Corn Cannery Waste	3.8	0.048
Bananas, whole	0.070	0.016
Banana, edible portion	0.050	0.018
Figs	0.95	0.015
Cranberries	0.40	0.012
Papayas	2.8	0.002
Rhubarb	65	0.35
washed	39	0.35
cooked	39	8.1
<u>Beef Commodities</u>		
Milk	0.065	0.050
Liver	0.18	0.054
Muscle	0.06	0.024
kidney	0.11	0.050
Fat	0.10	0.002
<u>Poultry Commodities</u>		
Whole eggs	0.007	0.006
Liver	< 0.01	0.008
Kidney	< 0.01	0.008
Muscle	0.012	0.009
Fat	0.25	< 0.0008

Summary of Maximum Residue Estimates - Maneb

Crop	Residue (ppm)	
	Maneb	ETU
Carrots	18.	0.080
washed	9.0	0.080
cooked	9.0	2.4
Potatoes	0.099	0.003
washed	0.049	0.003
baked flesh	0.049	0.17
baked skins	0.049	0.69
baked whole	0.049	0.22
Wet Peel	0.099	0.003
Dry Peel	0.099	0.003
Potato Chips	0.099	0.003
Potato Granules	0.099	0.003
Sugar Beets	2.7	0.004
White Sugar	1.0	0.004
Molasses	1.0	0.004
Dried Pulp	3.5	0.004
Sugar Beet Tops	179	1.7
Turnips	19	0.043
washed	9.5	0.043
cooked	9.5	2.5
Turnip Tops	122	0.68
washed	61	0.68
cooked	61	15
Onions, Green	22	0.040
washed	11	0.040
cooked	11	2.7
Onions, bulb	12	0.16
washed	6.1	0.16
cooked	6.1	1.7
Celery	180	1.3
washed	108	1.3
cooked	108	23
Lettuce, Leaf		1.7
washed	119	1.7
Lettuce, Head	18	0.29
washed	11	0.29
cooked	11	2.4
Spinach	92	0.47
washed	55	0.47
cooked	55	12
Collards	92	0.47
washed	55	0.47
cooked	55	12
Mustard Greens	85	0.20
washed	51	0.20
cooked	51	10

Summary of Maximum Residue Estimates - Maneb
cont.

Crop	Residue (ppm)	
	Maneb	ETU
Broccoli, unwashed	48	0.24
washed	29	0.24
cooked	29	6.0
Kohlrabi	48	0.24
washed	29	0.24
cooked	29	6.0
Brussels Sprouts	48	0.24
washed	29	0.24
cooked	29	6.0
Cabbage, untrimmed	16	0.11
Cabbage, trimmed	2.1	0.020
washed	1.3	0.020
cooked	1.3	0.27
Chinese Cabbage	2.1	0.020
washed	1.3	0.020
cooked	1.3	0.27
Cauliflower	2.1	0.020
washed	0.020	0.020
cooked	0.27	0.27
Kale	57	0.32
washed	34	0.32
cooked	34	7.2
Beans, Succulent	11	0.24
Cooked/canned	0.11	1.1
Cooked/frozen	0.80	0.62
Cooked/pureed	0.11	0.80
Cannery waste	15	0.47
Beans, Dry	6.3	0.090
washed	0.44	0.090
cooked	0.44	0.57
Succulent Bean		
Vines	2140	9.0
Dry Bean Vines	702	14
Peppers	24	0.080
washed	17	0.080
cooked	17	1.2
Tomatoes	12	0.002
washed	8.5	0.002
Wet pomace	7.4	0.003
Dry pomace	4.0	2.4
Canned whole	4.0	0.003
Catsup	4.0	0.003
Paste	4.0	2.4
Juice from paste	4.0	2.4
Eggplant	see tomatoes	

Summary of Maximum Residue Estimates - Maneb
cont.

Crop	Residue (ppm)	
	Maneb	ETU
Cucumber	3.4	0.10
washed	2.4	0.10
cooked	2.4	0.26
Squash	0.95	0.002
washed	0.66	0.002
cooked	0.66	0.044
Melons	2.3	0.015
washed	1.6	0.015
cooked	1.6	0.12
Pumpkin	2.3	0.015
washed	1.6	0.015
cooked	1.6	0.12
Apples	30	0.51
washed	21	0.51
cooked-see applesauce		
Fresh Juice	1.5	0.78
Cooked Juice	1.5	0.64
Wet Pomace	139	2.6
Dry Pomace	388	13.9
Apple Sauce	2.7	0.64
Apple Baby Food	1.5	0.64
Apricots	156	3.9
washed	109	3.9
cooked	109	24
Peaches	175	5.5
washed	122	5.5
cooked	122	6.3
Nectarines	75	2.0
washed	52	2.0
cooked	52	2.3
Grapes	15	0.54
washed	8.4	0.54
cooked	8.4	0.60
Dry Pomace	9.6	1.2
Wet Pomace	9.0	0.75
Thick juice	0.55	7.5
Raisins	4.3	1.4
Raisin Waste	24	2.4
Almonds	2.3	0.010
Almond Hulls	368	0.10
Sweet Corn (K+CWHR)	1.9	0.016
washed	0.13	0.016
cooked	0.13	0.16
Corn Fodder	93	0.24
Corn Cannery Waste	3.8	0.048

Summary of Maximum Residue Estimates - Maneb
cont.

<u>Crop</u>	<u>Residue (ppm)</u>	
	<u>Maneb</u>	<u>ETU</u>
Bananas, whole	0.22	0.023
Banana, edible portion	0.050	0.030
Figs	3.2	0.066
Cranberries	0.74	0.012
Papayas	5.2	0.002
Rhubarb	180	1.3
washed	108	1.3
cooked	108	23

Beef Commodities

Milk	0.21	0.15
Liver	0.44	0.13
Muscle	0.14	0.058
Kidney	0.19	0.12
Fat	0.23	0.019

Poultry Commodities

Whole eggs	0.014	0.010
Liver	0.11	0.023
Kidney	0.04	0.018
Muscle	0.03	0.011
Fat	0.30	< 0.0016

Note that many of the reported residues exceed the existing tolerances.

Detailed ConsiderationsTOLERANCES

Tolerances have been established for residues of the fungicide maneb (manganous ethylene bisdithiocarbamate) calculated as zineb (zinc ethylene bisdithiocarbamate), ranging from 0.1 part per million (ppm) in or on almonds and potatoes to 45 ppm on sugar beet tops (40 CFR 180.110). The tolerances are tabulated below.

Maneb Tolerances

<u>Raw Agricultural Commodity</u>	<u>Tolerance (ppm)</u>
Almonds	0.1
Apples (40 CFR 180.110-1972)	7
(40 CFR 180.110-1974)	2
Apricots	10
Bananas	4
Bananas (pulp without peel)	0.5
Beans (dry form)	7
Beans (succulent form)	10
Broccoli	10
Brussels sprouts	10
Cabbage	10
Carrots	7
Cauliflower	10
Celery	5
Chinese cabbage	10
Collards	10
Corn, sweet (K+CWHR)	5
Cranberries	7
Cucumbers	7
Eggplants	7
Endive (escarole)	10
Figs	7
Grapes	7
Kale	10
Kohlrabi	10
Lettuce	10
Melons	4
Mustard greens	10
Nectarines	10
Onions	7
Papayas	10
Peaches	10
Peppers	7
Potatoes	0.1
Pumpkins	7
Rhubarb	10

Maneb Tolerances, continued

<u>Raw Agricultural Commodity</u>	<u>Tolerance (ppm)</u>
Spinach	10
Sugar beet tops	45
Summer squash	4
Tomatoes	4
Turnip roots	7
Turnip tops	10
Winter squash	4

No tolerances are currently pending (40 CFR 180.110) for maneb, nor have any food or feed additive tolerances been established. No tolerances have been established for any animal commodity.

REGISTERED USES

The use patterns for maneb are summarized below in Table 1. Only crops which have registered uses are listed. This information was received from the Benefits and Use Division in their memorandum of 5/27/88 (E. N. Pelletier, SSB and G. Ballard, EAB). Information on the average number of applications used for apples and potatoes was received from BUD in their memo of 6/7/88 (G. L. Ballard and E. N. Pelletier). Information on the maximum number of applications for other crops was received from BUD in their memo of 7/6/86 (J. D. Hansen, SSB). Additional information on these uses may be found in the Residue Chemistry Chapter for the Maneb Registration Standard. (dated 8/86) or in the Maneb index. No tolerance has been established for the asparagus planting stock treatment.

Table 1

SITES, APPLICATION RATES, AND USE PRACTICES FOR MANEB

CROP	Use Rates AI POUNDS/ACRES	NUMBER SEASONAL APPLICATIONS		PREHARVEST INTERVAL (PHI) AND LIMITATIONS
		AVERAGE	MAXIMUM	
<u>Almonds</u>				
Brown rot	4.0-6.4 lb/A	1-2	8	Do not apply later than 5 weeks after petal fall. Apply at 7- to 10-day intervals. (>100 day PHI)
Scab				
Shothole				
<u>Apples</u>				
Fruit rots	6.0-8.0 lb/A	1-6	12	15-day PHI for a few States, 30-day PHI for all others. Delayed dormant and cover sprays.
Leaf spots				
Twig blights				
<u>Apricot</u>				
Brown rot	6.0-8.0 lb/A	1-2	10	14-day PHI. Apply at red bud, early bloom, full bloom, and petal fall, and at 7- to 14-day intervals.
<u>Asparagus</u> (planting stock)				
Crown rot	0.8 lb/100 gal	1		Dip treatment to crowns. dip, then drain and plant as soon as possible.
<u>Bananas</u>				
Cercospora leaf	1.6-4.0 lb/A	8 min.	16	0-day PHI. Begin when disease first appears and spot-repeat at 2- to 3-week intervals.
<u>Beans, Lima</u>				
Downy mildew	1.2-1.6 lb/A	3-6	6	4-day PHI. Begin when mildew appears. Repeat at 7-day intervals.
<u>Beans, Snap</u>				
Rust	0.8 to 2.4 lb/A	3-6	6	4-day PHI. Apply at first sign of rust and 7 days before harvest (4- to 7 day intervals).
<u>Broccoli</u>				
Alternaria leaf spot	0.8-2.4 lb/A	2	9	7-day PHI. Apply when disease threatens. Repeat at 7- to 10-day intervals (for field) or 3 days (plant bed).
Downy mildew				

Table 1 SITES, APPLICATION RATES, AND USE PRACTICES FOR MANEB, continued

CROP	Use Rates AI POUNDS/ACRES	NUMBER SEASONAL APPLICATIONS		PREHARVEST INTERVAL (PHI) AND LIMITATIONS
		AVERAGE	MAXIMUM	
<u>Brussels Sprouts</u> Alternaria leaf spot Downy mildew	0.8-2.4 lb/A	2	9	7-day PHI. Apply when disease threatens. Repeat at 7- to 14-day intervals (for field) or 3 days (plant bed).
<u>Cabbage</u> Alternaria leaf spot Downy mildew	1.2-1.8 lb/A	2-5	9	7-day PHI. Apply mid to late season with insecticide sprays (7- to 10-day interval).
<u>Carrots</u> Leaf blights	0.8-2.4 lb/A	2	8	0-day PHI. Apply when plants are 6 weeks old or at first sign of disease. Repeat at 7- to 10-day intervals.
<u>Cauliflower</u> Alternaria leaf spot Downy mildew	0.8-2.4 lb/A	2	9	7-day PHI. Apply when disease threatens. Repeat at 7- to 14-day intervals (for field) or 3 days (plant bed).
<u>Celery</u> Blights	0.8-2.4 lb/A	7-22	22	14-day PHI. Field application every 7 to 10 days or every 3 to 5 days for plant bed.
<u>Collards</u> Downy mildew	0.8-2.4 lb/A	2-3	8	10-day PHI. Apply when disease first appears and repeat at 7- to 10-day intervals.
<u>Cranberries</u> Fruit rots Twig blights	3.0-6.0 lb/A	1	8	30-day PHI. Apply at mid-bloom. Repeat at 10 to 14-day intervals.
<u>Cucumber</u> Downy mildew	0.8-2.4 lb/A	2-7	15	5-day PHI. Apply when vines begin to run or at first sign of disease, then every 3 to 30 days.
<u>Eggplant</u> Phomopsis blight	0.8-2.4 lb/A	2-8	10	0-day PHI. Begin as fruit forms. Repeat at 7- to 10-day intervals.

Table 1 SITES, APPLICATION RATES, AND USE PRACTICES FOR MANEB (cont'd)

CROP	Use Rates AI POUNDS/ACRES	NUMBER SEASONAL APPLICATIONS		PREHARVEST INTERVAL (PHI) AND LIMITATIONS
		AVERAGE	MAXIMUM	
<u>Fig (Kadota)</u> Surface molds and rots	0.5-0.6 lb/100 gal	1	1	10-day PHI. Foliar applica- tion. Apply once, 10 to 20 days before harvest.
<u>Grapes</u> Black rot Bunch rot	1.2-4.0 lb/A	2-3	10	7-day PHI for the 1.5 lb/A rate or do not apply later than 10 days after bloom for the 4.0 lb/A rate.
<u>Kale</u>	0.8-2.4 lb/A			10-day PHI.
<u>Lettuce</u> Downy mildew	0.8-2.4 lb/A	2-3	6	10-day PHI. Apply at first sign of disease and repeat every 7 to 10 days.
<u>Melons</u> Anthracnose Downy mildew	0.8-2.4 lb/A	2-7	9	5-day PHI. Apply when vines begin to run or when disease first appears. Repeat at at 7- to 10-day intervals.
<u>Mustard Greens</u>	0.8-2.4 lb/A			10 day PHI.
<u>Nectarine</u> Brown rot Scab Shothole	4.8-8.0 lb/A	1-2	10	2-day PHI. Apply at red bud, early bloom, full bloom, petal fall, and at 7- to 14-day intervals.
<u>Onion</u> Blotch Downy Blast	0.8-2.4 lb/A	3-7	8	0-day PHI. Begin when disease first becomes visible.
<u>Papaya</u> Anthracnose Phytophthora fruit rot	1.6-2.4 lb/A	6 min.	14	0-day PHI. Apply at flowering to crown, blossom area, central column, and developing fruit.
<u>Peach</u> Brown rot Scab Shothole	8.0 lb/A	1-2	10	2-day PHI. Apply at red bud, early bloom, full bloom, petal fall, and at 7- to 14-day intervals.

Table 1 SITES, APPLICATION RATES, AND USE PRACTICES FOR MANEB (cont'd)

CROP	Use Rates AI POUNDS/ACRES	NUMBER SEASONAL APPLICATIONS		PREHARVEST INTERVAL (PHI) AND LIMITATIONS
		AVERAGE	MAXIMUM	
<u>Peppers</u> Anthracnose Cercospora leaf spot	0.8-2.4 lb/A	2-8	8	0-day PHI. 7- to 10-day intervals.
<u>Potato</u> Blights	0.8-1.6 lb/A	4	15	0-day PHI. Begin using 0.8 lb rate when plants are 2 to 6 inches high.
<u>Pumpkins</u> Angular leaf spot Downy mildew	2.4 lb/A	2	12	0-day PHI. Begin when disease threatens and repeat at 7- to 10-day intervals as needed.
<u>Spinach</u> Downy mildew	0.8-2.4 lb/A	1-5	12	10-day PHI. 7- to 10-day intervals beginning at first true leaf.
<u>Squash</u> Anthracnose Downy mildew	0.8-2.4 lb/A	2	9	5-day PHI. Apply when vines begin to run or when disease first appears. Repeat at 7- 10-day intervals.
<u>Sugar Beet</u> Cercospora leaf spot	1.2-2.4 lb/A	1	12	14-day PHI. Apply at first sign of disease. Repeat at 7- to 10-day intervals.
<u>Sweet Corn</u> Helminthosporium	1.6-2.0 lb/A	2-11	18	0-day PHI. 3- to 7-day intervals beginning at 6 inches in height.
<u>Tomato</u> Blights	0.8-2.4 lb/A	4-22	13	7-day PHI. Apply when seedlings emerge or when transplants set and repeat at 7- to 10-day intervals.
<u>Turnips</u> Downy mildew Leaf spot	0.8-2.4 lb/A	6 min.	10	10-day PHI. Apply when disease first appears and repeat at 7- to 10-day intervals.
<u>Watermelons</u> Downy mildew	0.8-2.4 lb/A	2-7	12	5-day PHI. Apply at 7- to 10-day intervals. Start when vines begin to run.

PLANT AND ANIMAL METABOLISM

The metabolism of maneb was discussed in the Residue Chemistry Chapter of the Maneb Registration Standard (9/86). The metabolism of maneb is not adequately understood. Additional metabolism data have been required via the Maneb Comprehensive Data Call In Notice (4/1/87). For the purposes of the Special Review, the residue of concern will be considered to be the parent compound, maneb, and ethylenethiourea (ETU).

