

US EPA ARCHIVE DOCUMENT



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

JUL 11 1988

*Handwritten: 10/15/88*  
**EXPEDITE**

MEMORANDUM

**SUBJECT:** Zineb (014506) Dietary Exposure to Zineb and ETU;  
[No MRID No., No RCB No.]

OFFICE OF  
PESTICIDES AND TOXIC SUBSTANCES

**FROM:** Susan V. Hummel, Chemist  
Special Registration Section II  
Residue Chemistry Branch  
Hazard Evaluation Division (TS-769C)

*Susan V. Hummel*

**THRU:** Charles L. Trichilo, Ph.D., Chief  
Residue Chemistry Branch  
Hazard Evaluation Division (TS-769C)

*[Signature]*

**TO:** Valerie Bael, PM#77  
Special Review Branch  
Registration Division (TS-767C)

The purpose of this memo is to estimate residues of zineb and ETU in human food items based on available residue and processing data, and livestock feeding studies. The residue estimates for zineb and ETU are based on data submitted by other registrants for other EBDC fungicides. OGC should be made aware of this and should determine whether the use of other registrants' data is justified. 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 zineb and ETU. Acute exposure and risk will be estimated for ETU.

Residue chemistry data were required by the Zineb Comprehensive Data Call In Notice of 4/21/87. A Special Review was initiated for zineb 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. No residue data for zineb were received in response to these DCI's. Metabolism data received in response to the 4/21/87 Comprehensive Data Call In Notice were recently reviewed and found to be inadequate (D. Edwards, 6/27/88, RCB No. 3481). Residue data are due in October, 1988.

We have made estimates of zineb and ETU residues, based on the available residue and processing data for other EBDC fungicides. 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 residues in apple pomace comprise the largest portion of the total livestock dietary burden.

#### SUMMARY OF RESIDUE ESTIMATES

Residue values to be used in the Special Review are the best available estimates. No residue data have been submitted for zineb and ETU in response to the Data Call In Notices of 10/19/84, 4/30/85, and 4/21/87. For the purpose of estimating residues for the Special Review only, we have translated residue data from other EBDC's using data from the EBDC with the highest reported residue on that commodity, usually maneb. Our residue estimates will be revised when residue data for zineb and ETU are received. (Data are due in October, 1988.)

Average residues from field trial data are being used to estimate chronic exposure. The average residues from residue field trial data from studies closest to the maximum rate and minimum PHI were used for the residue estimates. 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. Available residue data generally used more than 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%. To account for the difference in the maximum application rate between zineb and other EBDC's, the residue estimate was multiplied by the ratio of the zineb application rate to the other EBDC application rate for which residue data were available.

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

For ETU residue estimates in processed commodities, we have multiplied the zineb 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 zineb. 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.

For acute exposures, we have estimated the maximum zineb and ETU residues from the maximum residue found in field trial data for other EBDC fungicides, usually maneb. Adjustments in the maximum residue estimates are the same as described above for the average residue estimates.

Our best available estimates are tabulated below.

Summary of Average Residue Estimates - Zineb

Crop	Average Residues (ppm)	
	Zineb	ETU
Carrots	12	0.029
washed	6.2	0.029
cooked	6.2	1.7
Radishes - see carrots		
Radish tops - see turnip tops		
Potatoes	0.10	0.004
washed	0.050	0.004
baked flesh	0.050	0.17
baked skins	0.050	0.70
baked whole	0.050	0.23
chips and granules	0.10	0.004
Turnips	17	0.36
washed	8.6	0.36
cooked	8.6	2.6
Turnip Tops	60.	0.36
washed	36	0.36
cooked	36	7.5
Beets - see turnips		
Onions, Green	25	0.075
washed	12	0.075
cooked	12	3.1
Onions, bulb	7.4	0.20
washed	3.7	0.20
cooked	3.7	1.2

Summary of Average Residue Estimates - Zineb  
cont.

