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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PREVENTION, PESTICIDES, AND TOXIC SUBSTANCES
WASHINGTON, D.C. 20460

June 27, 2000

MEMORANDUM

SUBJECT: Response to comments from the BASF Corporation submitted in MRID 451114-01 to the Agency's February 8, 2000 occupational and residential risk assessment for vinclozolin [Case #816411, PC Code 113201, DP Barcode D265676]

From: Jeffrey L. Dawson, Chemist
Reregistration Branch I
Health Effects Division 7509C

Thru: Whang Phang, Ph.D., Branch Senior Scientist
Reregistration Branch I
Health Effect Division 7509C

To: William Hazel, Ph.D., Chemist
Reregistration Branch I
Health Effects Division 7509C

Deanna Scher, Chemical Review Manager
Special Review and Reregistration Division
Mail Code 7509C

The purpose of this document is to address the comments provided by the BASF Corporation on the February 8, 2000 Occupational and Residential Exposure/Risk Assessment completed by the Agency (DP Barcode 260678). These comments address specific issues related to how the Agency completed the post-application worker and residential risk assessments for vinclozolin. Specifically, many of the major comments addressed the manner in which the Agency calculated dislodgeable foliar residue and turf transferable residue levels for use in the risk assessment.

1. Introduction:

The comments submitted by the BASF Corporation were included in the following document:

Title:	Re-evaluation of EPA-Calculated Dislodgeable Foliar Residues of Vinclozolin and Margins of Exposure
Author:	Douglas G. Baugher, Ph.D.
Date:	April 28, 2000
Sponsor:	BASF Corporation 26 Davis Drive Research Triangle Park, NC 27709
Performing Laboratory:	EXP Corporation 660 Orchard Lane Aspers, PA 17304
Identification Codes:	EXP Project # 42998 EXP Report # 00024 BASF Registration Document # 2000/5167 EPA MRID 451114-01 (451114-00 is transmittal letter)

The submission makes no claims of confidentiality and also indicates that GLPs do not apply.

In most cases, when the Agency responds to comments on Reregistration Eligibility Documents the specific comments are reproduced and then responded to individually for the sake of clarity. However, the BASF comments referenced above are 27 pages so the comments have been summarized by the Agency as appropriate and responded to in that form. As a result, this document will present a summary of the BASF comments in Section 2 below and the Agency's response to the BASF comments in Section 3 followed by an overall summary and recommendations for future actions in Section 4.

2. Summary of BASF Comments:

As the premise for these comments, BASF evaluated Agency policies relating to dissipation kinetics for dislodgeable foliar residue (DFR) or turf transferable residue (TTR) data and identified four distinct areas where no specific guidance exists. These include:

- Inclusion of Day 0 (day of application) data in analysis (i.e., because of suspected differing levels of dislodgability or transferability immediately after application);
- Use of individual replicates on each sampling day or average values to represent each sample collection day;
- Use of data from different study sites on the same crop (i.e., how should regional variability be addressed in analyses?); and
- Inclusion of "DFRs at time intervals not relevant to the REI (e.g., Day 28 DFR when days 2-10 may be the REI period of interest)."

The registrants also referenced three earlier risk assessments that were submitted including MRIDs 444094-01, -02, and -03. These documents focused on the evaluation of the vinclozolin data for Monte Carlo risk assessment purposes. The Agency has not to this point accepted probabilistic worker risk assessments which was indicated in the February 8, 2000 exposure/risk assessment completed by the Agency (DP Barcode 260678, page 72). For this reason, BASF has reanalyzed the data for use in a deterministic assessment in this document (i.e., current comments are included in MRID 451114-01).

BASF indicated that "in the time period of interest, the EPA-predicted DFR are approximately 2X to 13X the observed residues. Exposures calculated from the EPA curves would therfore be 2X to 13X greater than exposures based on the observed mean DFRs." BASF also included an excerpt from page 58 of the February 8, 2000 Agency document:

> "The simple linear regression model... has been used by the Agency, registrants, and other investigators... to [predict] DFR or TTR residue levels over time in lieu of the exponential decay model. It should be noted, however, that the current Agency approach is to use the exponential decay model for predicting DFR or TTR concentrations over time if the data are sufficiently linear which appears to be the case for vinclozolin."

BASF indicated "we respectfully disagree with the above statement and the current EPA approach to vinclozolin."

BASF then provided "mathematical rationales and graphic representations supporting alternative approaches" for calculating DFR or TTR levels. Three mathematical approaches were discussed in the document. The first is the approach used by the Agency in which an

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exponential decline curve was used to calculate residue levels as is outlined in the current Agency guidance included in Series 875-Group B. BASF has recreated the Agency results in the document which is based on using the actual monitored Day 0 concentration as the C_0 value and also has completed the calculation using the calculated intercept as the C_0 value. The second approach discussed by BASF is a multi-compartment process described by non-linear equations outlined in Gustafson *et al.* which is also identified in the Series 875-Group B Agency guidance as an option for analyzing dissipation data. The last approach discussed by BASF "to constructing DFR dissipation curves is 'brute force' curve-fitting" where a commercially available software is to be used (i.e., Table Curve 2D, Version 4 from SPSS Corporation). It appears as though BASF presented the results of the analysis for both types of exponential approaches (i.e., C_0 values as measured and as a calculated intercept) then also presented results using the Gustafson approach completed with the commercially available software (i.e., Table Curve 2D). No "brute force" curve fitting results have been presented in which trial and error application of different equations has been completed with the data to find the equation that best describes the available data solely from a mathematical and not physical/chemical perspective.

BASF provided some specific details of the completed calculations. These included:

- "Since the REIs in the EPA evaluations were based on deterministic estimates rather than probabilistic estimates, we have not reconstructed DFR curves that incorporate the variance associated with all individual measurements of DFRs."

- 0-Day (day of application) data were used in the analysis as with the Agency analysis.

- Individual replicates on each sampling day were averaged as with the Agency analysis.

- "Nondetectable" DFR values were considered 0 values for averaging purposes while the Agency only averaged detectable values or those at the LOQ at the first sampling interval where residues reached that level.

- Data were Ln-transformed as with the Agency analysis.