ANALYTICAL METHODS

This section contains a summary of the methods available for the determination of maneb and ethylene thiourea (ETU), and a description of the methods reportedly used for the determination of metiram and ETU in plant and animal samples. These methods were submitted as part of the final protocols for the storage stability data. The final protocols were dated 8/29/87 and were submitted to the Agency on 10/1/87. These protocols were reviewed by M. Kovacs in his review of 11/18/87. The protocols were found to be in compliance with the requirements of the 3/31/87 Storage Stability DCI.

EBDC (Maneb and other EBDC's)

Previous submissions

The analytical methods for the determination of EBDC residues are based on liberation of carbon disulfide from the EBDC moiety by acid digestion in the presence of stannous chloride, followed by colorimetric determination of the carbon disulfide produced. The methods currently in use today are all modifications of the basic dithiocarbamate method described by Pease (J. Assoc. Offic. Anal. Chem., 40, 1113-1118 (1957)). It should be noted that these methods are not specific for the individual EBDC's analyzed and that because of substrate interferences from some crops, the limit of detection may range from 0.1 to 0.5 ppm.

This submission

The following method was reportedly used for the determination of maneb in the residue field trial samples. Determination of Maneb in Crops, D. Holstege, G. L. Westberg, Morse Laboratories, 6/15/87. The method was reportedly adapted from JAOAC, 52 (6) 1226 (1969), "Headspace Gas Procedure for Screening Food Samples for Dithiocarbamate Pesticide Residues."

Maneb residues on crops are decomposed by reaction with HCl/stannous chloride in a sealed reaction flask in a boiling water bath. Evolved carbon disulfide in the headspace (airspace) is

analyzed by headspace Gas Chromatography using a Pennwalt 223 packed column and a flame photometric detector (FPD) in the sulfur mode after the column is preconditioned with CS₂. Standards and fortified samples are prepared and analyzed in the same manner. The limit of detection was reported to be 0.05 ppm. Quantitation was accomplished with external standards and a four point calibration curve.

The following method was reportedly used for the determination of maneb in animal tissues. "A Gas Chromatographic Method for Measurement of Dithane." 8/14/86 method, author not specified, Hazleton Laboratories America, Inc.

The EBDC is quantitatively decomposed to carbon disulfide by refluxing the sample in dilute HCl in the presence of stannous chloride. The liberated carbon disulfide is cleaned up by purification traps containing malcosorb, lead acetate, sulfuric acid, and ethanol to remove H₂S and other volatile impurities. The ETU is then trapped in ethanol at ethanol/dry ice temperature. The carbon disulfide is measured by gas chromatography using a flame photometric detector in the sulfur mode. Samples are homogenized and added directly to the digestion flask. Quantitation is by external standard. The limit of detection of the method was reported to be 0.02 ppm maneb.

ETU

Previous submissions

Analytical methodology for ETU is based on the original method published by Onley, J. and Yip, G., J.A.O.A.C., Vol. 54, No. 1 (1971) pp. 165-169. ETU is extracted and then analyzed by GC, measured as the S-butyl derivative, after reaction of ETU with 1-bromobutane, using a flame photometric detector (FPD) in the sulfur mode. ETU may also be quantitated by liquid chromatography (LC), following clean up on another aluminum oxide column and direct injection into the LC.

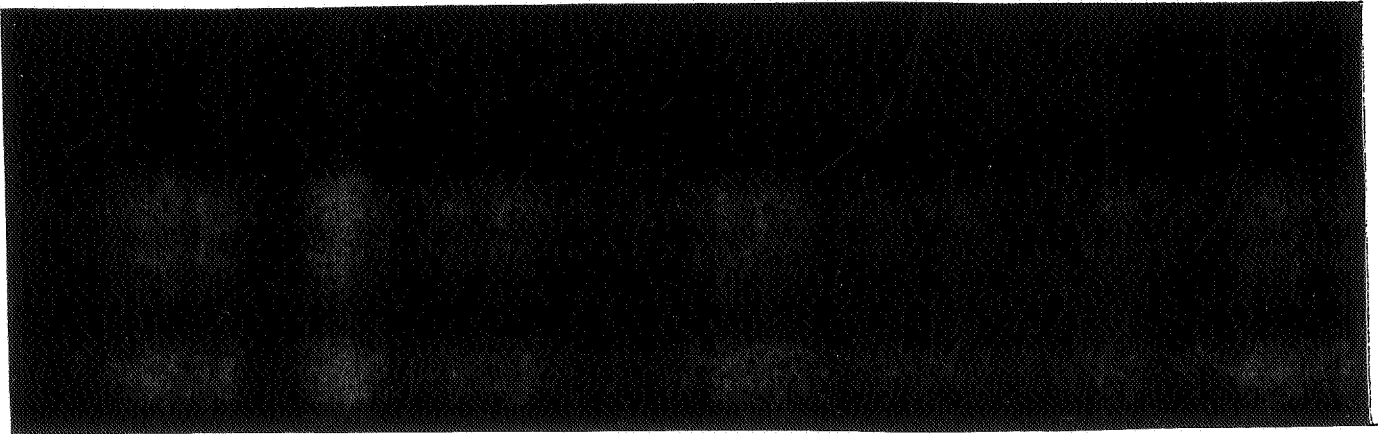
This submission

The following method was used for the determination of ETU in raw plant materials. "Determination of Ethylene Thiourea in Crops," E. Rogers, G. L. Westberg, Morse Laboratories, 7/10/87.

ETU is extracted from the crop sample with water/ethanol. The extract is pH adjusted to 7-9, concentrated by rotary evaporation, and cleaned up on an alumina column. The ETU is eluted with ethanol/chloroform 4/96. The eluate is concentrated by rotary evaporation. The concentrated extract is analyzed by HPLC using a reverse phase C-18 column, 5% methanol in water as

the mobile phase, and detection by UV at 233 nm. Quantitation is by external standard using a four point calibration curve. The limit of detection of the method was reported to be 0.01 ppm.

The following analytical method was reportedly used for the determination of ETU in animal commodities. "An Analytical Method for Determining Ethylenethiourea in Chicken Tissues, Eggs, and Excreta." undated method, author not specified. Method No. TR36F-82-15. (Appears to be a Rohm and Haas Method.) The method is marked "COMPANY CONFIDENTIAL" on every page.



STORAGE STABILITY DATA

Previous Submissions

Previously submitted storage stability data were received from the Maneb Task Force (BASF, Griffin, Pennwalt, and Rohm and Haas) on 11/21/86; and reviewed in our memo of 1/21/87 (M. Kovacs, RCB Nos. 1703, 1716). Both manebe and ETU were found to be unstable in frozen storage. The Maneb Task Force requested additional time to complete additional storage stability studies because they did not believe that the studies accurately reflected the stability of manebe and ETU residues in storage.

The storage stability studies submitted in 1986 were conducted on three crops: apples, lettuce, and tomatoes under normal frozen storage conditions. The crops were ground, fortified separately with manebe and ETU at 10 ppm, and blended. The samples were frozen in glass containers until the date of analysis.

In addition to the fortified storage stability studies which were required, the Maneb Task Force reanalyzed samples from the 1985 residue field trials in which finite residues had been found. The reanalysis was conducted six to twelve months after the original analysis. Different results were obtained from

those of the fortified storage stability studies. The Task Force suggested several possible reasons for the differences.

1. Natural crop residues are surface residues; and grinding, fortifying, and blending the samples could allow rapid enzymatic breakdown of maneb and ETU.
2. The storage stability samples were stored in glass containers, whereas the crop samples were stored in plastic freezer bags. Glassware has been shown to adsorb ETU from residue samples. (No reference was given for this statement.)

The Maneb Task Force proposed to conduct new storage stability studies in which the residue and storage stability samples would be frozen without grinding, and would be analyzed on the day of receipt in the laboratory, and periodically for one year.

Results of previously submitted Storage Stability Study

(MRID Nos. 400088-00 to -03)

Fortified maneb residues (fortified at 10 ppm)

Commodity	% of original amount at various storage intervals			
	(months)	0	1	3
apples		84	34	10
tomatoes		78	64	24
lettuce		84	36	12

Fortified ETU residues (fortified at 10 ppm)

Commodity	% of original amount at various storage intervals				
	(months)	0	2	3	4
apples		81	0.1	0.4	-
tomatoes		94	58	-	49
lettuce		84	5.8	-	0.8

Reanalysis of Stored samples

Determination of Maneb

Commodity	Initial Result (ppm)	Storage Time (mo)	Percent Remaining
Corn Forage	232	8.5	82
Dry Beans	4.99	7.5	113
Dry bean vine	360	8.5	34
Lettuce	143	9.5	97
Sugar Beet Tops	45.3	8.5	114

Determination of ETU

<u>Commodity</u>	<u>Initial Result (ppm)</u>	<u>Storage Time (mo)</u>	<u>Percent Remaining</u>
Corn Forage	0.748	8	136
Dry Beans	0.132	7.5	64
Dry bean vine	2.93	8.5	34
Lettuce	1.16	10	24
Sugar Beet Tops	0.618	8	24

Previous RCB Comment

Our comments were given in M. Kovacs review of the previous submission (M. Kovacs, 1/21/87, RCB Nos. 1703 and 1716). The storage stability studies on ground and macerated tomato, lettuce and apple samples fortified with maneb and ETU clearly indicate that the stability of maneb and ETU declined rapidly during frozen storage. RCB takes issue with the contention of the MTF that sample grinding and maceration alone enhanced the decomposition of ETU in the racs examined since ETU has been observed in studies submitted by other laboratories to be significantly more stable in these same ground, macerated, and frozen racs. Thus, the MTF should carefully look at all parameters including temperature, time lapse between each step, etc. The MTF should be advised as to the difficulty of uniformly spiking whole or unmacerated sample as part of their proposed storage stability study and additionally be advised that field treated samples are unacceptable for determining the storage stability of ETU residues since it is not clear as to how much maneb could be converted to ETU during storage.

Current RCB Comments

Studies on conversion of EBDC residues to ETU on frozen storage have now been submitted and are discussed below. The lowest conversion which could be measured by the studies was 0.5% (0.01 ppm ETU/2 ppm EBDC * 100% = 0.05 %).

We note that for lettuce, a 1% conversion of maneb to ETU in storage would result in a 1.43 ppm enhancement of the ETU level, compared to the initial ETU residue of 1.16 ppm. In corn forage, a 1% conversion would result in a 2.32 ppm enhancement (initial residue 0.748 ppm); and for dry beans, a 0.05 ppm enhancement (initial residue 0.132 ppm). The possible enhancement of the ETU level is of the same order of magnitude as the original ETU level. Thus, weathered ETU storage stability studies cannot be useful.

Storage Stability Protocols

As a result of the earlier storage stability studies which showed significant degradation of both maneb and ETU residues on frozen storage, new residue and storage stability studies were required (3/31/87 Storage Stability Data Call In Notice). The Data Call In Notice also required that protocols for the storage stability studies be submitted and approved. Meetings were also held to discuss the protocols for new storage stability studies.

The registrant's initial submission of protocols was reviewed by M. Kovacs (5/28/87, RCB No. 2254). An addendum to the review was written (J. Onley, 6/10/87, No RCB No.). Revised protocols for storage stability studies on crops and processed commodities were reviewed in our memo of 7/31/87 (M. Kovacs, RCB No. 2535). The protocols were approved at that time, with the exception of apple processed commodities and animal commodities. Revised protocols for animal commodities were approved in our memo of 11/4/87 (M. Kovacs, RCB No. 2847). Animal commodities to be analyzed were whole eggs without shells; poultry muscle, liver and fat; whole milk; and muscle, liver, kidney, and fat of dairy cattle. Revised protocols for processed apple commodities were approved in our memo of 4/7/88 (S. Hummel, RCB No. 3504). (The revised protocol for apple processed fractions was dated 6/23/87, but was not submitted to the Agency at that time.)

This submission

The following storage stability data were submitted.

<u>Crop</u>	<u>Maneb</u>		<u>ETU</u>	<u>MRID No.</u>
	<u>fortified</u>	<u>weathered</u>	<u>fortified</u>	
Apples	x	x	x	405401-16
Tomatoes	x	x	x	405401-14
Lettuce	x	x	x	405401-17
Spinach	x		x	405401-19
Potatoes	x		x	405401-18
Livestock	x		x	405401-01 and 405401-02

The following storage stability data were submitted for processed fractions of raw agricultural commodities.

<u>Crop</u>	<u>Processed Commodity</u>	<u>MRID No.</u>
Green Beans	cooked, canned cooked, frozen cooked, pureed (baby food) cannery waste	405401-20

<u>Crop</u>	<u>Processed Commodity</u>	<u>MRID No.</u>
Tomatoes	wet pomace	405401-15
	dry pomace	
	canned, whole tomatoes	
	tomato puree	
	tomato catsup	
	tomato paste	
	tomato juice from paste	
Sugar Beets	white sugar	405401-23
	molasses	
	dried pulp	
Grapes	dry pomace	405401-22
	wet pomace	
	thick juice	
	raisins	
	raisin waste	
Apples	cooked, canned juice	405401-24
	cooked, canned applesauce	
	strained apple baby food	
	wet pomace	not submitted
	dry pomace	
Potatoes	dehydrated flakes	405401-21
	fried chips	
	wet peel	not submitted (not required)
	dry peel	

Weathered storage stability data were not submitted for maneb in spinach or potatoes. No storage stability data were submitted for some of the apple processed fractions (fresh juice, wet pomace, dry pomace) or for potato wet and dry peel. We note that storage stability data for potato wet and dry peel were not explicitly required by the 3/31/87 DCI. The submitted storage stability data are tabulated below. Fortifications of maneb were made at 2 ppm and fortifications of ETU at 0.5 ppm for raw agricultural commodities, processed commodities, and animal commodities. Conversion of maneb to ETU in frozen storage was reported as percent conversion, corrected for the difference in molecular weights between maneb and ETU (ppm ETU found / ppm ETU equivalent to 2 ppm maneb * 100%). Conversion of maneb to ETU in animal commodities was reported as ppm ETU found.

Maneb Storage Stability Data

Weathered maneb residues

Commodity	% of original amount at various storage intervals					
	(months)	0	0.5	1	3	6
(initial residue)						
apples (12.5 ppm)		100	96	87	104	
tomatoes (1.04 ppm)		100	109	81	75	
lettuce (6.08 ppm)		100	97	80		
spinach			not done			
potatoes			not done			

Fortified maneb residues (fortified at 2 ppm maneb)

Commodity	% of original amount at various storage intervals					
	(months)	0	0.5	1	3	6
(months)						
apples		99	84	91	107	76
tomatoes		96	104	83	110	85
lettuce		101	96	99	89	72
spinach		91	107	90	105	91
potatoes		90	93	113	109	77

Fortified ETU residues (fortified at 0.5 ppm ETU)

Commodity	% of original amount at various storage intervals					
	(months)	0	0.5	1	3	6
apples		102	87	71	31	14
tomatoes		87	104	99	82	69
lettuce		101	97	92	60	21
spinach		95	83	100	82	76
potatoes		136	96	83	75	63

Maneb conversion to ETU in frozen storage
(fortified at 2 ppm maneb)

Commodity	% conversion at various storage intervals					
	(months)	0	0.5	1	3	6
apples		35.6	<1.8	<2.0	0.0	0.0
tomatoes		9.9	11.3	9.02	8.8	6.4
lettuce		<1.8	4.2	2.7	<1.7	<1.8
spinach		2.1	1.8	2.2	<1.7	<1.8
potatoes		2.0	<2.0	<1.8	0.0	<1.7

Storage Stability in Processed CommoditiesFortified maneb residues (fortified at 2 ppm maneb)

Commodity % of original amount at various storage intervals
 (months) 0 0.5 1 3 6

tomato processed commodities

cooked juice	106	112	92	74	59
stewed, canned	105	99	85	76	79
canned, pureed	101	100	95	91	75
canned sauce	101	103	101	73	73
canned paste	98	93	88	89	98
canned catsup	95	123	72	59	56
wet pomace	90	111	109	87	
dry pomace	101	113	112	82	
fresh juice	98	101	98	86	

grape processed commodities

wet pomace	104	104	98		
dry pomace	99	93	67		
fresh juice	106	106	94		
raisins	111	90	90	73	84
raisin waste	99	90	98		

apple processed commodities

cooked juice	98	102	970	107	71
cooked applesauce	108	99	101	98	80
strained baby food	108	95	812	94	74
fresh juice					
wet pomace					
dry pomace					

green bean processed commodities

cooked, frozen	90	91	89	121	87
cooked, canned	101	94	105	110	94
cooked baby food	96	98	86	87	73
cannery waste	99	119	112	85	

sugar beet processed commodities

beet sugar	118	90	89	84	56
dehydrated pulp	104	111	58		
molasses	104	110	105		

potato processed commodities

dehydrated flakes	104	98	79	80	101
fried chips	94	87	96	80	83

corn processed commodities

cannery waste

Storage Stability in Processed Commodities , continuedFortified ETU residues (fortified at 0.5 ppm ETU)