Crop	Average Residues (ppm)	
	Zineb	ETU
Celery	81	0.44
washed	49	0.44
cooked	49	10.
Lettuce, Leaf	28	0.78
washed	17	0.78
Lettuce, Head	8.5	0.065
washed	5.1	0.065
cooked	5.1	1.1
Endive - see lettuce		
Spinach	55	0.12
washed	33	0.12
cooked	33	6.7
Collards - see spinach		
Swiss chard - see spinach		
Mustard Greens	64	0.12
washed	38	0.12
cooked	38	7.8
Broccoli, unwashed	40	0.18
washed	24	0.18
cooked	24	5.0
Kohlrabi - see broccoli		
Brussels Sprouts - see broccoli		
Cabbage, untrimmed	8.0	0.11
Cabbage, trimmed	2.3	0.007
washed	1.4	0.007
cooked	1.4	0.28
Chinese Cabbage - see cabbage		
Cauliflower - see cabbage		
Kale	28	0.14
washed	16	0.14
cooked	16	3.4
Beans, Succulent	3.9	0.094
Cooked/canned	0.039	0.39
Cooked/frozen	0.27	0.22
Cooked/pureed	0.039	0.28
Cannery waste	5.0	0.17
Beans, Dry	3.1	0.056
washed	0.22	0.056
cooked	0.22	0.29
Succulent Bean		
Vines	805	2.2
Dry Bean Vines	270	7.7
Peas	3.1	0.075
washed	0.22	0.075
cooked	0.22	0.31
Sweet corn (K+CWHR)	0.30	0.004
washed	0.02	0.004
cooked	0.02	0.021

Summary of Average Residue Estimates - Zineb  
cont.

Crop	Average Residues (ppm)	
	Zineb	ETU
Field corn and all processed fractions	0.020	0.002
Wheat grain	0.27	0.002
bran	0.5	0.002
shorts	0.3	0.002
flour	0.27	0.002
bread	0.14	0.002
Peppers	8.9	0.10
washed	6.2	0.10
cooked	6.2	0.51
Tomatoes	5.3	0.003
washed	4.6	0.003
Wet pomace	3.2	0.003
Dry pomace	1.7	0.075
Canned whole	1.7	0.003
Catsup	1.7	0.003
Paste	1.7	0.075
Juice from paste	1.7	0.075
Eggplant - see tomatoes		
Cucumber	0.94	0.075
washed	0.66	0.075
cooked	0.66	0.12
Squash	1.2	0.003
washed	0.83	0.003
cooked	0.83	0.055
Melons	2.0	0.019
washed	1.4	0.019
cooked	1.4	0.11
Pumpkin - see melons		
Apples	13	0.21
washed	9.4	0.21
cooked - see applesauce		
Fresh Juice	0.67	0.78
Cooked Juice	0.67	0.65
Wet Pomace	62	2.6
Dry Pomace	173	14
Apple Sauce	1.2	0.64
Apple Baby Food	0.67	0.64
Pears	12	0.18
washed	8.1	0.18
cooked	8.1	0.26
Apricots	31	2.2
washed	22	2.2
cooked	22	2.4
Peaches	30	0.06
washed	21	0.06
cooked	21	1.4
Nectarines - see peaches		

Summary of Average Residue Estimates - Zineb  
cont.

Crop	Average Residues (ppm)	
	Zineb	ETU
Plums/prunes - see peaches		
Citrus	103	0.3
peel, raw	515	1.5
peel, cooked	464	53
pulp, raw	3.1	0.009
pulp, cooked	2.8	0.32
juice - see pulp		
Pecans	0.020	0.002
Grapes	11	0.270
washed	7.6	0.270
cooked	7.6	0.32
Dry Pomace	6.9	0.74
Wet Pomace	6.4	0.42
Thick juice	0.68	5.2
Raisins	3.1	0.86
Raisin Waste	17	1.6
Currant/Gooseberry - see grapes		
Cranberries	0.74	0.013
Blackberries & Raspberries & other small berries	4.3	0.11
washed	3.0	0.11
cooked	3.0	0.13
Strawberries	9.4	0.24
washed	6.6	0.24
cooked	6.6	0.28
Cherries (sour)	25	0.62
washed	17	0.62
cooked	17	0.73
Mushrooms	1.7	0.012
washed	0.36	0.012
cooked/canned	0.05	0.14
Peanuts	0.02	0.04
and all fractions		
Asparagus - cannot make estimate without residue data		
Hops - cannot make residue estimate without data		
Milk	0.18	0.045
Liver	0.17	0.052
Muscle	0.06	0.023
Kidney	0.11	0.048
Fat	0.10	0.002
Whole eggs	0.007	0.006
Liver	< 0.01	0.008
Kidney	< 0.01	0.008
Muscle	0.012	0.009
Fat	0.26	< 0.0008