The DFR and TTR values used by BASF in their calculations are the same as those presented and used by the Agency in its February 8, 2000 risk assessment document. To ensure the validity of calculations presented by BASF, the Agency verified all of the numerical DFR and TTR values used by BASF in their calculations. One minor discrepancy was identified which appears to be a transcription error in the strawberry data at California/site B. The day 3/replicate 2 value should be 1.018 instead of 1.081. The investigators presented the data for each crop considered, the graphical outputs of their analyses (i.e., first order kinetics and Gustafson approach), and their proposed DFR or TTR values calculated using the Gustafson approach and Table Curve 2D.

After the discussion of the calculation of the DFRs and TTRs, BASF presented revised MOE values for various crops using the strawberry DFR data and for harvesting kiwi based on the peach DFR data. The MOEs presented based on the strawberry data are summarized below:

"Vinclozolin MOE Based On Strawberry DFR"						
Day	DFR ($\mu g/cm^2$)	MOE For TC =				
		1,000	2,500	4,000	5,000	10,000
0	1.890	47	19	12	9	5
5	0.769	116				
11	0.315		113			
14	0.213			105		
16	0.167				107	
22	0.086					104

Day 0 and day where MOE ≥100 presented for clarity.
1000 = Scouting canola, onions, etc.
2,500 = Harvesting lettuce, sorting/packing ornamentals
4,000 = Scouting/harvesting raspberries; irrigating ornamentals
5,000 = Cutting flowers, literature TC
10,000 = Cutting flowers, standard TC

BASF did not present a table for the kiwi harvesting calculations which is the only scenario where the peach DFR dissipation data were used. BASF indicated that with their DFR calculations "using the EPA default TC of 10,000, the MOE approximate 100 on Day 8. Using the BASF peach harvester study that showed a TC of approximately 1,300, MOE approximate 100 by Day 1 posttreatment."

BASF also presented MOE values for vinclozolin uses on sodfarms. In this assessment, BASF considered dermal and oral exposures that included mouthing hands that have touched treated turf and also mouthing objects that have touched treated turf. Soil ingestion was not considered as in the Agency assessment because BASF believed "we had no credible way to quantify exposure by this pathway." Additionally, all BASF calculations were completed using the turf transferable residue data generated with the California Cloth Roller. None of the aqueous turf wash data were used in the vinclozolin risk assessment which is different from the Agency assessment that used the aqueous turf wash data to complete the nondietary hand- and object-to-mouth assessments. The results of the BASF calculations are presented below:

"Vinclozolin Used on turf: Toddler MOE"					
Day	TTR ($\mu g/cm^2$)	Dermal MOE	Hand-to-mouth MOE	Object-to-mouth MOE	Aggregate MOE
0	0.334	49	561	449	41
2	0.137	120	1370	1096	100
9	0.013	1251	14314	11452	1045

Finally, BASF indicated that the "exposure scenarios could be further refined by probabilistic approaches generally accepted by the scientific community."

3. EPA Response to BASF Comments:

The comments provided by the BASF Corporation are multi-faceted in that they address many technical and over-arching scientific issues related to the calculation of post-application exposures and risks. BASF comments addressed issues related to the exposure inputs. calculation of DFR or TTR levels for use in risk assessment. and the models used to calculate residential exposures on turf. Each comment is addressed by the Agency below following a brief summary of the Agency's February 8, 2000 post-application risk assessment (DP Barcode 260678).

a. Summary of Agency Risk Assessment

In order to adequately address the issues raised by BASF it is necessary to summarize the data that were available to the Agency when the risk assessment was completed and how the Agency handled the data in the risk assessment including: specific calculations, the development of exposure scenarios, and the translation of data from crop to crop. Vinclozolin can be used in ways that can expose individuals after application in occupational settings and in areas frequented by the general public because residues become available in areas where people work or otherwise frequent. As a result, the Agency believes that occupational exposures can come from uses in agriculture and in ornamental production areas such as outdoor nurseries and greenhouses. Exposures to the general population (herein referred to as residential exposures) can result from vinclozolin uses on golf courses. Additionally, the Agency was concerned about treated sod that can be transplanted in residential settings so exposures to treated turf on sod farms were considered to establish the time required after application to allow for residue dissipation prior to harvest.

Occupational exposures that were considered in the February 8, 2000 Agency risk assessment ranged from lower values associated with minimal contact activities to higher level exposures associated with more extensive contact with treated foliage. Vinclozolin uses that can result in exposures to the general population (i.e., residential exposures) included those for golfers and for children to establish harvest intervals for treated turf grown on sodfarms. The measures of post-application exposure that are used in Agency risk assessments are transfer coefficients that represent the ratios of exposure to ambient concentrations (i.e., dislodgeable foliar or turf transferable residue levels) for specific activities. The activities and the transfer coefficients that were used by the Agency include:

In Agriculture:

Scenario 1/TC = 1,000 cm2/hour: adults scouting in canola, onions, lettuce, and other low row crops;

Scenario 2/TC = 2,500 cm2/hour: adults harvesting lettuce;

Scenario 3/TC = 4,000 cm2/hour: adults scouting/harvesting raspberries and snapbeans; and

Scenario 4/TC = 10,000 cm2/hour: adults harvesting onions, kiwi, and trellised snapbeans.

[Note: Exposures were monitored in peaches and strawberries which have been dropped by BASF. The transfer coefficients from these studies were similar to the Agency default values for various crops so the Agency default values were used in the post-application assessments. See below for further explanation.]

In Ornamentals:

Scenario 1/TC = 500 cm2/hour: adults mowing and maintaining treated turf;

Scenario 2/TC = 2,500 cm2/hour: adults sorting and packing ornamentals in a greenhouse;

Scenario 3/TC = 4,000 cm2/hour: adults irrigating ornamentals;

Scenario 4/TC = 5,000 cm2/hour: adults cutting flowers in a greenhouse based on literature study; and

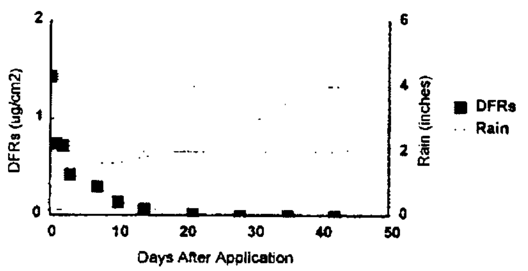
Scenario 5/TC = 10,000 cm2/hour: adults harvesting/placing sod or cutting flowers in a greenhouse using standard Agency TC value.