Commodity	% of original amount at various storage intervals				
	(months)	0	0.5	1	3

tomato processed commodities

cooked juice	101	97	95	101	63
stewed, canned	98	84	96	79	55
canned, pureed	107	92	94	93	70
canned sauce	116	104	95	89	93
canned paste	106	98	103	101	80
canned catsup	104	95	96	90	67
wet pomace	93	86	61	63	
dry pomace	99	88	81	75	
fresh juice	99	96	93	98	

grape processed commodities

wet pomace	96	99	79		
dry pomace	90	54	52		
fresh juice	95	96	81		
raisins	75	98	88	97	84
raisin waste	110	74	79		

apple processed commodities

cooked juice	93	97	104	91	77
cooked applesauce	94	99	95	95	98
strained baby food	94	88	98	101	92
fresh juice					
wet pomace					
dry pomace					

green bean processed commodities

cooked, frozen	102	94	96	88	78
cooked, canned	98	108	109	102	89
cooked baby food	102	98	85	87	84
cannery waste	101	61	36	12	

sugar beet processed commodities

beet sugar	99	97	101	105	97
dehydrated pulp	104	96	94		
molasses	104	110	105		

potato processed commodities

dehydrated flakes	97	95	98	106	86
fried chips	101	89	101	91	89

corn processed commodities

cannery waste					
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Maneb Conversion to ETU in frozen storage
(fortified at 2 ppm maneb)

Commodity	% conversion at various storage intervals				
	(months) 0	0.5	1	3	6
<u>tomato processed commodities</u>					
cooked juice	7.6	8.2	7.9	7.5	2.8
stewed, canned	10.6	15.2	12.5	6.5	4.5
canned, pureed	8.8	9.1	10.8	8.2	4.0
canned sauce	11.8	16.4	12.5	9.1	6.0
canned paste	9.4	9.6	7.8	8.5	3.4
canned catsup	10.6	8.6	6.1	5.5	3.7
wet pomace	1.6	1.4	<1.6		
dry pomace	2.1	2.1	2.1		
fresh juice	2.2	1.8	1.7		
<u>grape processed commodities</u>					
wet pomace	<1.8	<1.8	<1.7		
dry pomace	<1.8	<1.9	2.1		
fresh juice	<1.6	<1.7	<1.7		
raisins	3.0	3.7	4.5	2.8	1.8
raisin waste	1.9	<1.6	<1.4		
<u>apple processed commodities</u>					
cooked juice	7.8	7.9	10.8	11.3	4.7
cooked applesauce	1.8	3.0	2.0	2.3	2.4
strained baby food	3.0	3.1	2.4	2.4	2.1
fresh juice					
wet pomace					
dry pomace					
<u>green bean processed commodities</u>					
cooked, frozen	1.8	2.0	1.6	1.6	<1.7
cooked, canned	1.6	2.7	2.1	0.0	1.6
cooked baby food	3.0	3.1	2.4	2.4	2.1
cannery waste	4.3	1.9	2.1	<1.4	
<u>sugar beet processed commodities</u>					
beet sugar	1.8	2.0	1.8	3.5	2.4
dehydrated pulp	<1.9	<1.8	<1.7		
molasses					
controls contaminated					
<u>potato processed commodities</u>					
dehydrated flakes	4.4	3.3	1.8	6.0	4.5
fried chips	<2.0	1.7	<1.7	9.6	1.7
<u>corn processed commodities</u>					
cannery waste					

Storage Stability in Animal CommoditiesFortified maneb residues (fortified at 2 ppm maneb)

Commodity	% of original amount at various storage intervals					
	(months)	0	0.5	1	3	6
whole eggs		94	83	77	79	
poultry muscle		100	99	100	115	
beef liver		85	80	78	92	
beef kidney		93	102	92	124	
whole milk		94	84	84	122	
beef fat		112	103	93	141	

Fortified ETU residues (fortified at 0.5 ppm ETU)

Commodity	% of original amount at various storage intervals					
	(months)	0	0.5	1	3	6
whole eggs		113	91	105	83	
poultry muscle		93	94	95	97	
beef liver		96	90	86	90	
beef kidney		111	85	82	101	
whole milk		104	110	84	92	
beef fat		83	95	87	99	

Maneb Conversion to ETU in frozen storage
(fortified at 2 ppm maneb)

Commodity	ppm ETU found					
	(months)	0	0.5	1	3	6
whole eggs		0.01	0.02	0.03	0.03	
poultry muscle		0.02	0.02	0.02	0.02	
beef liver		<0.01	0.01	0.01	<0.01	
beef kidney		0.01	0.01	0.01	0.01	
whole milk		0.01	0.01	0.02	<0.01	
beef fat		0.01	0.01	0.02	0.01	

RCB Comments

Maneb and ETU are reasonably stable in processed commodities and animal commodities under the conditions in the submitted storage stability study (up to 3 months). Maneb is reasonably stable in raw agricultural commodities (up to 6 months). Storage stability of ethylene thiourea (ETU) in raw agricultural commodities is highly variable and is dependent on the raw agricultural commodity and on the laboratory conducting the study. Variable conditions would include sample handling and storage conditions, analytical methods used, and analyst

familiarity with the analytical methodology. ETU appears to be most stable in tomatoes and least stable in apples. Storage stability in root crops and leafy vegetables was reported to be between that of apples and tomatoes.

For studies conducted by Morse Laboratories under contract to Pennwalt or the Maneb Task Force, we can conclude that ETU is stable in tomatoes, leafy vegetables, and root crops for up to three months in frozen storage. ETU residues in apples are stable for up to one month in frozen storage.

Conversion of maneb to ETU was reported in tomatoes and several processed commodities. Although conversion of maneb to ETU was reported in these fortified studies, no detectable ETU residue was reported in any tomato sample. (See Residue Data Section of this review.)

RESIDUE DATA

This Submission

The following residue data were submitted:

Crop	Location	Rate (lb ai/A)	MRID No.
Cucumbers	CA, MI, NC, SC, TX	1.6	405873-01
Watermelons	GA, TX	1.6	405401-03
Peppers	CA	1.6	405401-04
Dry Beans	CA, CO, MI, ND, NE	1.6	405401-05
Succ. Beans	CA, DE, MI, NY, OR, WI	1.6	405873-03
Cabbage	MI, NY, TX	1.6	405401-06
Broccoli	CA	1.6	405401-07
Sweet Corn	GA, IL, MN, NY, WI, OR	1.6	405873-04
Kale	CA, NJ, TX	1.6	405401-08
Lettuce	CA	1.6	405401-09
Potatoes	CA, ID, ME, ND, OR	1.6	405401-10
Spinach	NJ, TN, TX	1.6	405401-11
Sugar Beets	CA, ID, MN, ND	1.6	405873-05
Tomatoes	CA, FL, MI, TX	2.4	405873-07
Green Onions	TX	1.6	405401-13
Apples	CA, OH, NY, WV, VA	4.5	405542-02
Grapes	CA	3.2	405542-04

All residue data submitted reflected ground application except apples. Additionally, a volume of data was submitted on ground vs. aerial applications (MRID No. 405542-01).

No residue data were submitted for carrots, turnips, turnip tops, dry bulb onions, celery, endive, rhubarb, collards, mustard greens, kohlrabi, brussels sprouts, cauliflower, chinese cabbage, eggplant, squash, pumpkin, apricots, peaches, nectarines, cranberries, almonds, corn forage and silage, asparagus, bananas,

figs, and papayas. No residue data were required by the 3/31/87 Special Review Data Call In Notice for the use on tobacco or the seed, seed piece, and planting stock treatments on barley, corn, cotton, flax, oats, peanuts, pineapple, rice, rye, sorghum, soybeans, sunflowers, and wheat, since there are no tolerances to cover residues resulting from these uses.

Although residue data were required for all commodities having tolerances, the registrant apparently assumed that translation of data may be done as stated in the Comprehensive Data Call In Notice of 4/1/87. The 4/1/87 DCI stated that data for collards and mustard greens may be translated from spinach; kohlrabi and brussels sprouts from broccoli; cauliflower from cabbage, eggplant from tomatoes, squash from cucumbers, pumpkin from melons, and nectarines from peaches. The registrant's assumption is reasonable.

In the Pennwalt letter of 7/6/87, Pennwalt Corporation indicated that they would drop uses on rhubarb, chinese cabbage, kale, cranberries, asparagus, figs, and papayas. However, no revised labeling has been submitted to date. Residue data have now been submitted for kale.

In the Pennwalt letter of 7/6/87, Pennwalt indicated that they intended to validate previously submitted data for carrots, celery, and apricots. However, the registrant did not provide any information on how these studies were to be validated. The registrant also indicated that they intended to validate existing livestock feeding studies in their letter of 2/29/88. A summary of the sample history for the dairy cattle and poultry feeding studies was also included in this submission (MRID No. 405401-02).

Pennwalt had requested time extensions for the submission of residue data on peaches, almonds, and dry bulb onions. The requested time extensions were denied in the Agency letter of 2/25/88. Time extensions were later granted for residue data on peaches and almonds, but not for dry bulb onions (See SRB letter of 4//88). A Notice of Intent to Suspend was issued for failure to submit residue data for dry bulb onions. (See SRB letter of 4//88.) Pennwalt responded to the NOIS by removing onions from their label (Pennwalt submission of 5/2/88).

Pennwalt indicated in their letter of 7/6/87 that they intended to provide residue data for bananas. No residue data were submitted for bananas. Bananas have now been removed from the Pennwalt label. (See Pennwalt submission of 5/2/88.)

The residue data submitted in March, 1988, from the 1987 growing season are tabulated below.

Maneb Residue Data from 1987 Growing Season

Commodity	Rate (lb ai/A)	#Appli- cations	PHI (days)	Max. Storage (days)	Residue (ppm)				Locations
					Ave. Maneb	Max. Maneb	Ave. EIU	Max. EIU	
Carrots		not submitted							
Potatoes	1.6	12	14	44	<0.05	<0.05	<0.01	0.02	CA, ID, ME, ND, OR
Sugar Beets	1.6	7	14	126	0.35	1.8	<0.01	<0.01	CA, ID, MN, ND
Sugar Beet Tops	1.6	7	14	126	42.01	179	0.07	0.50	SC
onions, dry bulb		not submitted							
onions, green	1.6	7	7	50	13.4	14.9	0.04	0.08	TX
Celery		not submitted							
Lettuce	1.6	6	10	32	0.02	0.13	<0.01	<0.01	CA
Spinach, unwashed	1.6	4-5	10	60	8.58	13.26	0.04	0.08	TX
Spinach, washed	1.6	4-5	10	60	6.44	12.21	0.03	0.04	TX
Spinach, unwashed	1.6	4-5	14	83	13.51	17.26	0.07	0.08	TN
Spinach, washed	1.6	4-5	14	83	9.59	9.96	0.07	0.07	TN
Broccoli	1.6	6	3	29	7.08	8.52	0.12	0.17	CA
Cabbage, untrimmed	1.6	6-8	7	49	2.98	15.58	0.04	0.11	CA, MI, NY, TX
Cabbage, trimmed	1.6	6-8	7	49	0.85	2.08	<0.01	0.02	"
Kale	1.6	4	7	68	15.24	28.8	0.11	0.29	CA, NJ, TX
Kale	1.2	4	7	68	15.0	22.1	0.15	0.23	CA, NJ
Kale	1.6	4	10	68	21.95	57.35	0.11	0.15	CA, NJ
Kale	1.2	4	10	68	12.67	15.27	0.2	0.32	CA, NJ
Beans, succ.	1.6	6-7	4	90	2.08	7.58	0.05	0.16	NY, WI, MI, DE, CA,
Succ bean vines	1.6	6-7	4	90	214	802	1.16	5.95	"
Succ bean vines	1.6	6-7	7	90	429	1425	0.86	1.38	"
Beans, Dry	1.6	6-7	4	107	1.67	4.16	0.03	0.06	CA, CO, MI, ND, DE
Dry bean vines	1.6	6-7	4	107	144	468	4.12	9.56	"
Peppers	1.6	6	7	99	0.76	1.86	0.01	0.05	CA, FL, TX
Tomatoes	2.4	7	3	59	0.91	3.81	<0.01	<0.01	CA, FL, MI, TX
Cucumbers	1.6	7-8	5	42	0.5	2.3	0.04	0.07	CA, MI, NC, SC
Melons	1.6	8	5	85	0.43	1.41	0.01	0.01	GA, TX
Apples	4.5	7-13	21-30	191	0.55	0.99	<0.01	<0.01	CA, OH, NY, WV, VA
Apricots		not submitted							
Peaches		not submitted							
Grapes	3.2	5	8	17	8.6	12	0.03	0.06	CA
	3.2	3	30	53	1.7	2.3	0.01	0.01	
	2.4	3	30	53	1.3	1.9	<0.01	<0.01	
	1.2	3	30	53	0.63	0.38	<0.01	<0.01	
Almonds		not submitted							
Corn, Sweet (K+CWHR)	1.6	5	4	105	0.07	0.27	<0.01	<0.01	GA, IL, MN, NY, WI,
Corn Fodder	1.6	5	4	105	26.2	70.8	0.07	0.17	

RCB Comment

The samples were stored one to four months, except for apples. Apples samples were stored for seven months prior to analysis. Storage stability data were submitted for six months

of frozen storage, except for spinach. Spinach storage stability are available for 4 months. The storage stability data showed that apple residues degrade to 14 % of the original amount within 6 months of frozen storage. Because of the severe degradation of ETU residues in the time the samples were held before analysis, ETU residues estimates will be corrected for the loss of ETU on frozen samples storage.

Except for potatoes and tomatoes, the submitted residue data did not reflect the maximum rate on registered labels. (See registered uses section of this review.) The minimum PHI on the label was not always observed. Data reflecting the maximum rate, maximum number of applications, and minimum PHI were required in the 4/1/87 Comprehensive Data Call In Notice.

Although the 3/31/87 Storage Stability Data Call In Notice did not explicitly require residue data at the maximum rate, maximum number of applications, and the minimum PHI, these requirements are discussed in the Residue Chemistry Guidelines (Subdivision O, Pesticide Assessment Guidelines).

The Residue Chemistry Guidelines state the following on the rate, mode, number, and timing of applications:

Field experiments must reflect the proposed use with respect to the rate and mode of application, number and timing of applications, and formulations proposed. Because of differences observed in residue levels resulting from ultra low volume (ULV) and aerial applications, these too should be represented unless the proposed label specifically prohibits such application methods. The label should contain a restriction against the use on irrigated crops unless data are provided for crops grown under these conditions.

On geographical representation:

Field trials should represent all of the principal growing regions of the crop as indicated in the USDA publication, Agricultural Statistics, and all of the seasonal variations. Several varieties should be represented. The number of field trials required is not specified in the Guidelines, although the Guidelines state that more important crops require more field trials and more toxic pesticides need more field trials.

On residue decline studies:

Residue decline studies are also required. Samples from a single location should be harvested with differing PHI's to indicate residue decline. Data on the decline of residues after harvest are also desirable.

On storage stability data:

Accepted procedure for maintaining sample integrity should be followed after taking the sample. Normally, samples should be kept frozen until analyzed. Information should be furnished on how samples are shipped and stored until analyzed. If samples are likely to be held in storage, storage stability data should be obtained by fortifying control samples, storing them under the same conditions as the treated samples, and analyzing at the end of the storage period. It is always advisable to have spiked storage stability samples available to allow for unforeseen delays in analysis of check samples should reanalysis be necessary to verify possibly aberrant results.

Residue Field Trials are also discussed in the Addendum to the Residue Chemistry Guidelines: Standard Evaluation procedure - Field trials (published 6/85):

A sufficient number of field trials is needed. All types of applications must be represented: broadcast/soil/aerial, concentrate/dilute/ULV. Studies must be conducted at the maximum rate and minimum PHI specified on the label. Generally several locations per geographical area are needed. Side by side field trials are needed for evaluation of ground vs. aerial and concentrate vs dilute vs ULV types of application.

In the limited amount of time the registrants were given to conduct residue field trials for the 3/31/87 Storage Stability Data Call In Notice (11 months), studies should have been conducted at the maximum rate, maximum number of applications, and minimum PHI, with studies conducted in at least the major growing areas.

Because the residue data submitted did not reflect the maximum rate, maximum number of applications, and minimum PHI, residue estimates will be based on proportional increases from the reported residue to the maximum rate. Since residue data were not submitted on all commodities which have tolerances, some previously submitted residue data will be used to estimate residues. Additionally, if higher residues were reported in previously submitted residue data, the higher reported residue will be used as the residue estimate.

Previously submitted residue data

Previously submitted residue data include data from tolerance petitions and data submitted in response to an earlier 3c2B letter (10/19/84). Petition data did not include analyses for ETU. Petition data and residue data from the 1985 growing

season were reviewed in our memo of 2/20/87 (M. Kovacs, RCB Nos. 958, 972, 1238, 1239, 1379, 1380); and were included in the Residue Chemistry Chapter for the Maneb Registration Standard (8/25/86). Some residue data from the 1986 growing season were reviewed in an update to the Residue Chemistry Chapter (3/31/87). Other residue data from the 1986 growing season had not been reviewed because of data showing poor storage stability under the conditions the residue field trial samples had been stored. (See M. Kovacs memo of 1/21/87, RCB Nos. 1703 and 1716.)