Summary of Maximum Residue Estimates

Crop	Residues (ppm)	
	Zineb	ETU
Carrots	22	0.10
washed	11	0.10
cooked	11	3.0
Radishes - see carrots		
Radish tops - see turnip tops		
Potatoes	0.13	0.004
washed	0.064	0.004
baked flesh	0.064	0.22
baked skins	0.064	0.89
baked whole	0.064	0.29
chips and granules	0.13	0.004
Wet Peel		
Dry Peel		
Turnips	24	0.054
washed	12	0.054
cooked	12	3.1
Turnip Tops	152	0.84
washed	76	0.84
cooked	76	19
Beets - see Turnips		
Onions, Green	28	0.051
washed	14	0.051
cooked	14	3.4
Onions, bulb	15	0.25
washed	7.6	0.20
cooked	7.6	2.2
Celery	225	1.6
washed	135	1.6
cooked	135	29
Lettuce, Leaf		2.1
washed	150	2.1
Lettuce, Head	22	0.36
washed	13	0.36
cooked	13	3.0
Endive - see lettuce		
Spinach	115	0.59
washed	69	0.59
cooked	69	14
Collards - see spinach		
Swiss chard - see spinach		
Mustard Greens	106	0.25
washed	64	0.25
cooked	64	13
Broccoli, unwashed	96	0.47
washed	58	0.47
cooked	58	12
Kohlrabi - see broccoli		



Summary of Maximum Residue Estimates  
cont.

Crop	Residues (ppm)	
	Zineb	ETU
Brussels Sprouts - see broccoli		
Cabbage, untrimmed	43	0.30
Cabbage, trimmed	5.7	0.054
washed	3.4	0.054
cooked	3.4	0.73
Chinese Cabbage - see cabbage		
Cauliflower - see cabbage		
Kale	71	0.40
washed	43	0.40
cooked	43	9.0
Beans, Succulent	14	0.30
Cooked/canned	0.14	1.4
Cooked/frozen	1.0	0.77
Cooked/pureed	0.14	1.0
Cannery waste	18	0.59
Beans, Dry	7.9	0.11
washed	0.55	0.11
cooked	0.55	0.71
Succulent Bean		
Vines	2700	11
Dry Bean Vines	880	18
Peas	11	0.24
washed	0.80	0.24
cooked	0.80	1.1
Sweet corn (K+CWHR)	1.9	0.016
washed	0.13	0.016
cooked	0.13	0.16
Field corn	0.020	0.002
and all processed fractions		
Wheat grain	1.7	0.002
bran	3.0	0.002
shorts	2.0	0.002
flour	1.7	0.002
bread	0.83	0.002
Peppers	30.	0.10
washed	21	0.10
cooked	21	1.5
Tomatoes	15	0.003
washed	13	0.003
Wet pomace	9.3	0.003
Dry pomace	5.0	3.0
Canned whole	5.0	0.003
Catsup	5.0	0.003
Paste	5.0	3.0
Juice from paste	5.0	3.0
Eggplant - see tomatoes		

Summary of Maximum Residue Estimates  
cont.

Crop	Residues (ppm)	
	Zineb	ETU
Cucumber	4.3	0.13
washed	3.0	0.13
cooked	3.0	0.33
Squash	1.2	0.003
washed	0.83	0.003
cooked	0.83	0.055
Melons	2.9	0.019
washed	2.0	0.019
cooked	2.0	0.15
Pumpkin - see melons		
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	14
Apple Sauce	2.7	0.64
Apple Baby Food	1.5	0.64
Pears	26	0.44
washed	18	0.44
cooked	18	0.56
Apricots	140	3.5
washed	98	3.5
cooked	98	22
Peaches	53	0.21
washed	37	0.21
cooked	37	2.6
Nectarines - see peaches		
Citrus	259	1.1
peel, raw	1100	5.5
peel, cooked	990	112
pulp, raw	7.8	0.033
pulp, cooked	7.0	0.81
juice - see pulp		
Plums/prunes - see peaches		
Grapes	15	0.54
washed	9.6	0.54
cooked	9.6	0.61
Dry Pomace	9.6	1.2
Wet Pomace	9.0	0.75
Thick juice	0.95	7.5
Raisins	4.3	1.4
Raisin Waste	24	2.4
Currant/Gooseberry - see grapes		
Cranberries	0.74	0.013

Summary of Maximum Residue Estimates  
cont.