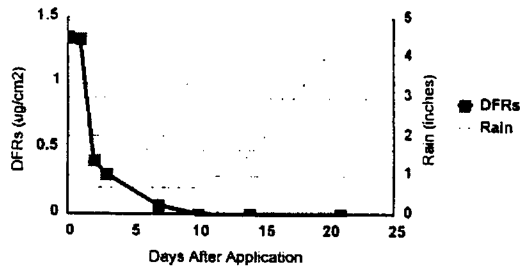
In The General Population:

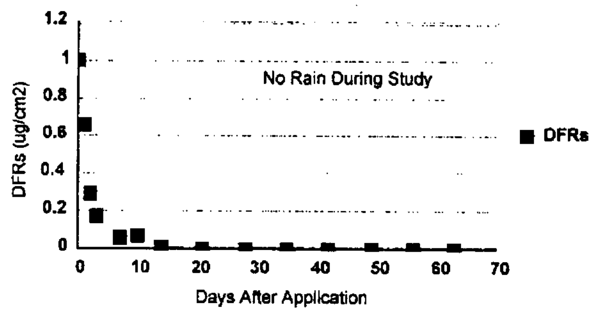
Scenario 1/TC = 500 cm2/hour: adults golfing on treated greens and tees or over the entire course; and

Scenario 2/TC = 9,082 cm2/hour: toddlers after contact with treated sodfarm turf, based on vinclozolin Jazzercize study.

To support the reregistration of vinclozolin, BASF generated several dislodgeable foliar residue (DFR) and turf transferable residue (TTR) studies as detailed in the February 2000 Agency risk assessment [see section 2 above and DP Barcode 260678, pages 45 to 56]. Exposure monitoring studies were also completed on these crops [See notes above concerning use of the vinclozolin exposure data.] DFR studies on peaches, strawberries, and TTR studies on turf were completed. The peach data were collected after a single application using an airblast sprayer to sites in Pennsylvania, Georgia, and California at a rate of 1 lb ai/acre. No rainfall or foliar irrigation was noted at the California site. At the Pennsylvania site, 0.2" of rain fell the day after application to a point where 1.81" of rain had fallen at 14 days after application. At the Georgia site, 0.7" of rain fell two days after application and 1.54" of rain had fallen at 14 days after application. Recovery and other quality assurance data appeared acceptable. Corrections to residue levels were made as appropriate based on recovery results. The data generated for vinclozolin on peaches are presented below as well as the rainfall (includes foliar irrigation if any occurred) for each study site in a table and in graphical form.







SUMMARY OF VINCLOZOLIN PEACH DFR DATA						
DAT	PENNSYLVANIA		GEORGIA		CALIFORNIA	
	AVG. DFR ($\mu g/cm^2$)	DAILY RAIN (inches)	AVG. DFR ($\mu g/cm^2$)	DAILY RAIN (inches)	AVG. DFR ($\mu g/cm^2$)	DAILY RAIN (inches)
0	1.449	0	1.363	0	1.007	0
1	0.760	0.2	1.341	0	0.665	0
2	0.729	0	0.414	0.7	0.295	0
3	0.442	0.48	0.309	0	0.179	0
7	0.307	0.93	0.078	0	0.064	0
10	0.150	0	0.012	0	0.075	0
14	0.073	0.2	0.004	0.84	0.013	0
21	0.020	0.25	0.002	3	0.008	0
28	0.006	0.57			0.008	0
35	0.002	0.9			0.004	0
42	0.003	0.55			0.003	0
49					0.002	0
56					0.001	0
63					0.002	0

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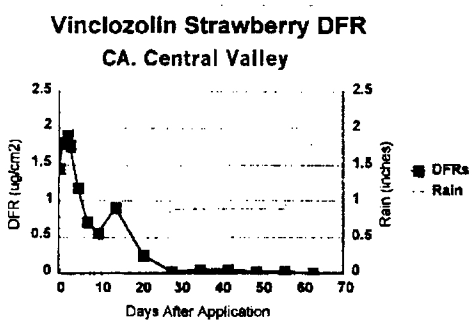
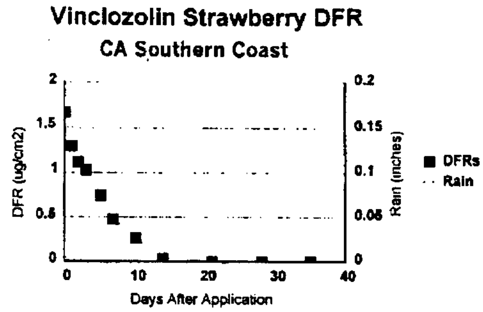
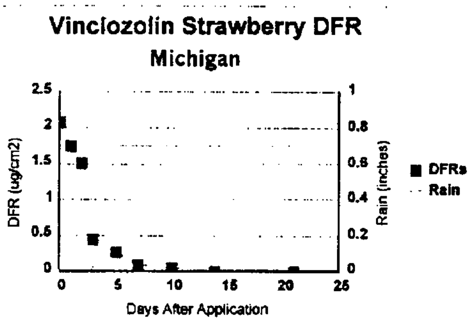
The strawberry data were collected after six sequential applications, each 1 week apart. using a groundboom sprayer to two sites in California and a site in Michigan at a rate of 1 lb ai/acre. No rainfall or foliar irrigation was noted at the California sites until 14 or 15 days after application where 0.15 and 0.19 inches of rain fell, respectively, at each site. At the Michigan site. 0.7" of rain fell between three and five days after application. Recovery and other quality assurance data appeared acceptable. Corrections to residue levels were made as appropriate based on recovery results. The data generated for vinclozolin on strawberries are presented below as well as the rainfall (includes foliar irrigation if any occurred) for each study site in a table and graphical form.