All of the available residue data are tabulated here, along with the source of the data.

Source of Residue Data

1. 1987 Residue data from 3/31/87 DCI
2. 1986 Residue data, not previously reviewed (rejected because of inadequate storage stability data; updates of reports previously submitted and included in the update of the Residue Chemistry Chapter, 3/31/87)
3. 1986 Residue data included in Residue Chemistry Chapter of Registration Standard, update 3/31/87
4. 1985 Residue data, included in 2/20/87 review and Reg. Std.
5. Dupont data, included in 2/20/87 review and Reg. Std.
6. Petition data, included in 2/20/87 review and Reg. Std. (no analyses for EIU)

All Available Maneb Residue data

<u>Commodity</u> <u>Source</u>	<u>Rate</u> <u>(lb ai/A)</u>	<u>#Appli-</u> <u>cations</u>	<u>PHI</u> <u>(days)</u>	<u>Storage</u> <u>(days)</u>	<u>Residue (ppm)</u>				<u>Locations</u>
					<u>Max.</u> <u>Ave.</u>	<u>Maneb</u> <u>Max.</u>	<u>ETU</u> <u>Ave.</u>	<u>Max.</u>	
<u>Carrots</u>									
6 1/	1-1.4	3-7	14-30	-	<0.1	<0.1			
2 2/	1.6	7	0	180	1.87	6.02	0.011	0.014	CA,MI,TX,WI
	1.6	7	1		7.48	9.04	0.015	0.016	CA
	1.6	7	3		3.23	3.99	0.01	0.01	CA
	2.4	7	0		3.61	17.95	0.021	0.08	CA,MI,TX,WI
	2.4	7	1		9.99	12.68	0.023	0.024	CA
	2.4	7	3		4.0	5.5	0.01	0.014	CA
<u>Potatoes</u>									
1 3/	1.6	12	14	44	<0.05	<0.05	<0.01	0.02	CA, ID, ME, ND, OR
6 1/	0.9	9	25	-	<0.50	<0.50			DE
5	1.6	4-6	1-9	-	<0.1	<0.1	<0.05	<0.05	FL, ME, IN
4	1.6	6-16	0-7	-	0.077	0.099	<0.012	<0.012	CA, WA, NY, WI,
<u>Sugar Beets</u>									
1 4/	1.6	7	14	126	0.35	1.8	<0.01	<0.01	CA, ID, MN, ND
6 5/	1.2-1.6	3-6	0-14	-	<0.1	<0.1			MN, IA, OH
4	2.4	5	10	-	0.27	0.81	<0.012	<0.012	CA, MI
<u>Sugar Beet Tops</u>									
1 4/	1.6	7	14	126	42.01	179	0.07	0.50	SC
6 5/	1.2-1.6	3-6	0-22	-	28	104			MN, IA, OH
4	2.4	5	10	-	26.1	54	0.17	0.59	
<u>Turnip tops</u>									
3 6/	2.4	8	3	245	101.3	288.3	0.319	1.514	CA, TX, GA
			7		53.21	70.73	0.126	0.128	GA, NJ
			10			47.15		0.045	GA
			14			26.24		0.022	GA
			21		47.82	122.1	0.06	0.142	CA

1/ PP#21, no analyses for ETU

2/ MRID No. 402021-03 and MRID No. 400456-03

3/ MRID No. 405401-10

4/ MRID No. 405873-05

5/ PP#439, no analyses for ETU

6/ MRID No. 401099-03 and MRID No. 400676-03

All Available Maneb Residue data

<u>Commodity</u> <u>Source</u>	<u>Rate</u> <u>(lb ai/A)</u>	<u>#Appli-</u> <u>cations</u>	<u>PHI</u> <u>Storage</u> <u>(days)</u>	<u>Max.</u> <u>Storage</u> <u>(days)</u>	<u>Residue (ppm)</u>				<u>Locations</u>
					<u>Ave.</u>	<u>Max.</u>	<u>Ave.</u>	<u>Max.</u>	
<u>Turnip Roots</u>									
3 ⁷ /	2.4	8	3	245	9.1	17.78	0.016	0.033	CA, TX, GA
			7		8.64	15.02	0.016	0.042	GA, NJ
			10		13.68	19.28	0.018	0.027	GA
			14		8.73	11.82	0.015	0.019	GA
			21		9.09	9.24	0.015	0.016	CA
<u>Onions, green</u>									
1 ⁸ /	1.6	7	7	50	13.4	14.9	0.04	0.08	TX
<u>Onions (bulb)</u>									
2 ⁹ /	1.6	8	0	195	2.86	7.88	0.02	0.04	CA, MI, NY, TX
	2.4	8	0		4.58	11.36	0.02	0.05	
	1.6	8	1		3.15	6.35	0.01	0.02	CA, NY
	2.4	8	1		7.87	17.3	0.04	0.07	
	1.6	8	3	120	9.38		0.05		NY
	2.4	8	3		12.19		0.11		
	1.6	8	7		10.53		0.03		
	2.4	8	7		5.89		0.11		
	1.6	8	14		7.4		0.03		
	2.4	8	14		7.7		0.06		
<u>Celery, untrimmed</u>									
6 ¹⁰ /	1-1.4	7-20	0-11	-	9.25	20.6			DE, FL
<u>Celery, trimmed</u>									
6 ¹⁰ /	1-1.4	7-20	0-11	-	3.91	5.9			DE, FL

⁷/ MRID No. 401099-04 and MRID No. 400529-03. Registrant concluded that there was a negligible level of maneab in turnip roots, and a background level of 5-20 ppm due to natural presence of sulfur

⁸/ MRID No. 405401-13

⁹/ MRID No. 402021-05 and MRID No. 400456-05

¹⁰/ PP#21 and PP#156

All Available Maneb Residue data

<u>Commodity</u>	<u>Rate</u>	<u>#Appli-</u>	<u>PHI</u>	<u>Storage</u>	<u>Residue (ppm)</u>				<u>Locations</u>
<u>Source (lb ai/A)</u>	<u>cations (days)</u>	<u>(days)</u>	<u>Ave.</u>	<u>Max.</u>	<u>Ave.</u>	<u>Max.</u>	<u>Ave.</u>	<u>Max.</u>	<u>ETU</u>
<u>Celery, unspecified</u>									
2 11/	1.6	8	7	165	31.6	131.2	0.072	0.22	CA,FL,MI
	2.4	8	7		61.3	172.5	0.097	0.22	CA,FL,MI
	1.6	8	10		45.1	81.1	0.029	0.05	CA,FL,MI
	2.4	8	10		71.6	145.4	0.062	0.12	CA,FL,MI
	1.6	8	14		47.1	182.4	0.031	0.08	CA
	2.4	8	14		64.9	168	0.073	0.27	CA
	1.6	8	21		26.5	71.6	0.021	0.05	CA
	2.4	8	21		61	179.9	0.062	0.17	CA
<u>Lettuce, unspecified</u>									
1 12/	1.6	6	10	32	0.02	0.13	<0.01	<0.01	CA
<u>Lettuce, head, trimmed</u>									
6 10/	1.4	1-3	2-23	-	5.0	14.8			
4	3.2	4-7	10	-	5.46	14.9	0.023	0.059	CA,FL
<u>Lettuce, leaf, washed</u>									
6 13/	1.05	15	7	-		2.4			FL
4	3.2	4-7	10	-	28.2	119	0.255	0.357	CA,NY,MI
<u>Lettuce, head</u>									
3 14/	3.2	6	10	515		8.08		0.023	FL
	6.4	6	10			17.6		0.038	FL
<u>Lettuce, leaf</u>									
3 14/	3.2	6	10	-		9.35		0.011	MI
	3.2	7	10			24.8		<0.01	NY
	6.4	6	10			35.6		0.025	MI
	6.4	7	10			67.2		0.149	NY

11/ MRID No. 402021-02 and MRID No. 400456-02

12/ MRID No. 405401-09

13/ PP#156

14/ MRID No. 400635-03, not specified if washed or trimmed

All Available Maneb Residue data

<u>Commodity</u> <u>Source</u>	<u>Rate</u> <u>(lb ai/A)</u>	<u>#Appli-</u> <u>cations</u>	<u>PHI</u> <u>(days)</u>	<u>Storage</u> <u>(days)</u>	<u>Residue (ppm)</u>				<u>Locations</u>
					<u>Ave.</u>	<u>Max.</u>	<u>Ave.</u>	<u>Max.</u>	
<u>Spinach, unwashed</u>									
1 ^{15/}	1.6	4-5	10	60	8.58	13.26	0.04	0.08	TX
	1.6	4-5	14	83	13.51	17.26	0.07	0.08	TN
6	1.68	2-3	0-7		30.5	43			TN
<u>Spinach, washed</u>									
1 ^{15/}	1.6	4-5	10	60	6.44	12.21	0.03	0.04	TX
	1.6	4-5	14	83	9.59	9.96	0.07	0.07	TN
6 ^{14/}	1.68	2-3	0-7	-	3.5	4.0			TN
<u>Spinach, unspecified</u>									
2 ^{16/}	1.6	8	7	165	31.3	65	0.19	0.37	CA,OK,NJ, TX
	2.4	8	7		54	93.3	0.23	0.53	
	1.6	8	10		23.4	50.1	0.1	0.21	CA,OK,NJ
	2.4	8	10		44.1	81.4	0.16	0.36	
	1.6	8	14	150	22.2	48.1	0.06	0.18	CA,NJ
	2.4	8	14		39.4	91.9	0.08	0.23	
	1.6	8	21		21	74	0.04	0.12	
	2.4	8	21		22.1	60.2	0.05	0.21	
<u>Mustard Greens</u>									
2 ^{17/}	2.4	10	3	285	114	269	0.28	0.55	CA,FL,GA, TX
	2.4	10	7	285	85.2	111.2	0.18	0.31	CA,FL, TX
	2.4	10	10	285	45.2	65.4	0.12	0.15	CA,FL, TX
	2.4	10	14	285	51.1	85.1	0.05	0.07	CA,FL, TX
	2.4	10	21	285	16.2	42.5	0.02	0.06	CA,FL, TX
<u>Broccoli, unspecified</u>									
1 ^{18/}	1.6	6	3	29	7.08	8.52	0.12	0.17	CA

15/ MRID No. 405401-11

16/ MRID No. 402021-06 and MRID No. 400456-06

17/ MRID NO. 402021-07 and MRID No. 400529-02

18/ MRID No. 405401-07

All Available Maneb Residue data

<u>Commodity</u> <u>Source</u>	<u>Rate</u> <u>(lb ai/A)</u>	<u>#Appli-</u> <u>cations</u>	<u>PHI</u> <u>(days)</u>	<u>Storage</u> <u>(days)</u>	<u>Residue (ppm)</u>					<u>Locations</u>
					<u>Maneb</u> <u>Ave.</u>	<u>Maneb</u> <u>Max.</u>	<u>EIU</u> <u>Ave.</u>	<u>EIU</u> <u>Max.</u>	<u>Locations</u>	
<u>Broccoli, unwashed</u>										
6	19/	2.8	2-8	0-16		6.86	25			NY
2	20/	1.6	12	3	210	5.6	19.9	0.02	0.04	CA, NJ, NY, TX
		2.4		3	210	8.8	26.5	0.05	0.3	CA, NJ, NY, TX
		1.6		7	210	13.7	28.2	0.06	0.09	CA, NJ, TX
		2.4		7	210	19.9	47.8	0.07	0.18	CA, NJ, TX
		1.6		10	210	3	4	0.01	0.01	CA, NJ, TX
		2.4		10	210	8.8	8.8	0.04	0.05	CA, NJ, TX
<u>Broccoli, washed</u>										
6	19/	2.8	2-8	0-16	-	4.1	7.3			NY
<u>Cabbage, untrimmed</u>										
1	21/	1.6	6-8	7	49	2.98	15.58	0.04	0.11	CA, MI, NY, TX
<u>Cabbage, trimmed</u>										
1	21/	1.6	6-8	7	49	0.85	2.08	<0.01	0.02	CA, MI, NY, TX
4		2	6-7	7	-	1.16	2.83	<0.010	<0.010	CA
3	22/	2	10	7	-		16		ns	IN, NY
		2	11	7			0.556		ns	MI
		4	10	7			16.9		ns	IN, NY
		4	11	7			0.556		ns	MI
<u>Kale</u>										
1	23/	1.6	4	7	68	15.24	28.8	0.11	0.29	CA, NJ, TX
		1.2	4	7	68	15.0	22.1	0.15	0.23	CA, NJ
		1.6	4	10	68	21.95	57.35	0.11	0.15	CA, NJ
		1.2	4	10	68	12.67	15.27	0.2	0.32	CA, NJ

19/ PP#183

20/ MRID No. 402021-04 and MRID No. 400456-04

21/ MRID No. 405401-06

22/ MRID No. 400635-04 ns = not sampled (low recovery)

23/ MRID No. 405401-08

All Available Maneb Residue data

<u>Commodity</u> <u>Source</u>	<u>Rate</u> <u>(lb ai/A)</u>	<u>#Appli-</u> <u>cations</u>	<u>PHI</u> <u>Storage</u> <u>(days)</u>	<u>Max.</u> <u>Storage</u> <u>(days)</u>	<u>Residue (ppm)</u>				<u>Locations</u>
					<u>Ave.</u>	<u>Max.</u>	<u>Ave.</u>	<u>Max.</u>	
<u>Beans, succulent</u>									
1 ^{24/}	1.6	6-7	4	90	2.08	7.58	0.05	0.16	NY,WI,MI,DE,CA,DE
4	2	1-7	0-4	-	3.5	5.7			FL
	3.2	8-9	7		19.69	31.4	0.051	0.078	CA
<u>Succulent bean vines</u>									
1 ^{24/}	1.6	6-7	4	90	214	802	1.16	5.95	NY,WI,MI,DE,CA,DE
	1.6	6-7	7	90	429	1425	0.86	1.38	NY,WI,MI,DE,CA,DE
<u>Beans, Dry</u>									
1 ^{25/}	1.6	6-7	4	107	1.67	4.16	0.03	0.06	CA,CO,MI,ND,DE
4	3.2	8-9	7	-	1.4	1.58	0.128	0.323	
<u>Dry bean vines</u>									
1 ^{25/}	1.6	6-7	4	107	144	468	4.12	9.56	
<u>Beans, lima</u>									
6 ^{13/}	2	1-6	0-7	-	0.06	0.14			FL
4	3.2	8-9	7	-	0.116	0.118	<0.010	<0.010	CA
<u>Bean hay, unspecified</u>									
4	3.2	8-9	7	-	26.36	69.4	0.184	0.601	CA
<u>Bean vines, unspecified</u>									
4	3.2	8-9	7	-	150.7	208	0.812	1.207	
<u>Peppers</u>									
1 ^{26/}	1.6	6	7	99	0.76	1.86	0.01	0.05	CA,FL,TX
6 ^{1/}	3.2	3-7	0-30	-	1.3	5.2			FL,CT,NJ
2 ^{27/}	1.6	8	0	210	4.1	7.9	0.01	0.03	CA,FL,NC,TX
	2.4	8	0	210	6.4	12.2	0.02	0.07	CA,FL,NC,TX
	1.6	8	1	165	6.6	16	0.03	0.08	CA,FL,TX
	2.4	8	1	165	7.1	13.6	0.03	0.08	CA,FL,TX
	1.6	8	3	165	3.6	10.3	0.01	0.03	CA,FL,TX
	2.4	8	3	165	4.1	8.4	0.02	0.03	CA,FL,TX

24/ MRID No. 405873-03

25/ MRID No. 405401-05

26/ MRID No. 405401-04

27/ MRID No. 402021-01 and MRID No. 400456-01

All Available Maneb Residue data

<u>Commodity</u> <u>Source</u>	<u>Rate</u> <u>(lb ai/A)</u>	<u>#Appli-</u> <u>cations</u>	<u>PHI</u> <u>(days)</u>	<u>Storage</u> <u>(days)</u>	<u>Residue (ppm)</u>				<u>Locations</u>
					<u>Max.</u> <u>Ave.</u>	<u>Maneb</u> <u>Max.</u>	<u>ETU</u> <u>Ave.</u>	<u>ETU</u> <u>Max.</u>	
<u>Peppers, continued</u>									
2 27/	1.6	8	7	165	4.7	8.1	0.02	0.02	CA, FL, TX
	2.4	8	7	165	5	10.6	0.02	0.02	CA, FL, TX
	1.6	8	14	165	3.9	4.2	0.02	0.03	CA, FL, TX
	2.4	8	14	165	5.8	7.2	0.02	0.02	CA, FL, TX
<u>Tomatoes</u>									
1 28/	2.4	7	3	59	0.91	3.81	<0.01	<0.01	CA, FL, MI, TX
6 1/	2.1-3.4	1-20	0-7	-	0.55	1.3			TX, FL
5	2.4	3-10	1-5	-	1.48	4	<0.05	<0.05	FL, MI, MD, DE,
4	2.4	5-10	5-7	-	4.25	12.2	<0.025	<0.025	CA, FL, IN, MI
<u>Cucumbers</u>									
1 29/	1.6	7-8	5	42	0.5	2.3	0.04	0.07	CA, MI, NC, SC
6 1/	1.40	4-7	0-7	-	0.03	0.2			FL
5	2.4	4-5	1-7	-	0.36	0.68	<0.05	<0.05	FL, SC, MI
4	3	7	5	-	0.2	0.29	0.004	0.009	IN, NY
4 30/	3	7	5	305		2.28		0.009	IN
	6	7	5			0.1		<0.01	
<u>Pumpkins</u>									
6 31/	1.2-2.4	1-5	0-7	-	0.16	0.39			IL, WI
<u>Squash</u>									
6 1/	2.8	3-7	0-7	-	0.21	0.5			FL
5	2.4	3-4	1-7	-	0.23	0.51	<0.05	<0.05	SC, FL
4 30/	3	6	5	415		0.949		<0.01	FL
	6	7	5			0.201		<0.01	
<u>Watermelons</u>									
1 32/	1.6	8	5	85	0.43	1.41	0.01	0.01	GA, TX
6 31/	1.2	4-8	3-23	-		<0.1			FL

28/ MRID No. 405873-07 and MRID No. 400635-02

29/ MRID No. 405873-01

30/ Rejected in Screen for Inadequate Storage Stability Data.
Report by Healy & Associates. MRID No. 400635-01. Extremely poor
documentation.