Crop	Residues (ppm)	
	Zineb	ETU
Blackberries & Raspberries & other small berries	6.0	0.17
washed	3.8	0.17
cooked	3.8	0.19
Strawberries	13	0.37
washed	8.4	0.37
cooked	8.4	0.42
Cherries (sour)	34	0.99
washed	22	0.99
cooked	22	1.1
Mushrooms	1.7	0.012
washed	0.36	0.012
cooked/canned	0.050	0.14
Peanuts and all fractions	0.020	0.040
Asparagus - cannot make estimate without residue data		
Hops - cannot make residue estimate without data		
Milk	0.18	0.13
Liver	0.40	0.12
Muscle	0.13	0.054
Kidney	0.18	0.11
Fat	0.21	0.018
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

Detailed Considerations

TOLERANCES

Tolerances have been established for residues of the fungicide zineb (zinc ethylene bisdithiocarbamate), ranging from 0.1 part per million (ppm) in or on corn grain to 60 ppm on hops (40 CFR 180.115). An interim tolerance has been established for potatoes (for seed piece treatment only) at 0.5 ppm (40 CFR 180.319). The tolerances are tabulated below.

Zineb Tolerances

<u>Raw Agricultural Commodity</u>	<u>Tolerance (ppm)</u>
Apples	2
Apricots	7
Beans	7
Beets (garden roots only)	7
Beet tops	25
Blackberries	7
Boysenberries	7
Broccoli	7
Brussels sprouts	7
Cabbage	7
Carrots	7
Cauliflower	7
Celery	5
Cherries	7
Chinese cabbage	25
Citrus fruits	7
Collards	25
Corn Grain	0.1
Corn, sweet (K+CWHR)	5
Cranberries	7
Cucumbers	4
Currants	7
Dewberries	7
Eggplants	7
Endive (escarole)	10
Gooseberries	7
Grapes	7
Guavas	7
Hops	60
Kale	10
Kohlrabi	7
Lettuce	10
Loganberries	7
Melons	4
Mushrooms	7
Mustard greens	10
Nectarines	7
Onions	7
Parsley	7
Peaches	7
Pears	7
Peanuts	7
Peas	7
Peppers	7
Potatoes (seed piece treatment only)	0.5 (I)
Pumpkins	7
Quinces	7
Radishes (with or without tops)	7

Zineb Tolerances, continued

<u>Raw Agricultural Commodity</u>	<u>Tolerance (ppm)</u>
Radish tops	7
Raspberries	7
Romaine	25
Rutabagas (with or without tops)	7
Rutabaga tops	7
Salsify	7
Spinach	10
Squash	4
Strawberries	7
Summer squash	7
Swiss chard	25
Tomatoes	4
Turnip (with or without tops)	7
Turnip Greens	7
Wheat	1
Youngberries	7

No tolerances are currently pending (40 CFR 180.115) for zineb, 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 zineb 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 was received from BUD in their memo of 6/7/88 (G. L. Ballard and E. N. Pelletier). Additional information on these uses may be found in the Zineb index.

Table 1                      SITES, APPLICATION RATES, AND USE PRACTICES FOR ZINEB

<u>CROP</u>	<u>Use Rates AI POUNDS/ACRES</u>	<u>NUMBER SEASONAL</u>		<u>PREHARVEST INTERVAL (PHI) AND LIMITATIONS</u>
		<u>APPLICATIONS</u>	<u>TYPICAL</u>	
<u>Apples</u>	4.0-8.0 lb/A	3		15-day PHI for a few States, 30-day PHI for all others.
<u>Apricot</u>	7.2 lb/A	1-2		Do not apply after bloom.
<u>Asparagus</u>	1.5-2.3 lb/A	0		For treatment of fern stage after harvest.

Table 1, cont.