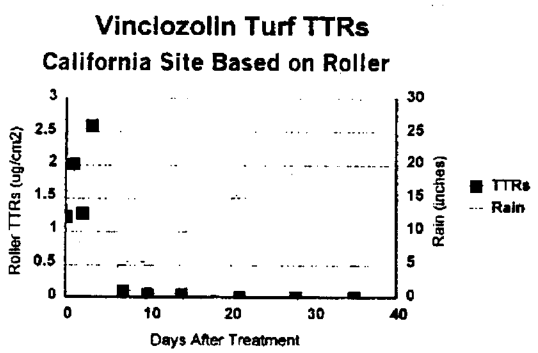


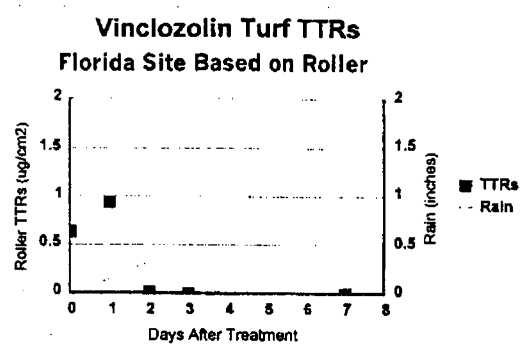


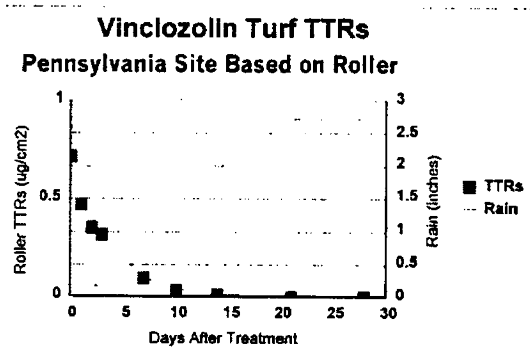


SUMMARY OF VINCLOZOLIN STRAWBERRY DFR DATA						
DAT	CALIFORNIA CENTRAL VALLEY		CALIFORNIA SOUTHERN COAST		MICHIGAN	
	AVG. DFR (μg/cm²)	DAILY RAIN (inches)	AVG. DFR (μg/cm²)	DAILY RAIN (inches)	AVG. DFR (μg/cm²)	DAILY RAIN (inches)
0	1.450	0	1.676	0	2.101	0
1	1.808	0	1.303	0	1.752	0
2	1.923	0	1.116	0	1.507	0
3	1.756	0	1.037	0	0.458	0
5	1.174	0	0.756	0	0.284	0.7
7	0.728	0	0.480	0	0.110	0
10	0.556	0	0.281	0	0.064	0
14	0.924	0	0.050	0	0.020	0
21	0.260	0.19	0.004	0.15	0.005	0
28	0.043	0.7	0.001	0		
35	0.060	0	0.003	0		
42	0.047	0				
49	0.030	0				
56	0.031	0				
63	0.010	0.94				

The turf data were collected after four sequential applications, each 2 weeks apart, using a groundboom sprayer at sites in California, Florida and Pennsylvania at a rate of 5.6 lb ai/acre. No rainfall or foliar irrigation was noted at the California sites until 4 days after application when 5.4 of rain fell on the site. At the Pennsylvania site, 0.01" of rain fell on the day of application and 0.015" of rain fell two days after application. At the Florida site, 1.69" of rain fell over the first 6 of 7 days after application. Corrections to residue levels were made as appropriate based on recovery results. The data generated for vinclozolin on turf using the California roller method for illustrative purposes are presented below as well as the rainfall (includes foliar irrigation if any occurred) for each study site in a table and in graphical form.







SUMMARY OF VINCLOZOLIN TTR DATA USING CALIFORNIA ROLLER METHOD						
	CALIFORNIA		FLORIDA		PENNSYLVANIA	
DAT	AVG. TTR ($\mu g/cm^2$)	DAILY RAIN (inches)	AVG. TTR ($\mu g/cm^2$)	DAILY RAIN (inches)	AVG. TTR ($\mu g/cm^2$)	DAILY RAIN (inches)
0	1.237	0	0.645	0	0.725	0.01
1	2.040	0	0.954	0.15	0.470	0
2	1.283	0	0.031	0.18	0.358	0.15
3	2.627	0	0.015	0.15	0.321	0
7	0.112	5.4	0.001	1.31	0.104	0.43
10	0.065	0	Mowed at Day 5		0.042	0.57
14	0.058	4			0.011	0.79
21	0.007	6.3			0.002	0.76
28	0.003	3.2			0.001	0
35	0.002	6.3				

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The peach data were used by the Agency to assess the risks associated with kiwi harvesting because of the similar application method expected between peaches and kiwi (i.e., airblast application is expected for each crop). The strawberry data were used to assess all other risks in agriculture and ornamentals because of the similarity between application methods anticipated for each compared to the study (i.e., groundboom application or possible handheld methods using similar nozzles and pressures). Neither of these datasets were adjusted during the extrapolation process due to differences in application rate because all of the data were generated at 1 lb ai/acre which is the current maximum application rate for several agricultural and ornamental crops. The turf dataset was adjusted to account for differences in application rate because the studies were conducted at an application rate of 5.6 lb ai/acre while the current maximum application rate for turf is 1.35 lb ai/acre. The adjustment was made using a simple proportional adjustment of the data as is commonplace when the Agency extrapolates DFR or TTR data due to differences in application rate. The turf assessment was completed using both sets of TTR data (i.e., aqueous wash and California roller - only California roller data are presented above for illustrative purposes). The California roller TTR data were used to calculate risks from dermal exposure while the aqueous wash data were used to calculate the dose levels associated with the mouthing behaviors of children (i.e., hand to mouth and object to mouth behaviors). The Agency analyzed these dissipation data by using actual data for all sample collection days. In this approach, the DFR or TTR data for all sites per crop, on all sampling days where there were detectable residues, were averaged together. These mean values were then ln-transformed and subjected to a semilog linear regression. The results of this analysis are presented in the table below (See Dissipation Method 4 in February 8, 2000 risk assessment document, DP Barcode 260678).