31/ PP#321

32/ MRID No. 405401-03

All Available Maneb Residue data

<u>Commodity</u> <u>Source</u>	<u>Rate</u> <u>(lb ai/A)</u>	<u>#Appli-</u> <u>cations</u>	<u>PHI</u> <u>(days)</u>	<u>Storage</u> <u>(days)</u>	<u>Residue (ppm)</u>				<u>Locations</u>
					<u>Max.</u> <u>Ave.</u>	<u>Maneb</u> <u>Max.</u>	<u>ETU</u> <u>Ave.</u>	<u>ETU</u> <u>Max.</u>	
<u>Cantaloupe</u>									
5	2.4	8-12	1-5	-	1.6	2.3	<0.05	<0.05	GA
4	3	5-7	5	-	2.31	4.1	<0.010	<0.010	CA
<u>Apples</u>									
1 ^{33/}	4.5	7-13	21-30	191	0.55	0.99	<0.01	<0.01	CA,OH,NY,WV,VA
6 ^{1/}	8-12	4-8	54-100	-	0.11	0.2			
4	6.4	4-14	15-30	-	10.7	23.7	0.024	0.057	
<u>Apricots</u>									
3 ^{34/}	5.6	10	7	250	34.76	158.9	0.187	0.543	CA
			14		27.07	107.3	0.117	0.357	
			21		4.31	34.78	0.095	0.174	
	8		7		27.07	138.9	0.3	0.918	
			14		34.25	155.5	0.209	0.541	
			21		11.33	62.23	0.344	1.31	
<u>Peaches</u>									
3 ^{35/}	5.6	7-10	2	250	37.13	64.38	0.1	0.49	CA,GA,NJ
			7		15.06	21.42	0.07	0.13	GA,NJ
			10		23.05	27.19	0.04	0.06	GA,NJ
			14		32.65	59.93	0.08	0.34	CA,GA,NJ
	8		2		68.81	174.4	0.2	0.77	CA,GA,NJ
			7		37.44	57.93	0.05	0.07	GA,NJ
			10		22.75	31.02	0.04	0.06	GA,NJ
			14		35.16	62.15	0.07	0.24	CA,GA,NJ
6 ^{13/}	4-8	1	0-33	-	11.1	23			CA,WA
<u>Nectarines</u>									
3 ^{36/}	5.6	10	7	250	15.32	58.24	0.029	0.07	CA
			14		17.68	31.54	0.05	0.112	
	8		7		19.24	48.18	0.058	0.28	
			14		20.88	74.02	0.058	0.233	

33/ MRID No. 405542-02

34/ MRID No. 401099-02 and MRID NO. 400676-02

35/ MRID No. 401099-06 and MRID No. 400529-01

36/ MRID No. 401099-01 and MRID No. 400676-01

All Available Maneb Residue data

<u>Commodity</u> <u>Source</u>	<u>Rate</u> <u>(lb ai/A)</u>	<u>#Appli-</u> <u>cations</u>	<u>PHI</u> <u>Storage</u> <u>(days)</u>	<u>Max.</u> <u>Storage</u> <u>(days)</u>	<u>Residue (ppm)</u>				<u>Locations</u>
					<u>Ave.</u>	<u>Max.</u>	<u>Ave.</u>	<u>Max.</u>	
<u>Grapes</u>									
1 37/	3.2	5	8	17	8.6	12	0.03	0.06	CA
	3.2	3	30	53	1.7	2.3	0.01	0.01	
	2.4	3	30	53	1.3	1.9	<0.01	<0.01	
	1.2	3	30	53	0.63	0.38	<0.01	<0.01	
4	4	7	7		11.93	13.5	<0.010	<0.010	CA
3 38/	EIU not measured								
<u>Almonds</u>									
4	1.6	3-4	96-182	-	0.111	0.58	<0.010	<0.010	
<u>Almond hulls</u>									
4	1.6	3-4	96-182	-	29.3	91.9	<0.020	0.026	
<u>Corn, Sweet</u>									
1 39/	1.6	5	4	105	0.07	0.27	<0.01	<0.01	GA, IL, MN, NY, WI, OR
4 40/	2	14	0	480		0.693		0.016	NY, FL
	4					12.6		0.077	
6 13/	2.1-2.8	5-13	0-21	-	<0.2	<0.2			FL
4	2	7-14	0-7	480	0.3	1.86	<0.016	<0.016	CA, NY, WI, FL
<u>Corn Fodder</u>									
1 39/	1.6	5	4	105	26.2	70.8	0.07	0.17	
4				480	42.4	93.2	0.105	0.235	
<u>Cannery Waste</u>									
4	2	14	0	-		3.83		0.048	
	4			480		10.7		0.06	

37/ MRID No. 405542-04

38/ MRID No. 400635-05

39/ MRID No. 405873-04. Sweet corn kernels plus cob with husk removed (K+CWHR) was analyzed. Corn Fodder was identified in the report as corn forage.

40/ MRID No. 401335-01. Compilation of 1985 data from MTF Report Nos. 85-21, 85-22, and 85- .

RESIDUE ESTIMATES IN RAW AGRICULTURAL COMMODITIES

Residue values to be used in the Special Review are the best available estimates based on the studies discussed above. We have used the average maneb residues from residue field trial data from studies closest to the maximum rate, minimum PHI, and at least the typical number of applications. If higher average residues were found in residue studies with a longer PHI or lower application rate, the higher residues were used as residue estimates. If residues from a lower application rate than the maximum application rate were used, then the residue estimate was increased proportionally to the maximum application rate. For ETU residues, we have used the average ETU residue from residue field trial data, corrected for the loss of ETU residue on sample storage when the loss on storage exceeded 20%. The correction for the loss of ETU on frozen sample storage is shown in the table. Average residue estimates will be used for chronic analysis. Maximum residue estimates will be used for acute analysis.

Average Residue Estimates in Raw Agricultural Commodities

<u>Crop</u>	Residue (ppm)	
	<u>Maneb</u>	<u>ETU</u> , with correction for loss of ETU on frozen storage
Carrots 47/	9.99	0.023
Potatoes 48/	0.077	<0.012
Sugar Beets 49/	0.35	$<0.012/0.70 = <0.017$
Sugar Beet Tops 49/	42.0	$0.17/0.34 = 0.50$
Turnips 47/	13.68	$0.018/0.63 = 0.29$
Turnip Tops 47/	47.8	$0.06/0.21 = 0.29$
Onions, Green 50/	20.	0.06
Onions, bulb 47/	5.89	$0.11/0.70 = 0.16$
Celery 47/	64.9	$0.073/0.21 = 0.35$
Lettuce, Leaf 47/	22.6	$0.13/0.21 = 0.62$
Lettuce, Head 51/	6.77	$0.011/0.21 = 0.052$

47/ 1986 residue data

48/ 1985 residue data with higher residue than 1987 residue data

49/ 1987 residue data with proportional increase for Maneb; 1985 residue data for ETU showing higher residue than 1987 residue data

50/ 1987 residue data with proportional increase

51/ 1986 and 1985 residue data

Average Residue Estimates in Raw Agricultural Commodities, continued

<u>Crop</u>	<u>Residue (ppm)</u>	
	<u>Maneb</u>	<u>ETU</u>
Spinach ^{52/}	44.1	0.16/0.76 = 0.092
Collards ^{53/}	44.1	0.16/0.76 = 0.092
Mustard Greens ^{54/}	51.1	0.012/0.76 = 0.092
Broccoli, unwashed ^{54/}	19.9	0.07/0.76 = 0.092
Kohlrabi ^{55/}	19.9	0.07/0.76 = 0.092
Brussels Sprouts ^{55/}	19.9	0.07/0.76 = 0.092
Cabbage, untrimmed ^{56/}	2.98	0.04
Cabbage, trimmed ^{56/}	0.85	<0.01
Cauliflower ^{57/}	0.85	<0.01
Chinese Cabbage ^{57/}	0.85	<0.01
Kale ^{58/}	22.0	0.11
Beans, Succulent ^{58/}	3.12	0.075
Beans, Dry ^{58/}	2.50	0.045
Succulent Bean Vines ^{58/}	644	1.74
Dry Bean Vines ^{58/}	216	6.18
Peppers ^{59/}	7.1	0.03
Tomatoes ^{60/}	4.25	<0.01
Eggplant ^{61/}	4.25	<0.01
Cucumbers ^{58/}	0.75	0.06
Squash ^{62/}	0.95	<0.01
Melons ^{63/}	1.6	0.015

52/ 1986 residue data with higher residue

53/ translated from spinach

54/ 1986 residue data

55/ translated from broccoli

56/ 1987 residue data

57/ translated from cabbage

58/ 1987 residue data with proportional increase

59/ 1986 residue data with higher residue

60/ 1985 residue data with higher residues

61/ translated from tomatoes

62/ 1985 residue data

63/ DuPont residue data for maneb and 1987 residue data with proportional increase for ETU

Average Residue Estimates in Raw Agricultural Commodities continued

<u>Crop</u>	<u>Residue (ppm)</u>	
	<u>Maneb</u>	<u>ETU</u>
Pumpkin ^{64/}	1.6	0.015
Apples ^{65/}	13.4	0.03/0.14 = 0.21
Apricots ^{66/}	34.2	0.344/0.14 = 2.46
Peaches ^{66/}	68.8	0.20/0.14 = 1.42
Nectarines ^{66/}	20.9	0.058/0.14 = 0.41
Grapes ^{67/}	10.8	0.038/0.14 = 0.27
Almonds ^{68/}	0.44	<0.040
Almond Hulls ^{68/}	117.2	<0.080
Sweet Corn (K+CWHR) ^{69/}	0.3	<0.016
Corn Fodder ^{69/}	42.4	0.105
Corn Cannery Waste ^{70/}	3.83	0.048
Bananas, whole ^{70/}	0.07	0.016
Banana, edible portion ^{70/}	<0.05	0.018
Figs ^{66/}	0.95	0.015
Cranberries ^{66/}	0.32	0.01
Papayas ^{71/}	2.8	-
Rhubarb ^{72/}	65	0.35

^{64/} translated from melons

^{65/} 1985 residue data showing higher residues and proportional increase

^{66/} 1986 residue data

^{67/} 1987 residue data with proportional increase

^{68/} 1985 residue data with proportional increase

^{69/} 1985 residue data with higher residues

^{70/} 1985 residue data

^{71/} PP#225

^{72/} translate from celery

Maximum Residue Estimates in Raw Agricultural
Commodities

Crop	Residue (ppm)	
	Maneb	ETU
Carrots	18.	0.080
Potatoes	0.099	0.003
Sugar Beets	2.7	0.004
Sugar Beet Tops	179	1.7
Turnips	19	0.043
Turnip Tops	122	0.68
Onions, Green	22	0.040
Onions, bulb	12	0.16
Celery	180	1.3
Lettuce, Leaf (washed)	119	1.7
Lettuce, Head	18	0.29
Spinach	92	0.47
Collards	92	0.47
Mustard Greens	85	0.20
Broccoli, unwashed	48	0.24
Kohlrabi	48	0.24
Brussels Sprouts	48	0.24
Cabbage, untrimmed	16	0.11
Cabbage, trimmed	2.1	0.020
Chinese Cabbage	2.1	0.020
Cauliflower	2.1	0.020
Kale	57	0.32
Beans, Succulent	11	0.24
Beans, Dry	6.3	0.090
Succulent Bean Vines	2140	9.0
Dry Bean Vines	702	14
Peppers	24	0.080
Tomatoes	12	0.002
Eggplant	see tomatoes	
Cucumber	3.4	0.10
Squash	0.95	0.002
Melons	2.3	0.015
Pumpkin	2.3	0.015
Apples	30	0.51
Apricots	156	3.9
Peaches	175	5.5
Nectarines	75	2.0
Grapes	15	0.54
Almonds	2.3	0.010
Almond Hulls	368	0.10
Sweet Corn (K+CWHR)	1.9	0.016
Corn Fodder	93	0.24
Corn Cannery Waste	3.8	0.048
Bananas, whole	0.22	0.023
Banana, edible portion	0.050	0.030

Average Residue Estimates in Raw Agricultural
Commodities continued

<u>Crop</u>	<u>Residue (ppm)</u>	
	<u>Maneb</u>	<u>ETU</u>
Figs	3.2	0.066
Cranberries	0.74	0.012
Papayas	5.2	0.002
Rhubarb	180	1.3

PROCESSING DATA

The following processing data were submitted:

<u>Crop</u>	<u>Processed Commodity</u>	<u>MRID No.</u>			
Green Beans	cooked, canned	405873-02			
	cooked, frozen				
	cooked, pureed (baby food)				
	cannery waste				
Tomatoes	wet pomace	405873-06			
	dry pomace				
	canned, whole tomatoes				
	tomato puree				
	tomato catsup				
	tomato paste				
	tomato juice from paste				
Sugar Beets	white sugar	405401-12			
	molasses				
	dried pulp				
Grapes	dry pomace	405542-03			
	wet pomace				
	thick juice				
	raisins				
	raisin waste				
Apples	cooked, canned juice	not submitted			
	cooked, canned applesauce				
	strained apple baby food				
	wet and dry pomace				
<u>Crop</u>	<u>Processed Commodity</u>	<u>MRID No.</u>			
			Potatoes	cooked dehydrated flakes	not submitted
				fried chips	
				wet and dry peel	

No processing data were submitted for any apple or potato processed fractions. No explanation was included for these omissions. The processing data submitted are tabulated below. The percent conversion was calculated on a weight/weight basis without correction for the difference in molecular weights of maneb and ETU. Thus, the maximum theoretical percent conversion from maneb to ETU is $MW\ ETU / MW\ maneb * 100\% = 102/265 * 100\% = 38.5\%$.

Maneb Processing Data

Commodity	Residue (ppm)		Conc.	% Conv
	Maneb	ETU	Factor Maneb	ETU
<u>Apples</u>				
	not done			
Fresh Juice	use metiram results		0.05	0.91
Cooked Juice			0.05	0.45
Wet Pomace			4.64	6.82
Dry Pomace			12.95	44.55
Apple Sauce			0.09	0.45
Apple Baby Food			0.05	0.45
<u>Potatoes</u>				
	not done			
Wet Peel	use metiram results		--	--
Dry Peel			--	--
Potato Chips			--	--
Potato Granules			--	--
<u>Sugar Beets</u>				
	0.13	<0.01		
White Sugar	<0.05	<0.01	0.38	--
Molasses	<0.05	<0.01	0.38	--
Dried Pulp	0.17	<0.01	1.31	--
<u>Tomatoes</u>				
	0.15	<0.01	(4.8 lb ai/A)	
Wet pomace	0.09	<0.01	0.61	
Dry pomace	<0.05	0.03	<0.33	20
Canned whole	<0.05	<0.01	<0.33	
Catsup	<0.05	<0.01	<0.33	
Paste	<0.05	0.03	<0.33	20
Juice from paste	<0.05	0.03	<0.33	20
<u>Snap Beans</u>				
raw	6.97	0.02		
Cooked/canned	0.04	0.55	0.01	7.6
Cooked/frozen	0.47	0.25	0.07	3.3
Cooked/pureed	<0.05	0.36	<0.01	4.9
Cannery waste	8.67	0.16	1.28	2.0

Maneb Processing Data, continued

Commodity	Residue (ppm)		Conc. Factor % Conv	
	Maneb	ETU	Maneb	ETU
<u>Grapes</u>	24.04	0.09		
at processor	14.08	0.03	1.0	0.0
Dry Pomace	9.04	0.66	0.6	4.5
Wet Pomace	8.43	0.23	0.6	1.4
Thick juice	0.89	6.56	0.04	46.4
Raisins	4	0.81	0.3	5.5
Raisin Waste	22.6	1.74	1.6	12.1

RCB Comment

Maneb concentrates in dry sugar beet pulp, an animal feed item. No conversion of maneb to ETU in sugar beet commodities was noted. We note that non-detectable residues of ETU have been reported in all prior residue studies on sugar beets.