## SITES, APPLICATION RATES, AND USE PRACTICES FOR ZINEB

CROP	Use Rates AI POUNDS/ACRES	NUMBER SEASONAL	
		APPLICATIONS TYPICAL	PREHARVEST INTERVAL (PHI) AND LIMITATIONS
<u>Beans (green &amp; dry)</u>	2.4-3.0 lb/A	3-6	7 day PHI.
<u>Beets</u>	0.6-3.0 lb/A	-	7 day PHI.
<u>Blackberry/ Raspberry</u>	0.6-1.2 lb/A	3	14 day PHI.
<u>Broccoli</u>	3.2-4.8 lb/A	2	14 day PHI.
<u>Brussels Sprouts</u>	3.2-4.8 lb/A	2	7 day PHI.
<u>Cabbage</u>	3.2-4.8 lb/A	2	7 day PHI.
<u>Carrots</u>	2.4-3.0 lb/A	-	7 day PHI.
<u>Cauliflower</u>	3.2-4.8 lb/A	2	7 day PHI.
<u>Celery</u>	2.4-3.0 lb/A	-	14 day PHI.
<u>Cherry (sour)</u>	6.9 lb/A	1-2	7 day PHI.
<u>Citrus</u>	11.6 lb/A	1-2	0 day PHI.
<u>Collards</u>	2.4-3.0 lb/A	-	10 day PHI.
<u>Com, field</u>	0.6-3.0 lb/A	-	40 day PHI.
<u>Cranberries</u>	4.0-6.0 lb/A	1	Do not apply after bloom.
<u>Cucumber</u>	2.4-3.0 lb/A	-	5 day PHI.
<u>Currant/Gooseberry</u>	3.0 lb/A	-	7 day PHI.
<u>Eggplant</u>	0.6-3.0 lb/A	-	0 day PHI.
<u>Endive</u>	0.6-3.0 lb/A	-	10 day PHI.
<u>Grapes</u>	3.0 lb/A	2-3	7 day PHI.
<u>Hops</u>	1.2-1.6 lb/A	-	14 day PHI.
<u>Kale</u>	2.4-3.0 lb/A	-	10-day PHI.
<u>Kohlrabi</u>	2.4-3.0 lb/A	-	7 day PHI.
<u>Lettuce</u>	2.4-3.0 lb/A	-	10 day PHI.

Table 1, cont.

## SITES, APPLICATION RATES, AND USE PRACTICES FOR ZINEB

<u>CROP</u>	Use Rates AI <u>POUNDS/ACRES</u>	NUMBER SEASONAL	
		<u>APPLICATIONS</u> <u>TYPICAL</u>	<u>PREHARVEST INTERVAL</u> <u>(PHI) AND LIMITATIONS</u>
<u>Melons</u>	0.6-3.0 lb/A	-	5 day PHI.
<u>Mushrooms</u>	0.15 lb/4000sq. ft.	15	0 day PHI.
<u>Mustard Greens</u>	2.4-3.0 lb/A	-	10 day PHI.
<u>Onion</u>	2.4-3.0 lb/A	-	7 day PHI.
<u>Peach, Nectarine</u>	6.9 lb/A	1-2	30 day PHI.
<u>Pecans</u>	6.6 lb/A	4	Do not apply after bloom.
<u>Peanuts</u>	1.2 lb/A	-	0 day PHI.
<u>Pears</u>	1.6-2.0 lb/A	1-2	7 day PHI.
<u>Peas</u>	1.0-2.4 lb/A	-	10 day PHI.
<u>Peppers</u>	2.4-3.0 lb/A	-	0 day PHI.
<u>Plum/Prune</u>	1.6-2.0 lb/A	1-2	30 day PHI.
<u>Potato</u>	1.8-2.1 lb/A	-	0 day PHI.
<u>Pumpkins</u>	2.4 -3.0 lb/A	-	0 day PHI.
<u>Radishes</u>	2.4-3.0 lb/A	-	0 day PHI.
<u>Spinach</u>	2.4-3.0 lb/A	3	10 day PHI.
<u>Squash</u>	2.4-3.0 lb/A	-	10 day PHI.
<u>Strawberries</u>	2.6 lb/A	8	7 day PHI.
<u>Swiss Chard</u>	2.4-3.0 lb/A	-	10 day PHI.
<u>Tomato</u>	2.4-3.2 lb/A	-	5 day PHI.
<u>Turnips</u>	2.4-3.0 lb/A	-	7 day PHI.
<u>Wheat</u>	1.2-1.6 lb/A	-	26 day PHI.