Analysis and Summary of Vinclozolin Dissipation Data					
Crop	Application Rate (lb ai/A)	Correlation Coefficient	Slope	Observed C_0 ($\mu g/cm^2$)	Half-Life (days)
Peaches	1	0.934	-0.108	1.274	6.4
Strawberries	1	0.932	-0.078	1.743	8.9
Turf (Aqueous Wash Data)	5.6	0.994	-0.128	12.93	5.4
Turf (CA Roller Data)		0.963	-0.201	0.869	3.5

Notes:

- Data from each site combined and used for risk assessment purposes in all cases because of (1) the extrapolation that has been completed to different crops other than those used for the studies and (2) vinclozolin can be used in a variety of regions within the country -- considering data from different areas accounts for regional variability.
- The TTR data have been adjusted for risk assessment purposes based on differences in application rate (i.e., turf study conducted at 5.6 lb ai/acre and current label maximum is 1.35 lb ai/acre).
- As described in this document above, an exponential decay model is the current Agency standard for calculating predicting residue levels over time as described in equation D2-16 as presented in the Series 875, Group B guidelines (U.S. EPA, 1997).

Using the exposure values reflected by different transfer coefficients for each crop/activity combination and the DFR or TTR levels the Agency calculated, risk levels (MOEs) for each sequential day after application across the DFR or TTR dissipation profile were developed. The Agency used the MOEs on sequential days after application to help define Restricted Entry Intervals and assess risks to the general population (e.g., when MOE ≥UF or uncertainty factor, for vinclozolin the UF is 100 for occupational populations and 1000 for the general population). The MOE values presented in the February 8, 2000 Agency risk assessment are summarized below. The values proposed by the registrant are also presented below along with current or proposed preharvest intervals for comparative purposes.

SUMMARY OF VINCLOZOLIN POSTAPPLICATION RISKS						
Scenario #	Activity	Agency Values		Proposed By BASF		PHI (crop)
		MOE on Day 0	Day When MOE≥100 (or 1000 for residential)	MOE on Day 0	Day When MOE≥100 (or 1000 for residential)	
In Agriculture						
1	Scouting	51	9 Days	47	5 Days	7 to 28 days depending on crop
2	Lettuce Harvest	20	21 Days	19	11 Days	28 days
3	Raspberry Scouting & Harvest	13	27 Days	12	14 Days	9 days
4	Onions & Trellis Snapbean Harvest	5	39 Days	5	22 Days	10 days (proposed for beans) & 18 days (onions)
4	Kiwi Harvest	7	25 Days	Not reported	8 Days	7 days
On Ornamentals						
1	Mowing turf	1705	0 Days	534	0 Days	N/A
2	Sorting/packing	20	21 Days	19	11 Days	N/A
3	Irrigating	13	27 Days	12	14 Days	N/A
4	Turf Harvest (with TTRs)	43	5 Days	27	4 Days	N/A
4	Cutting Flowers	5 or 10	30 or 39 Days	27	4 Days	N/A

SUMMARY OF VINCLOZOLIN POSTAPPLICATION RISKS						
Scenario #	Activity	Agency Values		Proposed By BASF		PHI (crop)
		MOE on Day 0	Day When MOE≥100 (or 1000 for residential)	MOE on Day 0	Day When MOE≥100 (or 1000 for residential)	
Residential Uses						
1	Golfing	1700 6800	0 Days	534	2 Days	N/A
2	Toddlers on Sodfarm Turf	33	24 Days	41	9 Days	N/A

All MOE values presented in this table are for the short-/intermediate-term endpoints.
Agency presented two values for cutting flowers because a standard and literature value Transfer Coefficient used for the assessment.
Two golfer risk values represent just treating greens and tees (6800) or treatment of entire course (1700).
BASF estimates for children on sodfarm turf do not include soil ingestion which was included in Agency assessment.
BASF turf mowing and golfing MOEs are based on an 8 hour day and not 4 hours as was done in the Agency assessment.
See section 3.d below for details concerning the differences between the Agency and BASF toddlers on sodfarm calculations.

b. Occupational Exposure Inputs

The Agency reviewed the inputs used to calculate the occupational post-application exposure levels used by BASF. The key elements in the calculation of postapplication exposures and risks by the Agency are the ambient concentration in the environment in which a worker completes their job or a person spends their time engaged in various activities (i.e., as measured by DFRs or TTRs), the activities that individuals do that lead to exposure (i.e., represented by different transfer coefficients for different activities), and those parameters dictated by the hazard concerns associated with a chemical (e.g., toxicological effect, NOAEL values, body weights, dermal absorption, etc.). BASF used the same toxicological inputs, body weights, dermal absorption, and other factors as the Agency except as noted below. The major discrepancy between the results of the Agency assessment and those calculated by BASF is related to differences in the way that the DFR and TTR residue dissipation data have been used to predict daily residue levels. This issue is addressed separately below in *Section 3.c: Calculation of DFR or TTR Levels for Use in Risk Assessment* because of the extensive nature of the comments provided by BASF. Other discrepancies were minor and are discussed below.

The range of transfer coefficients and other factors that were applied by BASF to the strawberry DFR data to calculate exposures were the same as those used by the Agency in the February 8, 2000 risk assessment to represent the different crop/activity combinations associated with the use of vinclozolin. The resulting exposures addressed all vinclozolin uses in agriculture except on kiwis as well as all ornamental uses except mowing and sod harvesting. [Note: To reiterate, the key difference in results is due to differences in calculating DFR levels which is addressed below.]

BASF presented the risks associated with the uses on kiwi based on two different transfer coefficients which were the value used by the Agency of 10,000 cm^2/hour and the value of 1,300 cm^2/hour that BASF calculated from the peach harvesting study that was completed for vinclozolin and described in detail in the February 8, 2000 Agency risk assessment (i.e., harvester exposure study is MRID 42830002 and accompanying DFR is MRID 42830001). The transfer coefficient value calculated by BASF is well within the range of transfer coefficient values calculated by the Agency based on the same study. In fact, in the February 8, 2000 Agency risk assessment it was indicated that "the vinclozolin-specific transfer coefficients calculated by the Agency using chemical-specific data range... from less than 1000 up to approximately 7500 for peach harvesting depending upon how they were calculated." As a result, however, the Agency opted to use the 10,000 cm^2/hour value which is the current standard value for kiwi harvesting because the high-end of the transfer coefficient range calculated for peaches was similar at 7,500 cm^2/hour. It was also believed that the harvest of kiwi might be more similar to the harvest of trellised vine crops than peaches because of the nature of the crops and their foliage canopies (i.e., some uncertainty exists between peaches and kiwi because kiwi is a trellised vine like grapes and peaches are a small, sparse canopy tree crop).