Maneb does not concentrate in tomato processed commodities. Maneb is converted to ETU in tomato processed commodities (up to 20% conversion). We note that non-detectable residues of ETU have been reported in all prior residue studies on tomatoes.

Maneb concentrates in cannery waste of snap beans. ETU is formed in all processed fractions snap beans. (3-8% conversion)

Maneb does not concentrate in processed fractions of grapes; however, ETU is formed in all processed fractions of grapes. No explanation was given for the difference between "grapes" and "at processor." Presumably, the grapes were analyzed before and after shipment to the processor. Our concentration factor for maneb and % conversion to ETU are calculated from the maneb and ETU levels measured "at processor."

The percent conversion calculated for dry apple pomace and thick grape juice exceeds the theoretical maximum percent conversion. This may be due to the loss of water in the production of these processed commodities.

No conclusions can be made regarding concentration in apple and potato processed commodities, since the required studies were not submitted. For the purpose of estimating residues in the processed fractions of apples, we have used the results of the metiram apple processing study. No detectable residues were found in metiram treated potatoes, or in the processed commodities from metiram treated potatoes.

Previously submitted processing studies

Processing studies had been submitted earlier and were reviewed in our memo of 2/20/87 (M. Kovacs). The studies were inadequately documented, particularly lacking in sample storage information. The processing results reported in this submission generally show greater concentration or less reduction of maneb residues and greater conversion to ETU than was reported in previous studies. The previously submitted processing studies will not be discussed further.

Residue Estimates in Processed Commodities

For maneb residues in processed commodities of apples, we have multiplied the best available estimate for the raw agricultural commodity by the concentration factor determined for metiram in the metiram processing studies. For maneb residues in processed commodities of sugar beets, tomatoes, snap beans, and grapes, we have multiplied the best available estimate of maneb residues for the raw agricultural commodity by the concentration factor determined in the maneb processing studies. For potatoes, no processing study was submitted, and no concentration of metiram or conversion to ETU was demonstrated in the metiram potato processing study.

For ETU residue estimates in processed commodities, we have multiplied the maneb residue estimate for the raw agricultural commodity by the percent conversion determined in the metiram or maneb processing study, and added the ETU residue estimate from the raw agricultural commodity.

Our residue estimates for processed commodities are tabulated below.

<u>Commodity</u>	<u>Average Residue Estimates in Processed Commodities</u>		<u>Conc.</u>	
	<u>Factor</u> Maneb	<u>% Conv</u> ETU	<u>Residue Estimate (ppm)</u> Maneb	<u>ETU</u>
<u>Apples</u>			13.4	0.21
Fresh Juice	0.05	0.91	0.67	0.33
Cooked Juice	0.05	0.45	0.67	0.27
Wet Pomace	4.64	6.82	62	1.1
Dry Pomace	12.95	44.55	173	6.2
Apple Sauce	0.09	0.45	1.2	0.27
Apple Baby Food	0.05	0.45	0.67	0.27
<u>Potatoes</u>			0.077	<0.012
Wet Peel	--	--	0.077	<0.012
Dry Peel	--	--	0.077	<0.012
Potato Chips	--	--	0.077	<0.012
Potato Granules	--	--	0.077	<0.012

Average Residue Estimates in Processed Commodities
Conc.

Commodity	Factor		% Conv	Residue Estimate (ppm)	
	Maneb	ETU		Maneb	ETU
<u>Sugar Beets</u>				0.52	<0.012
White Sugar	0.38	--		0.20	<0.012
Molasses	0.38	--		0.20	<0.012
Dried Pulp	1.31	--		0.68	<0.012
<u>Tomatoes</u>				4.2	0.025
Wet pomace	0.61			2.6	0.025
Dry pomace	<0.33	20		1.4	0.075
Canned whole	<0.33			1.4	0.025
Catsup	<0.33			1.4	0.025
Paste	<0.33	20		1.4	0.075
Juice from past	<0.33	20		1.4	0.075
<u>Snap Beans</u>					
raw				3.1	0.075
Cooked/canned	0.01	7.6		0.031	0.31
Cooked/frozen	0.07	3.3		0.22	0.18
Cooked/pureed	<0.01	4.9		<0.031	0.23
Cannery waste	1.28	2.0		4.0	0.14
<u>Grapes</u>				11	0.26
at processor	1.0	0.0		11	0.26
Dry Pomace	0.6	4.5		6.4	0.74
Wet Pomace	0.6	1.4		6.4	0.42
Thick juice	0.1	46.4		0.41	5.2
Raisins	0.3	5.5		3.1	0.86
Raisin Waste	1.6	12.1		17	1.6

Maximum Residue Estimates in Processed Commodities
Conc.

Commodity	Factor		% Conv	Residue Estimate (ppm)	
	Maneb	ETU		Maneb	ETU
<u>Apples</u>				30.	0.51
Fresh Juice	0.05	0.91		1.5	0.78
Cooked Juice	0.05	0.45		1.5	0.64
Wet Pomace	4.64	6.82		139	2.6
Dry Pomace	12.95	44.55		388	14
Apple Sauce	0.09	0.45		2.7	0.64
Apple Baby Food	0.05	0.45		1.5	0.64
<u>Potatoes</u>				0.099	0.003
Wet Peel	--	--		0.099	0.003
Dry Peel	--	--		0.099	0.003
Potato Chips	--	--		0.099	0.003
Potato Granules	--	--		0.099	0.003

Maximum Residue Estimates in Processed Commodities

Commodity	Factor Maneb	% Conv ETU	Conc.	
			Residue Estimate (ppm) Maneb	Residue Estimate (ppm) ETU
Sugar Beets			2.7	0.004
White Sugar	0.38	-	1.0	0.004
Molasses	0.38	-	1.0	0.004
Dried Pulp	1.31	-	3.5	0.004
Tomatoes			12.2	0.025
Wet pomace	0.61		7.4	0.025
Dry pomace	<0.33	20	4.0	2.4
Canned whole	<0.33		4.0	0.025
Catsup	<0.33		4.0	0.025
Paste	<0.33	20	4.0	2.4
Juice from paste	<0.33	20	4.0	2.4
Snap Beans				
raw			11	0.24
Cooked/canned	0.01	7.6	0.11	1.1
Cooked/frozen	0.07	3.3	0.80	0.62
Cooked/pureed	<0.01	4.9	0.11	0.80
Cannery waste	1.28	2.0	15	0.47
Grapes			15	0.54
at processor	1.0	0.0	15	0.54
Dry Pomace	0.6	4.5	9.6	1.2
Wet Pomace	0.6	1.4	9.0	0.75
Thick juice	0.1	46.4	0.95	7.5
Raisins	0.3	5.5	4.3	1.4
Raisin Waste	1.6	12.1	24	2.4

PROCESSING AND COOKING STUDIES

Several washing and cooking studies have been conducted. One study was done under contract to EPA (W. F. Phillips and M. D. Grady, April, 1977, "Effects of Food Processing on Residues of Two Ethylenebisdithiocarbamate (EBDC) Fungicides and Ethylene-thiourea (ETU)," EPA-600/1-77-021). Tomatoes, spinach, and carrots were treated with EBDC fungicides and analyzed before and after washing and cooking. An earlier study was conducted by an EPA laboratory. (R. R. Watts, R. W. Storherr, J. H. Onley, "Effects of Cooking on Ethylenebisdithiocarbamate Degradation to Ethylene Thiourea," Bull. Environ. Contam. Toxicol., 12(2), 1974, 224-226). Samples of spinach, potato, and carrot were spiked with EBDC fungicides either before or after cooking, and analyzed after cooking. The percent conversion to ETU was calculated.

The results of the Phillips study are summarized below. Residues of EBDC and ETU are tabulated, along with the

concentration/reduction factor for the reduction of EBDC residues and the percent conversion of EBDC to ETU. The percent conversion of EBDC to ETU was calculated on a weight/weight basis without regard for the differing molecular weights of the various EBDC's and ETU.

Summary of Phillips Processing and Cooking Studies

	Residues (ppm)		Conc/ Reduc. Factor (EBDC)	%Conv. to ETU
	EBDC	ETU		
Tomatoes - Mancozeb - Trial 1				
Unwashed	0.3	<0.01		
Washed	0.2	<0.01	0.7	0.0
Canned Juice	<0.01	0.03	0.3	10.0
Tomatoes - Mancozeb - Trial 2				
Unwashed	2.1	0.01		
Washed	0.6	0.01	2.0	0.0
Canned Juice	0.5	0.11	1.7	4.8
Tomatoes - Maneb				
Unwashed	2.4	<0.01		
Washed	0.1	<0.01	0.0	0.0
Canned Juice	0.4	0.04	0.2	1.7
Canned Whole	0.3	0.02	0.1	0.8
Canned whole, then cooked 5 min'	0.2	0.06	0.1	2.5
cooked 60 min	0.1	0.07	0.0	2.9
Sauce	0.8	0.11	0.3	4.6
Paste	2.2	0.37	0.9	15.4
Carrots - Mancozeb				
Unwashed	0.6	<0.01		
Washed	0.3	<0.01	0.5	0.0
Frozen	<0.01	<0.01	0.2	0.0
Juice	<0.01	0.03	0.2	5.0
Spinach - Mancozeb - Trial 1				
Unwashed	2.4	<0.01		
Washed	1.5	<0.01	0.6	0.0
Frozen	0.1	0.04	0.0	1.7
Juice	<0.1	0.18	0.0	7.5
Spinach - Mancozeb - Trial 2				
Unwashed	61.9	0.34		
Washed	9.7	0.02	0.2	0.0
Frozen	0.6	0.5	0.0	0.3
Juice	0.1	0.71	0.0	0.6

Summary of Phillips Processing and Cooking Studies, continued

	Residues (ppm)		Conc/ Reduc. Factor (EBDC)	%Conv. to ETU
	EBDC	ETU		
Spinach - Maneb				
Unwashed	86.6	0.24		
Washed	35.2	0.06	0.4	0.0
Blanched Frozen	0.4	0.76	0.0	0.6
cooked 5 min	0.2	0.76	0.0	0.6
Canned	<0.1	1.82	0.0	1.8
cooked 5 min	<0.1	2.12	0.0	2.2

The results of the Watts study are summarized below. Samples were fortified with 10.0 ppm of EBDC compound either before or after cooking. Samples were cooked by boiling for 15 minutes on a hot plate. Samples were analyzed for ETU, and the percent ETU formed was calculated on a weight/weight basis.

ETU produced from cooking vegetables fortified
with 10.0 ppm EBDC Compound

Crop	EBDC	ppm ETU found		Percent ETU formed by cooking
		Fortified after cooking	Fortified before cooking	
Spinach	Maneb	0.16	1.82	16.6
	Dithane M-45	0.15	2.17	20.2
	Manzate 200	0.11	2.42	23.1
	Polyram	0.07	2.72	26.5
Potato	Polyram	0.08	1.43	13.5
	Maneb	0.08	1.20	11.2
Carrot	Polyram	0.09	1.42	13.3
	Maneb	0.08	1.42	13.4

A mancozeb cooking/processing study was submitted by Rohm and Haas and was discussed in our memo of 11/19/86 (M. Bradley). This study may be used for estimating concentration of residues in baked potato flesh and skin. The results are tabulated below.

	Concentration Factor (Mancozeb)	% Conversion to ETU (w/w)
potatoes		
baked flesh	1	1.7
baked skins	1	6.9

The results of these studies will be used to correct residue estimates for the effects of washing and cooking, since the Tolerance Assessment System has categories for both raw and cooked commodities. Tomato EBDC residues and EBDC residues in other fruits and fruiting vegetables will be multiplied by a factor of 0.7 to correct for washing. Tomato ETU residues will be corrected using a 4.6% conversion factor for EBDC to ETU. This same factor will be used for other fruiting vegetables. Apple and other fruit ETU residues will be corrected by a 0.45% conversion factor for EBDC to ETU. This factor is the EBDC to ETU conversion factor from the metiram processing study for applesauce. Bean EBDC residues and EBDC residues in other similar commodities will be multiplied by a factor of 0.07 to correct for the effect of washing. Bean ETU residues will be corrected for 7.6% conversion of EBDC to ETU. These factors are from the maneb snap bean processing study. EBDC residues in spinach and other leafy vegetables will be multiplied by 0.6 to correct for the effects of washing. ETU residues in spinach and other leafy vegetables will be corrected for 12% conversion of EBDC to ETU on cooking. The 12% figure is the average of the conversion factors determined in the Phillips study and the Watts study discussed above. EBDC residues in carrots and other root crops will be multiplied by 0.5% to correct for the effects of washing. ETU residues in carrots and other root crops will be corrected for 13% conversion of EBDC to ETU on cooking. The 13% figure is the average of the % conversion determined in the Watts study for carrots and potatoes. The percent conversion from EBDC to ETU for cooking is calculated using the EBDC residue in the raw agricultural commodity since the conversion factors were calculated from cooking and processing studies using unwashed raw agricultural commodities. Residues in baked whole potatoes have been estimated by assuming that baked whole potatoes contain 10% baked skins and 90% baked flesh. The corrected residue estimates are tabulated below. Non-detectable residues have been included as one-fourth the limit of detection.

Summary of Maneb Residue Estimates on Washed, Cooked and Processed Commodities

Crop	Average Residues (ppm)	
	Maneb	ETU
Carrots	10	0.023
washed	5	0.023
cooked	5	1.3
Potatoes	0.077	0.003
washed	0.038	0.003
baked flesh	0.038	0.13
baked skins	0.038	0.53
baked whole	0.038	0.17
Potatoes		
Wet Peel	0.077	0.004
Dry Peel	0.077	0.004
Potato Chips	0.077	0.004
Potato Granules	0.077	0.004
Sugar Beets	0.52	0.004
White Sugar	0.20	0.004
Molasses	0.20	0.004
Dried Pulp	0.68	0.004
Sugar Beet Tops	42	0.5
Turnips	14	0.29
washed	6.8	0.29
cooked	6.8	2.1
Turnip Tops	48	0.29
washed	29	0.29
cooked	29	6.0
Onions, Green	20.	0.060
washed	6.7	0.060
cooked	6.7	2.5
Onions, bulb	5.9	0.16
washed	2.9	0.16
cooked	2.9	0.93
Celery	65	0.35
washed	39	0.35
cooked	39	8.1
Lettuce, Leaf	23	0.62
washed	14	0.62
Lettuce, Head	6.8	0.052
washed	4.1	0.052
cooked	4.1	0.86
Spinach	44.	0.092
washed	26	0.092
cooked	26	5.4
Collards	44	0.092
washed	26	0.092
cooked	26	5.4

Crop	Average Residues (ppm)	
	Maneb	ETU
Mustard Greens	51	0.092
washed	31	0.092
cooked	31	6.2
Broccoli, unwashed	20	0.092
washed	12	0.092
cooked	12	2.5
Kohlrabi	20	0.092
washed	12	0.092
cooked	12	2.5
Brussels Sprouts	20	0.092
washed	12	0.092
cooked	12	2.5
Cabbage, untrimmed	3.0	0.040
Cabbage, trimmed	0.85	0.002
washed	0.51	0.002
cooked	0.51	0.10
Chinese Cabbage	0.85	0.002
washed	0.51	0.002
cooked	0.51	0.10
Cauliflower	0.85	0.002
washed	0.51	0.002
cooked	0.51	0.10
Kale	22	0.11
washed	13	0.11
cooked	13	2.8
Beans, Succulent	3.1	0.075
Cooked/canned	0.031	0.31
Cooked/frozen	0.22	0.19
Cooked/pureed	0.031	0.23
Cannery waste	4.0	0.14
Beans, Dry	2.5	0.045
washed	0.18	0.045
cooked	0.18	0.24
Succulent Bean Vines	644	1.7
Dry Bean Vines	216	6.2
Peppers	7.1	0.08
washed	5.0	0.08
cooked	5.0	0.41
Tomatoes	4.2	0.002
washed	3.0	0.002
Wet pomace	2.6	0.025
Dry pomace	1.4	0.075
Canned whole	1.4	0.025
Catsup	1.4	0.025
Paste	1.4	0.075
Juice from paste	1.4	0.075
Eggplant-see tomatoes		

Crop	Average Residues (ppm)	
	Maneb	ETU
Cucumber	0.75	0.060
washed	0.52	0.060
cooked	0.52	0.094
Squash	0.95	0.002
washed	0.66	0.002
cooked	0.66	0.044
Melons	1.6	0.015
washed	1.1	0.015
cooked	1.1	0.089
Pumpkin	1.6	0.015
washed	1.1	0.015
cooked	1.1	0.089
Apples	13	0.210
washed	9.4	0.210
cooked-see applesauce		
Fresh Juice	0.67	0.21
Cooked Juice	0.67	0.33
Wet Pomace	62	1.1
Dry Pomace	174	6.2
Apple Sauce	1.2	0.27
Apple Baby Food	0.67	0.27
Apricots	34	2.5
washed	24	2.5
cooked	24	2.6
Peaches	69	1.4
washed	48	1.4
cooked	48	1.7
Nectarines	21	0.41
washed	15	0.41
cooked	15	0.50
Grapes	11	0.26
washed	7.6	0.26
cooked	7.6	0.32
Dry Pomace	6.9	0.74
Wet Pomace	6.4	0.42
Thick juice	0.41	5.2
Raisins	3.1	0.86
Raisin Waste	17	1.6
Almonds	0.44	0.010
Almond Hulls	117	0.020
Sweet Corn (K+CWHR)	0.30	0.004
washed	0.02	0.004
cooked	0.02	0.021
Corn Fodder	42	0.10
Corn Cannery Waste	3.8	0.048
Bananas, whole	0.070	0.016
Banana, edible portion	0.050	0.018
Figs	0.95	0.015
Cranberries	0.40	0.012
Papayas	2.8	0.002