## PLANT AND ANIMAL METABOLISM

The metabolism of zineb is not adequately understood. Additional metabolism data have been required via the Zineb Comprehensive Data Call In Notice (4/21/87). Metabolism data were recently submitted on radishes, oranges, and tomatoes. The data were reviewed and found to be inadequate (D. Edwards, 6/27/88, RCB No. 3481). For the purposes of the Special Review, the residue of concern will be considered to be the parent compound, zineb, and ethylenethiourea (ETU).

## ANALYTICAL METHODS

Since no residue data were submitted for zineb, the analytical methodology will not be discussed in this memo. For a discussion of analytical methodology, see our dietary exposure assessments of maneb and metiram. (S. Hummel, memos of 6/30/88).

## RESIDUE DATA

No residue data have been submitted for zineb in response to the Data Call In notices of 10/19/84, or 4/30/85. Residue data in response to the 4/21/87 Comprehensive Data Call In notice are due in October, 1988. For the purpose of this dietary exposure assessment, residue data will be translated from other EBDC Fungicides. For the other EBDC fungicides, most of the available residue data were generated using more than the typical number of applications.

## EXPLANATION OF RESIDUE ESTIMATES FOR RAW AGRICULTURAL COMMODITIES

### Carrots

Residue data were translated from maneb with a proportional increase for the difference in application rates:  $3.0/2.4 =$  ratio of application rate for zineb to the application rate for maneb.

### Radishes

Residue data were translated from maneb data on carrots with a proportional increase for the difference in application rates:  $3.0/2.4$ .

### Potatoes

Residue data were translated from maneb with a proportional increase for the difference in application rates:  $2.1/1.6$ .



Turnips

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Beets

Residue data were translated from maneb data on turnips with a proportional increase for the difference in application rates: 3.0/2.4.

Onions

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Celery

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Lettuce

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Endive

Residue data were translated from maneb data on lettuce with a proportional increase for the difference in application rates: 3.0/2.4.

Spinach

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Collards

Residue data were translated from maneb data on spinach with a proportional increase for the difference in application rates: 3.0/2.4.

Swiss Chard

Residue data were translated from maneb data on spinach with a proportional increase for the difference in application rates: 3.0/2.4.

Mustard Greens

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Broccoli

Residue data were translated from maneb with a proportional increase for the difference in application rates: 4.8/2.4.

Kohlrabi and Brussels Sprouts

Residue data were translated from maneb data on broccoli with a proportional increase for the difference in application rates: 4.8/2.4.

Cabbage

Residue data were translated from maneb with a proportional increase for the difference in application rates: 4.8/1.8.

Chinese Cabbage and Cauliflower

Residue data were translated from maneb data on cabbage with a proportional increase for the difference in application rates: 4.8/1.8.

Kale

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Beans

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Peas

Residue data were translated from maneb data on beans.

Sweet Corn

Residue data were translated from maneb with no correction for the difference in application rates, because the application rate for zineb on corn is unknown.

Field Corn

Residue data were translated from mancozeb with no correction for the difference in application rates, because the residue of mancozeb and ETU in field corn was non-detectable.

Wheat

Residue data were translated from mancozeb.

Peppers

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Tomatoes

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.2/2.4.

Eggplant

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.2/2.4.

Cucumber, Squash, Melons, and Pumpkins

Residue data were translated from maneb with a proportional increase for the difference in application rates: 3.0/2.4.

Apples

Residue data were translated from maneb.

Pears

Residue data were translated from maneb data on apples with a proportional decrease for the difference in application rates: 6.9/8.0.

Apricots

Residue data were translated from maneb with a proportional decrease for the difference in application rates: 7.2/8.0.

Peaches, Nectarines, Plums, and Prunes

Residue data were translated from maneb with a proportional decrease for the difference in application rates: 6.9/8.0. Residue data for maneb and ETU from the longest PHI were used.

Citrus

Residue data were translated from maneb data on peaches with a proportional increase for the difference in application rates: 11.6/8.0. Residues in peel and pulp were estimated based on the peel constituting 33% of the weight of the citrus fruit.

Residues were proportioned in the pulp and peel based on residue data submitted for mancozeb (no ETU data) in PP#7F0609. For the effects of cooking, we assumed a 10% (w/w) conversion of zineb to ETU.