BASF calculated risks associated with treated turf using the same transfer coefficients and other inputs that were used by the Agency with the exception of the exposure duration value for mowing (e.g., 500 cm^2/hour for mowing and 10,000 cm^2/hour for sod harvest). BASF used a value of 8 hours per day while the Agency used a value of 4 hours per day for mowers. The Agency believes that a value of 4 hours per day is justified for golf course mowers instead of 8 hours per day for other agricultural settings because it is expected that golf course workers will routinely engage in other activities such as pin relocation or general maintenance that will preclude spending entire days mowing. The Agency also used the 8 hours per day for the sod harvesting scenario.

In summary, BASF and the Agency used essentially the same numerical inputs for the calculation of exposure. The minor differences, as noted above, should be considered in the interpretation of the risks as well as the rationale behind the Agency inputs.

c. Calculation of DFR or TTR Levels for Use in Risk Assessment

The comments received from BASF on the Agency's February 8, 2000 risk assessment document are focused primarily on the methods used by the Agency to calculate dislodgeable foliar and turf transferable residue levels based on the available data. There are major differences between the method used by the Agency and the methods proposed by BASF. In order to first put this issue in context, key elements of the Agency's draft Series 875, Group B guidelines (i.e., *Series 875 Occupational and Residential Exposure Test Guidelines, Group B- Postapplication Exposure Monitoring Test Guidelines*) are summarized to provide background information. Series 875/Group B provides guidance on the conduct of dislodgeable foliar or turf transferable residue studies as well as on how to interpret and use those studies in the risk assessment process. The *Study Design Chapter* (Part B, Chapter 2) illustrates factors that should be considered in the development of a study and conversely that should be considered in the interpretation of the data generated from such studies. Specifically, the elements of the guidelines that should be considered in the interpretation of the comments received from BASF on the February 8, 2000 Agency risk assessment include use patterns and associated cultural practices, geographic and climatological considerations, and seasonal considerations (i.e., ensuring that data are generated in the appropriate part of the growing season). Additionally, the other aspect of the guidelines that should be considered illustrate how residue dissipation data should be interpreted in order to calculate risks on a daily basis after application (i.e., to predict residue dissipation based on the collected data). In the *Calculations* chapter of the Series 875/Group B (Part D, Chapter 2), the Agency recommends the use of a pseudo-first order exponential kinetics model because this model seems to fit most data that have been generated and then recommends "in cases where pseudo-first order kinetics do not apply, other models may be used, including graphical techniques, if they are adequately explained and justified in any submission to the Agency (i.e., Gustafson and Holden, 1990)."

One of the key premises of the Agency's guidelines and the overall Agency approach for the calculation of postapplication exposures and risks, is that the collection of dislodgeable foliar or turf transferable residue dissipation data for all regional/crop combinations is not feasible. As such, it is standard practice for the Agency to require studies be developed on crops and in regions that can be considered representative of the uses of the chemical being considered. The database for vinclozolin, compared to other chemicals, is extensive in that foliar dislodgeable residue data were available from 3 different study sites on peaches and also on strawberries. Additionally, turf transferable residue data were generated at 3 different study sites. At the time these studies were conducted, the major uses of vinclozolin were on these crops which is no longer the case. In fact, vinclozolin is no longer labeled for use on peaches or strawberries. When the February 8, 2000 risk assessment was completed, the Agency based it on the use of vinclozolin in agriculture (i.e., snapbeans, canola, lettuce, onions, chicory/endive, raspberries and kiwi), on ornamentals (i.e., woody and herbaceous ornamentals and as a dip for different types of plant materials), and on turf where the general population can be exposed (i.e., golf courses and sodfarm turf). Given the available residue dissipation data, the Agency extrapolated from the existing data to the crops that still remained on current vinclozolin labels. The Agency used the peach data to complete the assessment for kiwi because both are likely to be treated with an airblast sprayer. Thus, the resulting 0-Day concentrations would be similar because of similar application rates, crop canopies, and spray pattern distribution. The strawberry data were used by the Agency to calculate risks for all other agricultural crops and ornamentals except turf and chicory/endive (for which no postapplication risk assessment was completed) again because the strawberry data were generated with a groundboom sprayer and the remaining agricultural crops would also be expected to be treated with a groundboom sprayer. For the same reasons as described above for the peach/kiwi extrapolation (i.e., rates, canopies, and spray patterns), it is anticipated that the 0-Day concentrations would on the remaining agricultural crops would be similar to those quantified on strawberries. The studies on peaches and strawberries were completed at application rates of 1 lb ai/acre which is also the current maximum application rate for the agricultural crops considered. The turf data, however, were completed at an application rate of 5.6 lb ai/acre which were proportionately adjusted to the current application rate of 1.35 lb ai/acre. In routinely completing these kinds of extrapolations with DFR and TTR data, the Agency acknowledges that it accepts uncertainty in the risk assessment process which is also reflected in the use of a pseudo-first order kinetics model.

Along with the crop to crop and application rate adjustments of DFR and TTR data routinely completed by the Agency, there is another aspect of the postapplication risk assessment process that is inherently uncertain associated with regional variability. The Agency's guidelines require that regional variability be evaluated in any suite of studies submitted to support the use of a chemical so that the Agency can consider differences in dissipation rates due to climate and other issues (e.g., pest pressures that require multiple versus single applications). Addressing how data are to be used to address regional variability is usually done by the Agency after consideration of the available data. For example, if residues dissipated much quicker at a study site compared to others and there were clear climatological reasons (e.g., a photolytic chemical in central California) for the dissipation, the Agency would complete separate risk assessments for each situation. In the case of vinclozolin, however, there were no clear cut reasons to preclude combining the data across different study sites because the dissipation patterns were similar for each site. This decision was also made by considering the crop to crop and application rate adjustment extrapolations described above. The Agency also supported this approach by evaluating the results of a series of linear regression analyses in the February 8, 2000 risk assessment in which correlation coefficients were compared for each crop after combining the values over all study sites using 5 unique approaches for comparative purposes (see pages 59 and 60 of the February 8, 2000 Agency risk assessment, DP Barcode 260678). In the psuedo-first order model used by the Agency, the dissipation of chemical residues is assumed to be linear after natural log transformation of the residue concentrations. Given this premise, the correlation coefficient can be used to explain how much of the variability of a best fit line, calculated based on a linear regression, can be explained when compared to the actual data upon which the regression is based. The closer the correlation coefficient is to 1 the better the predicted line corresponds to the actual data. The Agency has also used correlation coefficients to support the combining of data across study sites. The average correlation coefficients for each crop across all study sites, calculated by taking the average value of each of the 5 unique regression approaches, are 0.935 for peaches, 0.909 for strawberries, and 0.936 for turf (includes both roller and wash data). To calculate postapplication risks, the Agency selected an approach (4 of 5 in risk assessment) that was based on averaging residue levels collected at all study sites for each sampling day. For this method, the correlation coefficients are similar or even higher than the overall average with a 0.934 for peaches, 0.932 for strawberries, 0.963 for turf TTRs, and 0.963 for the turf California roller data. Another issue that is often critical in the interpretation of residue dissipation data are the inclusion of 0-Day samples in the analysis because of many issues such as differences in initial transferability and formulation effects. It appears for vinclozolin, however, that there are no such major effects because the correlation coefficients for the analysis are so high. Therefore, the 0-Day samples were considered in the method selected by the Agency for the calculation of risk.