Crop	Average Residues (ppm)	
	Maneb	ETU
Rhubarb	65	0.35
washed	39	0.35
cooked	39	8.1

Maneb Residue Estimates for Acute Exposure

Crop	Maximum Residues (ppm)	
	Maneb	ETU
Carrots	18.	0.080
washed	9.0	0.080
cooked	9.0	2.4
Potatoes	0.099	0.003
washed	0.049	0.003
baked flesh	0.049	0.17
baked skins	0.049	0.69
baked whole	0.049	0.22
Wet Peel	0.099	0.003
Dry Peel	0.099	0.003
Potato Chips	0.099	0.003
Potato Granules	0.099	0.003
Sugar Beets	2.7	0.004
White Sugar	1.0	0.004
Molasses	1.0	0.004
Dried Pulp	3.5	0.004
Sugar Beet Tops	179	1.7
Turnips	19	0.043
washed	9.5	0.043
cooked	9.5	2.5
Turnip Tops	122	0.68
washed	61	0.68
cooked	61	15
Onions, Green	22	0.040
washed	11	0.040
cooked	11	2.7
Onions, bulb	12	0.16
washed	6.1	0.16
cooked	6.1	1.7
Celery	180	1.3
washed	108	1.3
cooked	108	23
Lettuce, Leaf		1.7
washed	119	1.7
Lettuce, Head	18	0.29
washed	11	0.29
cooked	11	2.4
Spinach	92	0.47
washed	55	0.47
cooked	55	12

Crop	Maximum Residues (ppm)	
	Maneb	ETU
Collards	92	0.47
washed	55	0.47
cooked	55	12
Mustard Greens	85	0.20
washed	51	0.20
cooked	51	10
Broccoli, unwashed	48	0.24
washed	29	0.24
cooked	29	6.0
Kohlrabi	48	0.24
washed	29	0.24
cooked	29	6.0
Brussels Sprouts	48	0.24
washed	29	0.24
cooked	29	6.0
Cabbage, untrimmed	16	0.11
Cabbage, trimmed	2.1	0.020
washed	1.3	0.020
cooked	1.3	0.27
Chinese Cabbage	2.1	0.020
washed	1.3	0.020
cooked	1.3	0.27
Cauliflower	2.1	0.020
washed	0.020	0.020
cooked	0.27	0.27
Kale	57	0.32
washed	34	0.32
cooked	34	7.2
Beans, Succulent	11	0.24
Cooked/canned	0.11	1.1
Cooked/frozen	0.80	0.62
Cooked/pureed	0.11	0.80
Cannery waste	15	0.47
Beans, Dry	6.3	0.090
washed	0.44	0.090
cooked	0.44	0.57
Succulent Bean		
Vines	2140	9.0
Dry Bean Vines	702	14
Peppers	24	0.080
washed	17	0.080
cooked	17	1.2
Tomatoes	12	0.002
washed	8.5	0.002
Wet pomace	7.4	0.025
Dry pomace	4.0	2.4
Canned whole	4.0	0.025
Catsup	4.0	0.025
Paste	4.0	2.4
Juice from paste	4.0	2.4

Crop	Maximum Residues (ppm)	
	Maneb	ETU
Eggplant	see tomatoes	
Cucumber	3.4	0.10
washed	2.4	0.10
cooked	2.4	0.26
Squash	0.95	0.002
washed	0.66	0.002
cooked	0.66	0.044
Melons	2.3	0.015
washed	1.6	0.015
cooked	1.6	0.12
Pumpkin	2.3	0.015
washed	1.6	0.015
cooked	1.6	0.12
Apples	30	0.51
washed	21	0.51
cooked-see applesauce		
Fresh Juice	1.5	0.78
Cooked Juice	1.5	0.64
Wet Pomace	139	2.6
Dry Pomace	388	13.9
Apple Sauce	2.7	0.64
Apple Baby Food	1.5	0.64
Apricots	156	3.9
washed	109	3.9
cooked	109	24
Peaches	175	5.5
washed	122	5.5
cooked	122	6.3
Nectarines	75	2.0
washed	52	2.0
cooked	52	2.3
Grapes	15	0.54
washed	8.4	0.54
cooked	8.4	0.60
Dry Pomace	9.6	1.2
Wet Pomace	9.0	0.75
Thick juice	0.55	7.5
Raisins	4.3	1.4
Raisin Waste	24	2.4
Almonds	2.3	0.010
Almond Hulls	368	0.10
Sweet Corn (K+CWHR)	1.9	0.016
washed	0.13	0.016
cooked	0.13	0.16
Corn Fodder	93	0.24
Corn Cannery Waste	3.8	0.048
Bananas, whole	0.22	0.023
Banana, edible portion	0.050	0.030

Crop	Maximum Residues (ppm)	
	Maneb	ETU
Figs	3.2	0.066
Cranberries	0.74	0.012
Papayas	5.2	0.002
Rhubarb	180	1.3
washed	108	1.3
cooked	108	23

MEAT, MILK, POULTRY, AND EGGS

No animal feeding study was included in this submission. Pennwalt submitted storage stability data on animal commodities with this submission, and intends to support their previously submitted animal feeding studies. The previously submitted animal feeding studies were reviewed in our memo of 2/20/87 (M. Kovacs, RCB Nos. 1379 and 1380, Accession Nos. 263911, 263912, MRID Nos. 001626-26 and 001626-27). The results of the animal feeding studies are tabulated below.

TABLE -

Residues in Animal Commodities from Livestock Feeding Studies

Commodity	Residue (ppm) at various feeding levels (ppm)					
	Maneb			ETU		
	10	30	100	10	30	100
<u>Cattle</u>						
Milk	nd	nd	0.156	nd	0.017	0.109
Beef Liver	0.12	0.07	0.19	<0.016	0.025	0.056
Beef Kidney	nd	0.11	0.08	<0.008	0.008	0.053
Beef Muscle	0.01	0.02	0.06	<0.008	0.01	0.025
Renal Fat	0.08	0.09	0.10	<0.008	<0.008	<0.008
Omental Fat	0.05	0.08	0.04			
<u>Poultry</u>						
Eggs	nd	nd	0.072	nd	0.019	0.060
Egg Yolk	nd	0.262	0.186	-	-	-
Egg White	nd	nd	0.048	-	-	-
Poultry Liver	nd	0.214	0.102	0.009	0.037	0.081
Poultry Kidney	nd	0.068	0.349	0.009	0.027	0.060
Poultry Muscle	0.013	0.048	0.131	0.010	0.012	0.038
Poultry Fat	0.284	0.378	0.265	<0.008	<0.008	<0.008

Animal Diets

Cattle feed items for which residue data are available and for which no feeding restriction exists are apple pomace, green

bean cannery waste, dry grape pomace, raisin waste, cull potatoes, sugar beet tops, sweet corn cannery waste and dry tomato pomace. A typical diet utilizing these feed items for beef and dairy cattle would be as shown below in the calculation of the dietary burden.

Maneb Dietary Burden for Cattle Using Average Residues

<u>Beef Cattle</u>	<u>% in Diet</u>	<u>Mean Residue (ppm) Maneb</u>	<u>Dietary Burden (ppm) Maneb</u>
Apple pomace (dry)	50	174	87
Sugar beet tops	20	42.6	8.52
Raisin waste	10	8.1	0.81
Other feeds	20	--	--
Total =			96
<u>Dairy Cattle</u>			
Apple pomace (dry)	25	174	43.5
Sugar beet tops	20	42.6	8.5
Green bean cannery waste	20	9.7	1.9
Raisin waste	10	8.1	0.8
Other feeds	25	--	--
Total =			54.7

The dietary burden of maneb was calculated using the mean residue of maneb in the animal feed, because it is unlikely that a livestock grower would treat all crops used for animal feed with maneb and would feed only treated animal feed items.

Expected residues of maneb and ETU resulting in tissue and milk from these diets are as follows:

Expected Residues in Beef Tissues and Milk from Average Residues in Animal Feed Items

	Residue (ppm)	
	<u>Maneb</u>	<u>ETU</u>
Milk	0.065	0.050
Liver	0.18	0.054
Muscle	0.06	0.024
Kidney	0.11	0.050
Fat	0.10	0.002

Poultry feed items for which residue data are available and for which no feeding restriction exists are apple pomace, grape pomace, cull potatoes, and wet tomato pomace. A typical diet utilizing these feed items for poultry would be as shown below in the calculation of the dietary burden.

Maneb Dietary Burden for Poultry Using Average Residues

<u>Poultry</u>	<u>% in Diet</u>	<u>Mean Residue (ppm) Maneb</u>	<u>Dietary Burden (ppm) Maneb</u>
Cull potatoes	20	< 0.1	0.01
Apple pomace (dry)	5	174	8.70
Grape pomace (dry)	5	3.2	0.16
Tomato pomace (wet)	2	2.6	0.05
Other feed items	68		
			Total = 8.92

Expected residues of maneb and ETU resulting in poultry tissue and eggs from this diet are as follows:

Expected Residues in Poultry Tissues and Eggs from Average Residues in Animal Feed Items

	Residue (ppm)	
	<u>Maneb</u>	<u>ETU</u>
Whole eggs	0.007	0.006
Liver	< 0.01	0.008
Kidney	< 0.01	0.008
Muscle	0.012	0.009
Fat	0.25	< 0.0008

Residues in Meat, Milk, Poultry, and Eggs for Acute Exposure

For use in assessing the acute exposure to ETU from maneb, residues in livestock tissues, milk and eggs are estimated from diets of maximum maneb residues.

Maneb Dietary Burden for Cattle Using Maximum Residues

<u>Beef Cattle</u>	<u>% in Diet</u>	<u>Max. Residue (ppm) Maneb</u>	<u>Dietary Burden (ppm) Maneb</u>
Apple pomace (dry)	50	389	194.5
Sugar beet tops	20	179	35.8
Raisin waste	10	19	1.9
Other feeds	20	--	--
			Total = 232

	<u>% in Diet</u>	<u>Max. Residue (ppm) Maneb</u>	<u>Dietary Burden (ppm) Maneb</u>
<u>Dairy Cattle</u>			
Apple pomace (dry)	25	389	97.2
Sugar beet tops	20	179	35.8
Green bean cannery waste	20	15	3.0
Raisin waste	10	19	1.9
Other feeds	25	--	--
			Total = 138

Expected residues of mane b and ETU resulting in tissue and milk from these diets are as follows:

Expected Residues in Beef Tissues and Milk from
Maximum Residues in Animal Feed Items

	<u>Residue (ppm)</u>	
	<u>Maneb</u>	<u>ETU</u>
Milk	0.21	0.15
Liver	0.44	0.13
Muscle	0.14	0.058
Kidney	0.19	0.12
Fat	0.23	0.019

Maneb Dietary Burden for Poultry Using Maximum Residues

<u>Poultry</u>	<u>% in Diet</u>	<u>Max. Residue (ppm) Maneb</u>	<u>Dietary Burden (ppm) Maneb</u>
Cull potatoes	20	0.1	0.01
Apple pomace (dry)	5	389	19.4
Grape pomace (dry)	5	7.7	0.38
Tomato pomace (wet)	2	7.4	0.15
Other feed items	68		
			Total = 20

Expected residues of maneb and ETU resulting in poultry tissue and eggs from this diet are as follows:

Expected Residues in Poultry Tissues and Eggs from
Maximum Residues in Animal Feed Items

	Residue (ppm)	
	<u>Maneb</u>	<u>ETU</u>
Whole eggs	0.014	0.010
Liver	0.11	0.023
Kidney	0.04	0.018
Muscle	0.03	0.011
Fat	0.30	< 0.0016

Discussion of Residues in Meat, Milk, Poultry, and Eggs

Storage Stability data for animal commodities have now been submitted and are discussed in the Storage Stability section of this review. Storage stability samples were stored for 3 months. In the dairy cattle study, milk, muscle, fat, and kidney analyzed for maneb were held in frozen storage for up to 57 days, and when analyzed for ETU were held in frozen storage for up to 86 days. Liver was held for ETU analysis for up to 100 days. In the poultry study, eggs, liver, kidney, muscle, and fat analyzed for maneb were held in frozen storage for up to 4 weeks prior to analysis. Egg and tissue samples were held in frozen storage for up to 3 months, prior to ETU analysis.

The livestock feeding studies are adequately supported by storage stability data.

Attachment I: Table of available residue data
attached to all copies except circu

cc: R.F., circu, S. Hummel, Maneb S.F., Maneb S.R.F. (Hummel),
Maneb R.S.F. (Hazel), V. Bael (SRB/RD), S. Lewis (PM#21),
PMSD/ISB
RDI:EZ:06/27/88:RDS:06/28/88
TS-769:RCB:RM810:CM#2:SVH:svh:06/29/88

Attachment I

MASTER RECORD IDENTIFICATION NUMBERS

Maneb Storage Stability, Residue, and Processing Data

00158657 Maneb Data Task Force (1986) Residues of Maneb Found in Sugar Beets and Sugar Beets Tops from a Field Experiment Conducted in Bluff County, Nebraska during the 1985 Growing Season. Unpublished study prepared in cooperation with Bio/dynamics Inc. 29 p. (CDL:261550)

00158658 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Apples. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 166 p. (CDL:261557)

00158659 Maneb Data Task Force (1986) Residues of Maneb Found in Tomatoes from a Field Experiment Conducted in Porter County, Indiana during the 1985 Growing Season. Unpublished compilation prepared in cooperation with Bio/dynamics Inc. 28 p. (CDL:261558).

00158660 Maneb Data Task Force (1986) Residues of Maneb and Its Metabolites E.T.U. Found in Tomatoes from a Field Experiment Conducted in Berrien County, Michigan during the 1985 Growing Season. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 33 p. (MTF 85-03) (CDL:261559) Report later revised twice. See also MRID No. 001569-95 (CDL:262826) and MRID No. 00616-13 (CDL:263355).

00158661 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Beans. Unpublished compilation prepared in cooperation with Morse Laboratories, Inc. 64 p. (CDL:261560)

00158662 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Tomatoes. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 54 p. (CDL:261561)

00158663 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Potatoes. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 57 p. (CDL:261563).

00158664 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Sweet Corn. Unpublished study prepared by Reed D. Smith Associates, Inc., and Morse Laboratories. 62 p. (CDL:261564).

00158667 Maneb Data Task Force (1986) Residues of Maneb Found in Leaf Lettuce from a Field Experiment Conducted in Berrien County, Michigan during the 1985 Growing Season: Report #MTF-85-27.

Unpublished study prepared in cooperation with Bio/dynamics, Inc. 26 p. (CDL:261657).

00158668 Maneb Data Task Force (1986) Residues of Maneb Found in Sweet Corn from a Field Experiment Conducted in Portage County, Wisconsin during the 1985 Growing Season: Report #MTF-85-23. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 26 p. (CDL:261658).

00158669 Maneb Data Task Force (1986) Residues of Maneb Found in Sugar Beets and Sugar Beet Tops from a Field Experiment Conducted in Polk County, Minnesota during the 1985 Growing Season: Report # MTF-85-12. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 26 p. (CDL:261659).

00158670 Maneb Data Task Force (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Sweet Corn from a Field Experiment Conducted in Ontario County, New York during the 1985 Growing Season: Report #MTF-85-22. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 36 p. (CDL:262660). Report later revised. See also MRID No. 001596-98 (CDL:262827).

00158671 Maneb Data Task Force (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Sugar Beets and Sugar Beet Tops from a Field Experiment Conducted in Saginaw County, Michigan during the 1985 Growing Season: Report #MTF-85-11. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 35 p. (CDL:262662). Report later revised. See also MRID No. 001596-96 (CDL:262827).

00158672 Maneb Data Task Force (1986) Residues of Maneb Found in Tomatoes from a Field Experiment Conducted in Seminole County, Florida during the 1985 Growing Season: Report #MTF-85-01. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 22 p. (CDL:261562).

00158673 Maneb Data Task Force (1986) Residues of Maneb Found in Sweet Corn from a Field Experiment Conducted in Palm Beach County, Florida during the 1985 Growing Season: Report #MTF-85-21. Unpublished study prepared in cooperation with Bio/dynamics Inc. 33 p. (CDL:261563).

00158674 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985 Western United States: Lettuce. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 56 p. (CDL:262664).

