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

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Chemical name: Tebuconazole
PC Code: 128997
DP Barcodes: D256833, D263346, D256834, D263331, and D265744

MEMORANDUM

SUBJECT: Ecological Risk Assessment for Section 3 Registration of Tebuconazole on Wheat, Cucurbits, Bananas, Turnips, Tree nuts, Hops, and Sunflowers

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Summary of Conclusions

The proposed nationwide use of tebuconazole (Elite 45 DF) on bananas, cucurbits (melons, cucumbers, squash, pumpkin) turnips and turnip greens, hops, tree nuts (almonds, filberts, hazelnuts, macadamia nuts, pecans, pistachios, walnuts, other tree nuts) and sunflowers could potentially expose approximately 6,000,000 acres, based on 1997 USDA Census data.. With the addition of 58,000,000 acres of wheat, the total potential exposure increases to 61,000,000 agricultural acres. No estimate for turf acreage potential was determined, though this could also

be extensive. Based on current toxicological data and predicted exposure levels for the new crop uses, tebuconazole is not expected to pose significant *acute* risk to fish, aquatic invertebrates, aquatic plants, birds and small mammals. However, there is potential for **chronic risk to freshwater fish, marine fish and marine invertebrates** from proposed uses on turf at 1.4 lbs ai/A. Though acute risk to birds is not predicted, there is **a potential chronic risk to birds that feed primarily on vegetation (short and tall grass and foliage) or insects** resulting from all of the proposed new multiple application uses of tebuconazole. Since tebuconazole is persistent ($T_{1/2}$≈800 days) and has high affinity (K_{oc}=906 to 1251ml/g) for soil sorption, it is likely to adhere to soil particles and may move from the application site on entrained sediments in runoff waters. The table below provides a simplified look at tebuconazole risk to non-target organisms for proposed uses.

Table 1. Risk Presumptions Predicted by Proposed Uses of Tebuconazole

Levels of Concern -> Species Groups (below)	High Acute Risk	Restricted Use	Endangered Species	Chronic Risk
mammals	no	no	no	no
birds	no	no	Yes *	Yes **
non-target insects	no predicted	not assessed	not assessed	not assessed
freshwater fish	no	no	no	Yes *
estuarine fish	no	no	no	Yes*
freshwater invertebrates	no	no	no	no
estuarine invertebrates	no	no	Yes *	Yes *
terrestrial plants	no data	no data	no data	not assessed
aquatic plants	no	no	no	not assessed

*Turf only at 1.4 lbai/A

**Some multi application uses or single to turf at 1.4 lbs ai/A

For aquatic organism exposure, the estimated peak concentration of tebuconazole in surface water from most of the proposed new uses is not likely to exceed 13 µg/L for aerial applications and 12.43 µg/L for ground applications. The average 56 day concentration of tebuconazole in surface water is not likely to exceed 10.11 µg/L for aerial applications and 9.03 µg/L for ground applications. One exception is the use of tebuconazole at 1.4 lb ai/acre on turf which is estimated to result in potential peak levels of 57 ppb and 56 day residues of 42 ppb. The turf estimates are based on Tier I estimates as no Tier II model scenario has been developed for turf uses at this time. Surface water EECs indicate no acute risk to aquatic fish or aquatic invertebrates. Chronic risk concern levels (RQs) for freshwater fish, marine fish and marine invertebrates are exceeded by the 1.4 lb ai/A use on turf, but not by other proposed use rates in this application for new uses. Repeated applications may have the potential for residue buildup in sediments that may pose additional chronic hazard to aquatic organisms. The aquatic plant data requirement is incomplete

at this time but based on available aquatic plant data acute risk to algal populations may be limited.

The risk quotients for terrestrial organisms indicate that several proposed uses are expected to pose a chronic risk to birds . Acute levels of concern (RQ>0.1) are exceeded for endangered bird species that feed on vegetation (short and tall grass and foliage) or insects resulting from the proposed turf use of tebuconazole. The relatively long environmental persistence of tebuconazole will increase potential for chronic effects. Data are not available to assess the risk to non-target terrestrial plants. The registrant data indicate low acute risk to non-target honeybees. As mentioned previously, no acute risk to non-endangered birds or mammals is predicted.