Another factor that should be considered in the calculation of postapplication risks are the physical/chemical processes that actually drive the dissipation process. In Section 3.a above, the raw residue dissipation data upon which the risk assessment is based are presented in both tabular and graphical form. It appears that in several cases the dissipation of vinclozolin residues is hastened because of a rainfall event or application of foliar irrigation. The pattern of rainfall and irrigation noted in the available data are unique to these data but are also obviously expected in normal agricultural practice. The representativeness of the precipitation patterns and other climatological conditions recorded in the studies also add to the Agency's rationale for routinely selecting pseudo-first order kinetic models in the analysis of dissipation data. It should also be noted, that the environmental fate data for vinclozolin indicate that residues dissipate quickly in hydrolysis studies (i.e., ½ life is 12 minutes at ph 9 and 61 hours at ph 7) and in aqueous photolysis studies with sensitization (i.e., ½ life <4 hours at ph 2-3).

Given all of the above issues, the Agency completed the analysis of the residue dissipation data using pseudo-first order kinetics and presented Margin of Exposure values in the February 8, 2000 risk assessment as noted above in Section 3.a. The Agency did not consider a more sophisticated statistical approach even though they are described in the Series 875 guideline document because the correlation coefficients were high given the unique aspects of the available data (i.e., several rainfall/irrigation events were noted) and given all of the uncertainties associated with the extrapolation of the data between crops and application rates noted above. Also, in order to conserve resources, a tiered approach is used by the Agency during the completion of risk assessments when it does not appear that further refinement of the data are warranted. This was the approach taken in the February 8, 2000 Agency risk assessment for vinclozolin. The Agency does acknowledge, however, that often more refinements to risk values are required during the risk management phase of the regulatory process if adequately justified.

The comments provided by BASF indicate that the company disagrees with the Agency's approach. In fact BASF indicated that "in the time periods of interest, the EPA-predicted DFR are approximately 2x to 13x the observed residues. Exposures calculated from the EPA curves would therefore be 2x to 13x greater than exposures based on the observed mean DFRs." BASF did not address any of the physical/chemical issues described above or the unique aspects of the dataset for vinclozolin (e.g., rainfall events in studies). The BASF analysis was completed based on a purely mathematical approach.

BASF did not present the information in the current set of comments justifying the approach used in the analysis of the data outside of indicating that the Agency calculated values overpredict the measured data. As indicated in Section 2 above, a curve fitting approach based on Gustafson et al (as described in Series 875/Group B) was used. In a docketed March 22, 2000 meeting between the Agency and BASF, BASF indicated that the statistical basis for the curve fitting approach was an examination of the residuals of the curve for each dataset which showed an uneven distribution of residuals rather than a more random distribution of residuals which would be expected if the means for predicting DFR or TTF values were completely adequate. The Agency concurs that there is an uneven distribution of residuals as indicated by BASF. The

Agency also concurs that the predicted DFR and TTR values from the February 8, 2000 Agency risk assessment (DP Barcode 260678) overpredict in many cases the measured DFR and TTR values. The Agency did not have the opportunity to validate the numerical values calculated by BASF to conserve resources since the basic issue is one of general policy regarding how DFR and TTR data are to be used in the risk assessment process. Additionally, it should be noted that the strawberry data were used to complete the analysis for all agricultural and ornamental crops except kiwi and turf. The general agreement between the BASF calculated values and the Agency values was better, on average, than that seen in the same comparison for the peach and turf data (i.e., the differences between BASF and Agency values is smaller for the strawberry data used for most agricultural crop and ornamental risk assessments).

In summary, the Agency used a pseudo-first order model to predict DFR and TTR levels based on the fact that the available vinclozolin data were not generated on any currently labeled crops and given the unique aspects of the data such as weather events. It is Agency practice, to use pseudo-first order kinetics first in a tiered approach to conserve resources given the quality and limited nature of most residue dissipation datasets. Generally, more sophisticated dissipation kinetic analyses such as curve fitting are reserved for situations where the psuedo-first order model just does not fit given all of the uncertainties associated with residue dissipation data. The current labels for vinclozolin specify Restricted Entry Intervals of 12 hours after application. BASF has proposed REIs that range from 5 to 22 days in agriculture and from 4 to 14 days on ornamentals while the Agency has proposed MOEs that would result in REIs that range from 9 to 39 days in agriculture and from 5 to 39 days on ornamentals (excluding mowers which is 0 days for the Agency and BASF). The major differences in these values are due to differences in DFR or TTR levels. The Agency has several concerns over the use of curve fitting techniques in situations such as this with vinclozolin because the datasets should be of sufficient quality and quantity for a true statistical measure of dissipation that would be gained from more sophisticated analysis methodologies. It is not clear if the current analysis for vinclozolin meets statistical criteria for adequate numbers of datapoints, reproducibility, and representativeness to other crops which would justify the use of more sophisticated statistical methods. At a minimum, modifying the current labels to the REI values proposed by BASF would be a logical first step. Data should also be collected on the remaining crops if the curve-fitting approach is adopted to confirm the analysis. If confirmatory data are not collected, risk managers should carefully consider the use of the psuedo-first order analysis completed by the Agency in light of the unique attributes of the data currently available for vinclozolin.