#### Grapes, Currants, and Gooseberries

Residue data were translated from maneb residue data on grapes.

#### Cranberries

Residue data were translated from maneb.

#### Blackberries, Raspberries, and other small berries

Residue data were translated from maneb data on grapes with a proportional decrease for the difference in application rates: 1.2/3.0.

#### Strawberries

Residue data were translated from maneb data on grapes with a proportional decrease for the difference in application rates: 2.6/3.0.

#### Cherries

Residue data were translated from maneb data on grapes with a proportional increase for the difference in application rates: 6.9/3.0.

#### Mushrooms

Residue data were submitted for zineb on mushrooms in 1979. The data were discussed in our memo of 3/19/79 (M. Bradley). Similar residues were found in mushrooms analyzed by FDA in their surveillance monitoring program.

#### Peanuts

Residue data were translated from mancozeb.

#### Residues in Zineb Processed Products

Zineb Processing studies are not available. Zineb and ETU residue estimates in zineb treated processed products will be based on maneb or metiram processing studies.

Maximum Residues in Zineb Processed Products Using Processing Data from Other EBDC's

Commodity	Conc.		Residue Estimate (ppm)	
	Factor EBDC	% Conv. ETU	Zineb	ETU
Apples			30.000	0.510
Fresh Juice	0.05	0.91	1.500	0.783
Cooked Juice	0.05	0.45	1.500	0.645
Wet Pomace	4.64	6.82	139.200	2.556
Dry Pomace	12.95	44.55	388.500	13.875
Apple Sauce	0.09	0.45	2.700	0.645
Apple Baby Food	0.05	0.45	1.500	0.645
Potatoes			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
Tomatoes			15.250	0.003
Wet pomace	0.61		9.303	0.003
Dry pomace	<0.33	20	5.033	3.050
Canned whole	<0.33		5.033	0.003
Catsup	<0.33		5.033	0.003
Paste	<0.33	20	5.033	3.050
Juice from paste	<0.33	20	5.033	3.050
Snap Beans				
raw			14.250	0.300
Cooked/canned	0.01	7.6	0.143	1.384
Cooked/frozen	0.07	3.3	0.998	0.770
Cooked/pureed	<0.01	4.9	0.143	0.995
Cannery waste	1.28	2.0	18.240	0.586
Grapes			15.000	0.536
Dry Pomace	0.6	4.5	9.631	1.207
Wet Pomace	0.6	1.4	8.981	0.749
Thick juice	0.1	46.4	0.948	7.493
Raisins	0.3	5.5	4.261	1.367
Raisin Waste	1.6	12.1	24.077	2.358

Average Residues in Zineb Processed Products Using Processing Data from Other EBDC's

Commodity	Conc.		Residue Estimate (ppm)	
	Factor EBDC	% Conv ETU	Zineb	ETU
Apples			13.375	0.213
Fresh Juice	0.05	0.91	0.669	0.783
Cooked Juice	0.05	0.45	0.669	0.645
Wet Pomace	4.64	6.82	62.060	2.556
Dry Pomace	12.95	44.55	173.206	13.875
Apple Sauce	0.09	0.45	1.204	0.645
Apple Baby Food	0.05	0.45	0.669	0.645
Potatoes			0.077	0.040
Wet Peel	--	--	0.077	0.040
Dry Peel	--	--	0.077	0.040
Potato Chips	--	--	0.077	0.040
Potato Granules	--	--	0.077	0.040
Tomatoes	lb ai/A)		5.300	0.003
Wet pomace	0.61		3.233	0.003
Dry pomace	<0.33	20	1.749	0.075
Canned whole	<0.33		1.749	0.003
Catsup	<0.33		1.749	0.003
Paste	<0.33	20	1.749	0.075
Juice from paste	<0.33	20	1.749	0.075
Snap Beans				
raw			3.900	0.094
Cooked/canned	0.01	7.6	0.039	0.391
Cooked/frozen	0.07	3.3	0.273	0.223
Cooked/pureed	<0.01	4.9	0.039	0.284
Cannery waste	1.28	2.0	4.992	0.172
Grapes			10.750	0.263
at processor	1.0	0.0	10.750	0.263
Dry Pomace	0.6	4.5	6.902	0.744
Wet Pomace	0.6	1.4	6.436	0.415
Thick juice	0.1	46.4	0.680	5.248
Raisins	0.3	5.5	3.054	0.858
Raisin Waste	1.6	12.1	17.255	1.568

MEAT, MILK, POULTRY, AND EGGS

No zineb livestock feeding studies have been submitted. For the purpose of this zineb dietary exposure assessment, the maneb livestock feeding studies will be used. No adjustment will be made for the slight difference in molecular weight. The results

of the maneb livestock feeding studies are tabulated below. These 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).