00158675 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985 Western United States: Almond. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 112 p. (CDL:262665). Chromatograms submitted later. (See MRID No. (CDL:262822)).

00158676 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Cabbage. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 56 p. (CDL:262666).

00158677 Maneb Data Task Force (1986) Residues of Maneb Found in Leaf Lettuce from a Field Experiment Conducted in Ontario County, New York during the 1985 Growing Season. Unpublished study prepared in cooperation with Bio/dynamics Inc. 26 p. (MTF 85-28) (CDL:262667)

00158678 Maneb Data Task Force (1986) Residues of Maneb and Its Metabolites E.T.U. Found in Head Lettuce from a Field Experiment Conducted in Palm Beach County, Florida during the 1985 Growing Season. Unpublished study prepared in cooperation with Bio/dynamics Inc. 33 p. (MTF 85-26) (CDL:262668 and 263351).

00158679 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Cucurbits. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 39 p. (CDL:262669).

00158680 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Grapes. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 43 p. (CDL:262670).

00159463 Maneb Data Task Force (1986) Residues of Maneb and its Metabolite E.T.U. Found in Apples from a Field Experiment Conducted in Lancaster County, Pennsylvania during the 1985 Growing Season: Report #MTF-85-43. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 31 p. (CDL:262671). Report later revised. See also MRID No. 001596-99 (CDL:262830).

00159464 Maneb Data Task Force (1986) Residues of Maneb Found in Apples from a Field Experiment Conducted in Wayne County, New York during the 1985 Growing Season: Report #MTF-85-42. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 31 p. (CDL:262672).

00159465 Maneb Data Task Force (1986) Residues of Maneb Found in Apples from a Field Experiment Conducted in Berrien County, Michigan during the 1985 Growing Season: Report #MTF-85-41. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 28 p. (CDL:262673).

00159466 Maneb Data Task Force (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Whole Bananas and Banana Pulp from a Field Experiment Conducted in Honduras during the 1985 Growing Season: Report #MTF-85-51. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 39 p. (CDL:262674). Report later revised. See also MRID No. 001616-11 (CDL:263353).

00159467 Maneb Data Task Force (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Cucumbers from a Field Experiment Conducted in Porter County, Indiana during the 1985 Growing Season: Report #MTF-85-32. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 32 p. (CDL:262675). Report later revised. See also MRID No. 001596-94 (CDL:262826 and 263350).

00159468 Maneb Data Task Force (1986) Residues of Maneb Found in Cucumbers from a Field Experiment Conducted in Ontario County, New York during the 1985 Growing Season: Report #MTF-85-33. Unpublished study prepared in cooperation with Bio/dynamics, Inc. 29 p. (CDL:262676).

00159469 Maneb Data Task Force (1986) Magnitude of Residue Data: Maneb and ETU 1985, Western United States: Sugar Beets. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 59 p. (CDL:262677).

00159692 Healy, M. (1986) Residues of Maneb Found in Potatoes from a Field Experiment Conducted in Waushara County, Wisconsin during the 1985 Growing Season: Report #MTF-85-18. Unpublished compilation prepared by Healy and Associates in cooperation with Bio/dynamics Inc. 22 p. (CDL:262823).

00159693 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Potatoes from a Field Experiment Conducted in Piscataquis County, Maine during the 1985 Growing Season: Report #MTF-85-16. Unpublished compilation prepared by Healy and Associates in cooperation with Bio/dynamics Inc. 28 p. (CDL:262824). Report later revised. See also MRID No. 001616-12 (CDL:263354).

00159694 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Cucumbers from a Field Experiment Conducted in Porter County, Indiana during the 1985 Growing Season: Rev.:Report #MTF-85-32. Unpublished compilation prepared by Healy and Associates in cooperation with Bio/dynamics Inc. 35 p. (CDL:262825 and 263350). See also earlier report MRID No. 001594-66 (CDL:262674).

00159695 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Tomatoes from a Field Experiment Conducted in Berrien County, Michigan during the 1985 Growing Season: Rev.:Report #MTF-85-03. Unpublished compilation prepared by Healy and Associates in cooperation with Bio/dynamics Inc. 38 p. (CDL:252826). Report later revised again. See also MRID No. 001616-13 (CDL:263355). See also earlier report MRID No. 001586-60 (CDL: 261559).

00159696 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Sugar Beets and Sugar Beet Tops from a Field Experiment Conducted in Saginaw County, Michigan during the 1985 Growing Season: Rev.:Report #MTF 85-11. Unpublished study

prepared by Healy and Associates in cooperation with Bio/dynamics Inc. 39 p. (CDL:262827). See also earlier report MRID No. 001586-71 (CDL:262661).

00159697 Healy, M. (1986) Residues of Maneb Found in Potatoes from a Field Experiment Conducted in Ontario County, New York during the 1985 Growing Season: Report #MTF-85-17. Unpublished compilation prepared by Healy and Associates in cooperation with Bio/dynamics Inc. 29 p. (CDL:262828).

00159698 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Sweet Corn from a Field Experiment Conducted in Ontario County, New York during the 1985 Growing Season: Rev.: Report #MTF85-22. Unpublished study prepared by Healy and Associates in cooperation with Bio/dynamics Inc. 39 p. (CDL:262829). See also earlier report MRID No. 001586-70 (CDL:262660).

00159699 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Apples from a Field Experiment Conducted in Lancaster County, Pennsylvania during the 1985 Growing Season: Rev.: Report #MTF-85-43. Unpublished study prepared by Healy and Associates in cooperation with Bio/dynamics Inc. 34 p. (CDL:262830 and 263352). See also earlier report MRID NO. 001594-63 (CDL:262671).

00159700 Reed D. Smith Assoc. (1986) Process Conversion Data Maneb and ETU Tomatoes: Laboratory No. 38615: 85056. Unpublished compilation. 35 p. (CDL:252831). Report later revised. See also MRID No. 001616-14 (CDL:263356).

00159701 Reed D. Smith Assoc. (1986) Process Conversion Data Maneb and ETU Green/Snap Beans: Laboratory No. 37897 & 38614. Unpublished compilation. 23 p. (CDL:262832). Report later revised. See also MRID No. 001616-15 (CDL:263357).

00159847 Weete, J. (1986) Report to the Maneb Task Force on Metabolism of :Carbon 14: Maneb in Potato Plants. Unpublished study prepared by Auburn Univ., Dept of Botany, Plant Pathology, and Microbiology. 40 p. (CDL:261551).

00161611 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Whole Bananas and Banana Pulp from a Field Experiment Conducted in Honduras during the 1985 Growing Season: Rev. Final Report: Report #MTF-85-51. Unpublished study prepared by Healy & Assoc. and Bio/dynamics, Inc. 43 p. Revised 6/23/86). (CDL:263353)

00161612 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Potatoes from a Field Experiment Conducted in Piscataquis County, Maine during the 1985 Growing Season: Rev. Final Report: Report #MTF-85-16. Unpublished study prepared by Healy & Assoc. and Bio/dynamics, Inc. 30 p. (CDL:263354). See also earlier report MRID No. 001596-93 (CDL:262824).

00161613 Healy, M. (1986) Residues of Maneb and Its Metabolite E.T.U. Found in Tomatoes from a Field Experiment Conducted in Berrien County, Michigan during the 1985 Growing Season: Rev. Final Report dated June 23, 1986: Report #MTF-85-03. Unpublished study prepared by Healy & Assoc. and Bio/dynamics, Inc. 42 p. (CDL:263355). See also two earlier reports MRID No. 001586-60 (CDL:261551) and MRID No. 001596-95 (CDL:262826).

00161614 Reed D. Smith Assoc., Inc. (1986) Maneb (Manganous Ethylene Bisdithiocarbamate): Process Conversion Data: Maneb and ETU: Tomatoes. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 54 p. (CDL:263356). Revised report. See also earlier report MRID No. 001597-00 (CDL:263356).

00161615 Reed D. Smith Assoc., Inc. (1986) Maneb (Manganous Ethylene Bisdithiocarbamate): Process Conversion Data: Maneb and ETU: Beans. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 27 p. (CDL:263357). Revised report. See also earlier report MRID No. 001597-01 (CDL:263357).

00161616 Reed D. Smith Assoc., Inc. (1986) Maneb (Manganous Ethylene Bisdithiocarbamate): Process Conversion Data: Maneb and ETU: Grapes. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 33 p. (CDL:263358).

00161617 Reed D. Smith Assoc., Inc. (1986) Maneb (Manganous Ethylene Bisdithiocarbamate): Process Conversion Data: Maneb and ETU: Apples. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 58 p. (CDL:263359).

00161618 Reed D. Smith Assoc., Inc. (1986) Maneb (Manganous Ethylene Bisdithiocarbamate): Process Conversion Data: Maneb and ETU: Potatoes. Unpublished study prepared in cooperation with Morse Laboratories, Inc. 23 p. (CDL:263360).

00162626 Hughes, D. (1986) Residue Study of Maneb and Its Primary Metabolite in Edible Tissues and Eggs of Laying Hens: Final Report: HLA Study No. 6181-104. Unpublished study prepared by Hazleton Laboratories America, Inc. 168 p. (CDL:)

00162627 Hughes, D. (1986) Residue Study of Maneb and Its Primary Metabolite in Edible Tissues and Milk of Dairy Cattle: Final Report: HLA Study No. 6181-105. Unpublished study prepared by Hazleton Laboratories America, Inc. 207 p. (CDL:)

00164517 Weete, J. (1986) Report to the Maneb Task Force on the Metabolism of :Carbon 14: Maneb in Lettuce Plants. Unpublished study prepared by Auburn University, Dept. of Botany and Microbiology. 61 p. (CDL:265931). Slightly different from previous report. See MRID No. 001598-50.

00164518 Weete, J. (1986) Report to the Maneb Task Force on the Metabolism of :Carbon 14: Maneb in Tomato Plants. Unpublished

study prepared by Auburn University, Dept. of Botany and Microbiology. 66 p. (CDL:265932) See also MRID No. 001598-49.

00164519 Weete, J. (1986) Report to the Maneb Task Force on the Metabolism of :Carbon 14: Maneb in Snapbean Plants. Unpublished study prepared by Auburn University, Dept. of Botany and Microbiology. 65 p. (CDL:265933). See also MRID No. 001598-48.

00164520 Weete, J. (1986) Report to the Maneb Task Force on the Metabolism of :Carbon 14: Maneb in Potato Plants. Unpublished study prepared by Auburn University, Dept. of Botany and Microbiology. 63 p. (CDL:265934).

40008801 Westberg, G. (1986) Frozen Storage Stability Data--Apples :Using Maneb and ETU:: Project I.D. 39450. Unpublished study prepared by Morse Laboratories. 28 p.

40008802 Westberg, G. (1986) Frozen Storage Stability Data--Lettuce :Using Maneb and ETU:: Project I.D. 39451. Unpublished study prepared by Morse Laboratories. 28 p.

40008803 Westberg, G. (1986) Frozen Storage Stability Data--Tomatoes :Using Maneb and ETU:: Project I.D. 39452. Unpublished study prepared by Morse Laboratories. 28 p.

40052901 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Peaches Treated by Ground Equipment in Georgia, 1986: Final Report: Project No. 23186; File No. MAN/87001. Unpublished study prepared by Orius Associates, Inc. in association with Chemonics Laboratories. 60 p.

40052902 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Mustard Greens Treated by Ground Equipment in California, 1986: Final Report: Project No. 23186; File No. MAN/87004. Unpublished study prepared by Orius Associates, Inc. in association with Morse Laboratories. 39 p.

40052903 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Turnip Roots Treated by Ground Equipment in California, 1986: Final Report: Project No. 23186; File No. MAN/87005. Unpublished study prepared by Orius Associates, Inc. in association with Morse Laboratories. 54 p.

40063501 Healy & Associates (1987) Residues of Maneb and its Metabolite Ethylene Thiourea Found in Cucurbits: During the 1985 Growing Season. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 93 p.

40063502 Healy & Associates (1987) Residues of Maneb and its Metabolite Ethylene Thiourea Found in Tomatoes and Processed Tomato Products: During the 1985 Growing Season. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 146 p.

40063503 Healy & Associates (1987) Residues of Maneb and its Metabolite Ethylene Thiourea Found in Lettuce: During the 1985 Growing Season. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 86 p.

40063504 Healy & Associates (1987) Residues of Maneb and its Metabolite Ethylene Thiourea Found in Cabbage: During the 1985 Growing Season. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 82 p.

40063505 Healy & Associates (1987) Residues of Maneb and its Metabolite Ethylene Thiourea Found in Grapes and Processed Grape Products: During the 1985 Growing Season. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 88 p.

40067601 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residues in Nectarines Treated by Ground Equipment in California, 1986: Final Report: File/Issue No. MAN/87002; Project No. 23186. Unpublished study prepared by Orius Associates, Inc. in association with Morse Laboratories. 40 p.

40067602 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Apricots Treated by Ground Equipment in California, 1986: Final Report: File/Issue No. MAN/87003; Project No. 23186. Unpublished study prepared by Orius Associates, Inc. in association with Morse Laboratories. 52 p.

40067603 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Turnip Tops Treated by Ground Equipment in Georgia, 1986: Final Report: File/Issue No. MAN/87007; Project No. 23186. Unpublished study prepared by Orius Associates, Inc. in association with Chemonics Laboratories. 31 p.

40067604 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Figs Treated by Ground Equipment in California, 1986: Final Report: File/Issue No. MAN/87014; Project No. 23186. Unpublished study prepared by Orius Associates, Inc. in association with Morse Laboratories. 35 p.

40045602 Baugher, D. (1986) Maneb and Ethylene Thiourea: Magnitude of the Residue in Celery Treated by Ground Equipment in Florida and Michigan, 1986: Final Report: Project No. 23186. Unpublished compilation prepared by Orius Assoc., Inc. in cooperation with Chemonics Laboratories. 108 p.

40045603 Baugher, D. (1986) Maneb and Ethylene Thiourea: Magnitude of the Residue in Carrot Roots Treated by Ground Equipment in California, Michigan, and Wisconsin, 1986: Final Report: Project No. 23186. Unpublished compilation prepared by Orius Assoc., Inc. in cooperation with Chemonics Laboratories and Morse Laboratories. 77 p.

40045604 Baugher, D. (1986) Maneb and Ethylene Thiourea: Magnitude of the Residue in Broccoli Treated by Ground Equipment in New York, 1986: Final Report: Project No. 23186. Unpublished compilation prepared by Orius Assoc., Inc. in cooperation with Chemonics Laboratories. 36 p.

40045605 Baugher, D. (1986) Maneb and Ethylene Thiourea: Magnitude of the Residue in Onion Bulbs Treated by Ground Equipment in California, 1986: Final Report: Project No. 23186. Unpublished compilation prepared by Orius Assoc., Inc. in cooperation with Morse Laboratories. 34 p.

40045606 Baugher, D. (1986) Maneb and Ethylene Thiourea: Magnitude of the Residue in Spinach Treated by Ground Equipment in Oklahoma, 1986: Final Report: Project No. 23186. Unpublished compilation prepared by Orius Assoc., Inc. in cooperation with Chemonics Laboratories. 35 p.

40045601 Baugher, D. (1986) Maneb and Ethylene Thiourea: Magnitude of the Residue in Peppers Treated by Ground Equipment in California and Florida, 1986: Final Report: Project No. 23186. Unpublished compilation prepared by Orius Assoc., Inc. in cooperation with Chemonics Laboratories and Morse Laboratories. 103 p.

40108701 Healy & Associates (1987) Residues of Maneb and Its Metabolite Ethylene Thiourea Found in Apples and Processed Apple Products. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 134 p.

40108702 Healy & Associates (1987) Residues of Maneb and Its Metabolite Ethylene Thiourea Found in Beans and Processed Bean Products. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 103 p.

40108703 Healy & Associates (1987) Residues of Maneb and Its Metabolites Ethylene Thiourea Found in Bananas and Processed Banana Products. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 139 p.

40108704 Healy & Associates (1987) Residues of Maneb and Its Metabolite Ethylene Thiourea Found in Potatoes and Processed Potato Products. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 86 p.

40108705 Healy & Associates (1987) Residues of Maneb and Its Metabolite Ethylene Thiourea Found in Sugar Beets and Processed Sugar Beet Products. Unpublished compilation prepared in cooperation with Bio/dynamics, Inc. 102 p.

40109901 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Nectarines Treated by Ground Equipment in California, 1986: Final Report: Project No. 23186:

File/Issue MAN/87018. Unpublished compilation prepared by Orius Associates in association with Morse Laboratories. 163 p.

40109902 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Apricots Treated by Ground Equipment in California, 1986: Final Report: Project No. 23186: File/Issue MAN/87015. Unpublished compilation prepared by Orius Associates in cooperation with Morse Laboratories. 180 p.

40109903 Baugher, D. (1987) Maneb and Ethylene Thiourea: Magnitude of the Residue in Turnip Tops Treated by Ground Equipment in California, Georgia, New Jersey, and Texas, 1986: Final Report: Project No. 23186: Issue MAN/87020. Unpublished compilation prepared by Orius Associates, Inc. in association with Chemonics Laboratories and Morse Laboratories. 117 p.

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