d. Models Used to Calculate Residential Exposures on Turf

For adults, BASF did not specifically mention risks associated with golfers except to indicate "the only non-occupational exposure scenario is for residential exposure to newly placed sod treated with vinclozolin." This is incorrect since the Agency did consider the exposure of golfers in its February 8, 2000 risk assessment. The only values presented in the BASF comments were calculated risks associated with treated turf using the same transfer coefficients and other inputs that were used by the Agency with the exception of the exposure duration value for golfing (e.g., 500 cm^2/hour for golfing). BASF used a value of 8 hours per day for turf exposures while the Agency used values 1 or 4 hours per day for golfers depending upon how vinclozolin is used on golf courses. In the residential risk aspects of the February 8, 2000 Agency risk assessment, the Agency used a 1 hour duration value to calculate the risks for golfers after vinclozolin application to tees and greens (Appendix H, Table 3 of Agency risk assessment). The Agency also calculated post-application risks to golf course mowers using the same transfer coefficient as golfers (i.e., 500 cm^2/hour) and a duration of 4 hours which is the duration the Agency typically uses to calculate exposures for playing a round of golf on a course that has had greens, tees, fairways, and other areas treated with vinclozolin as opposed to just greens and tees. Therefore, the same numerical risk values calculated for golf course mowers are also representative of those anticipated for golfers if a round of golf is played on a course that has been completely treated (see Appendix G, Table 8 in the February 8, 2000 Agency assessment). For both golf course treatment scenarios, the risk values presented by BASF are different than would be expected based on the Agency risk assessment because of the different durations considered and the differences in the TTR levels which have been addressed above.

Differences were also noted between the sodfarm turf risk assessment for toddlers completed by BASF and the Agency. The durations, transfer coefficients, body surface areas, and event frequencies used in the calculations by BASF are all the same as those used by the Agency. The major differences between the two risk assessments, outside of the prediction of TTR levels addressed in Section 3.c above, are that BASF did not include soil ingestion in the calculation of aggregate dose because "we had no credible way to quantify exposure to this pathway." With regard to BASF's conclusion that soil ingestion is "truly insignificant", the Agency concurs for vinclozolin as is illustrated in Appendix H, Table 8 of the Agency's February 8, 2000 risk assessment. However, there are cases where this is not the case because soil residue levels are available, the chemical's use is more soil directed, or the application rate is comparably high. For these reasons, the Agency has included the calculation of soil ingestion risks into its standard suite of considered exposures during the completion of the aggregate risk assessment process. BASF calculations also differed from the Agency's in another critical manner. The turf transferable residue studies completed by BASF with vinclozolin (MRIDs 43343701 and 43528701) used two separate transferable residue monitoring methods including the California cloth roller and an aqueous surfactant solution grass wash. In the February 8, 2000 Agency risk assessment, both sets of data were used to calculate aggregate exposures. The California cloth roller method data were used to calculate the dermal exposure component of the total aggregate dose while the aqueous surfactant data were used in the calculation of the non-dietary exposure levels because "these values are thought to be more representative of children's hand contact with treated surfaces (e.g., children's hands might be wet)." This issue makes a significant difference in the calculation of aggregate risks because in the BASF assessment, dermal exposures are driving the overall risk levels while in the Agency risk assessment nondietary exposure from hand-to-mouth activity are driving the overall risk values followed closely by dermal exposure.

In summary, BASF did not specifically mention golfer exposures in its comments and calculated mower exposures using an 8 hour interval instead of 4 hours which is commonly used by the Agency. The Agency believes this to be an error and will propose decisions be made on a 4 hour duration for mowers. The Agency does not agree with the use of the TTR data by BASF and would recommend using the Agency calculated risk values for sodfarm turf because of the differences in the hand-to-mouth dose levels.

4. Summary and Recommendations for Future Actions

There are several issues that should be considered in the interpretation of the comments provided by BASF as well as with the Agency response. The major issue that drives the differences between the REIs proposed by BASF and the risk values calculated by the Agency is the method that has been used to calculate the DFR or TTR levels. The Agency used a pseudo-first order kinetics approach as outlined in the Series 875/Group B guideline for postapplication exposure assessment. This is consistent with the tiered approach that the Agency routinely uses in the analysis of residue dissipation data. The correlation coefficients for all regression analyses were high, but the residuals of the plots were not randomly distributed as would be optimal. Even given the issue with the residuals, the Agency was comfortable with the pseudo-first order approach because of the uncertainties associated with the extrapolations completed with data (e.g., from crop to crop, weather events, and using different application rates). BASF disagreed with the Agency approach and opted to apply a more sophisticated curve fitting technique to the data regardless of the uncertainties and without addressing issues such as having a large enough dataset to statistically justify such an approach. The only justification provided by BASF is that the residuals of the curve are not randomly distributed with which the Agency concurs. The bottom line of the analysis completed by both the Agency and BASF is that current label requirements for a 12 hour Restricted Entry Interval should be significantly lengthened. BASF has proposed REIs that range from 5 to 22 days in agriculture and from 4 to 14 days on ornamentals while the Agency calculated risks would likely result in still longer REIs. At a minimum, modifying the current labels to the REI values proposed by BASF would be a logical first step. Data should also be collected on the remaining crops if the curve-fitting approach is adopted to confirm the analysis. If confirmatory data are not collected, risk managers should carefully consider the use of the psuedo-first order analysis completed by the Agency in light of the unique attributes of the data currently available for vinclozolin. BASF has committed to permanently phasing out all uses of vinclozolin except for canola, golf courses, and an import tolerance for wine grapes with a gradual phase out on lettuce and snapbeans.

Generally, all other factors used by BASF to calculate exposures and risks were similar to those used by the Agency with a few exceptions as noted above (e.g., 8 hours for mowers by BASF instead of 4 hours by the Agency). In those cases, the Agency recommends using the standard values commonly used in Agency assessments and not those proposed by BASF. Additionally, the Agency does not concur with the BASF use of TTR data for the toddler turf risk assessment. It is recommended that the Agency continue using the risk values calculated in the February 8, 2000 Agency risk assessment.