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 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.

Zineb Dietary Burden for Cattle Using Average Residues

<u>Beef Cattle</u>	<u>% in Diet</u>	<u>Mean Residue (ppm) Zineb</u>	<u>Dietary Burden (ppm) Zineb</u>
Apple pomace (dry)	50	174	87
Sugar beet tops	20	21	4.4
Raisin waste	10	17	1.7
Other feeds	20	--	--
Total =			93

Zineb Dietary Burden for Cattle Using Average Residues

<u>Dairy Cattle</u>	<u>% in Diet</u>	<u>Mean Residue (ppm) Zineb</u>	<u>Dietary Burden (ppm) Zineb</u>
Apple pomace (dry)	25	174	43.5
Sugar beet tops	20	21	4.2
Green bean cannery waste	20	5	1.0
Raisin waste	10	17	1.7
Other feeds	25	--	--
Total =			50

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

Expected residues of zineb 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

	<u>Residue (ppm)</u>	
	<u>Zineb</u>	<u>ETU</u>
Milk	0.059	0.045
Liver	0.17	0.052
Muscle	0.06	0.023
Kidney	0.11	0.048
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.

Zineb Dietary Burden for Poultry Using Average Residues

<u>Poultry</u>	<u>% in Diet</u>	<u>Mean Residue (ppm) Zineb</u>	<u>Dietary Burden (ppm) Zineb</u>
Cull potatoes	20	< 0.1	0.01
Apple pomace (dry)	5	174	8.70
Grape pomace (dry)	5	6.9	0.35
Tomato pomace (wet)	2	3.2	0.11
Other feed items	68		
Total =			9.1



Expected residues of zineb 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>Zineb</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	0.26	< 0.0008

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

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

Zineb Dietary Burden for Cattle Using Maximum Residues

<u>Beef Cattle</u>	<u>% in Diet</u>	<u>Max. Residue (ppm) Zineb</u>	<u>Dietary Burden (ppm) Zineb</u>
Apple pomace (dry)	50	389	194.5
Sugar beet tops	20	90	18
Raisin waste	10	24	2.4
Other feeds	20	--	--
Total =			215

<u>Dairy Cattle</u>	<u>% in Diet</u>	<u>Max. Residue (ppm) Zineb</u>	<u>Dietary Burden (ppm) Zineb</u>
Apple pomace (dry)	25	389	97.2
Sugar beet tops	20	90	18
Green bean cannery waste	20	18	3.6
Raisin waste	10	24	2.4
Other feeds	25	--	--
Total =			121

Expected residues of zineb 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

	Residue (ppm)	
	<u>Zineb</u>	<u>ETU</u>
Milk	0.18	0.13
Liver	0.40	0.12
Muscle	0.13	0.054
Kidney	0.18	0.11
Fat	0.21	0.018

Zineb Dietary Burden for Poultry Using Maximum Residues

<u>Poultry</u>	<u>% in Diet</u>	<u>Max. Residue (ppm) Zineb</u>	<u>Dietary Burden (ppm) Zineb</u>
Cull potatoes	20	0.1	0.01
Apple pomace (dry)	5	389	19.4
Grape pomace (dry)	5	9.6	0.48
Tomato pomace (wet)	2	9.3	0.19
Other feed items	68		
Total =			20

Expected residues of zineb 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>Zineb</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

These residue estimates are tentative, pending receipt of adequate zineb residue data, processing data, and livestock feeding studies.

cc: R.F., circu, S. Hummel, Zineb S.F., Zineb S.R.F. (Hummel),  
Zineb R.S.F. (Hazel), V. Bael (SRB/RD), S. Lewis (PM#21),  
PMSD/ISB

RDI:EZ:07/11/88:RDS:07/11/88

TS-769:RCB:RM810:CM#2:SVH:svh:07/11/88