For drinking water assessment, the estimated peak (acute) concentration of tebuconazole in drinking water from surface water sources is not likely to exceed 20.79 µg/L for aerial application and 18.53 µg/L for ground applications. The estimated average 56 day (chronic) concentration of tebuconazole in surface water is not likely to exceed 15.10 µg/L for aerial applications and 13.46 µg/L for ground applications. **These estimates are based on registered tebuconazole use on cherries.**

In coarse texture soils with low organic matter tebuconazole may move into shallow ground water. The concentration of tebuconazole in drinking water from shallow ground water sources estimated by SCI-GROW is not expected to exceed 0.43 μg/L.

This assessment is based on acceptable and supplemental environmental fate and ecological data reviewed by EFED up to the present time. Additional data (i.e., mobility data, 163-1; terrestrial field dissipation data, 164-1) are currently under review. Since surface and ground water monitoring data for tebuconazole are not available, our aquatic exposure and drinking water assessment were based on modeling.

Environmental Fate and Effects Division
Multiple Use Risk Assessment For Tebuconazole - Bananas, Cucurbits, Turnips, Hops, Tree Nuts, Wheat, Sunflowers, and Turf

I. Characterization of New Proposed Uses and Exposure Areas

Description of the New Proposed Outdoor Uses: bananas, cucurbits (melons, cucumbers, summer and winter squash, pumpkin, chayote, Chinese waxgourd, edible gourd, gherkin) turnips and turnip greens, hops, tree nuts (almonds, filberts, hazelnuts, macadamia nuts, pecans, pistachios, walnuts, other tree nuts), wheat, sunflowers, and turf .

Sites to be Treated: Nationwide usage with additional potential acreage of greater than 65 million acres if wheat is considered., but probably less than 5.5 million for crops other than wheat. No estimate for national use on turf was located, but acreage could be extensive.

Method of Application: Foliar broadcast by air or groundspray. Ground application in water. Application through any type of irrigation equipment is prohibited.

Rate of application in lbs ai/A: bananas (0.11), cucurbits (melons, cucumbers, squash, pumpkin)(0.113 to 0.225), turnips and turnip greens (0.113 to 0.20), hops (0.113 to 0.225), tree nuts (almonds, filberts, hazelnuts, macadamia nuts, pecans, pistachios, walnuts, other tree nuts),wheat (0.113 to 0.225) sunflowers (0.225) and turf (0.35 to 1.4).

Maximum Number of Applications: varies by crop from 2 to 13 (turf). Most crop uses specify 2-8 applications permitted in one season. Wheat is labeled for a single application only.

Potential Maximum Exposed Acreage:(Based on 1997 Agricultural Census for U.S. crops) Bananas (1742 acres), cucurbits (melons, cucumbers, squash, pumpkin)(609,000 acres), turnips and turnip greens (11,800 acres), hops (43,996 acres), tree nuts (almonds, filberts, hazelnuts, macadamia nuts, pecans, pistachios, walnuts, other tree nuts)(1,457,086 acres), wheat (58,836,344 acres), sunflowers (3,300,000 acres) and turf (no estimate of acreage available). Though these are large potential acreages the percentage of these crop acreages requiring fungicidal control with tebuconazole is not known and may be substantially less. A major factor would be the percentages of infestation expected for wheat, sunflower, or tree nuts (particularly almonds, pecans, or walnuts). Use on commercial turf also presents potential exposure to significant acreage throughout the U.S., some of which is located near sensitive habitat areas.

Diseases Controlled: powdery mildew (cucurbit vegetable groups, hops, turnip, grasses) various leaf spot diseases (peanut, turnips), rusts (grasses, peanuts) stem and pod rots (peanuts)

Total Amount of Pesticide to be Used: Not able to estimate accurately unless disease infected acreage estimates are known for each crop

II. Environmental Fate Summary

Tebuconazole is persistent in soil (aerobic metabolism $T_{1/2}$ = 796 days) and moderately mobile to relatively immobile (K_d's of adsorption range from 7.69 to 16.39, K_{oc}'s range from 906 to 1251 ml/g). Its mobility increases as the soil organic matter decreases. Tebuconazole has little potential to reach ground water, except in soils of high sand and low organic matter content. However, during a runoff event, tebuconazole adsorbed onto the soil particles could enter adjacent bodies of surface water via runoff.

The main route of tebuconazole dissipation is soil adsorption which increases with increasing soil organic matter content. Tebuconazole is resistant to hydrolysis ($T_{1/2}$ >> 28 days or stable at pH 5, 7, and 9), aqueous and soil photodegradation [$T_{1/2}$= stable (extrapolated $T_{1/2}$ = 590 days and 192.5 days, respectively)], and soil metabolism (aerobic metabolism $T_{1/2}$ = 796 days).

Terrestrial field dissipation half-lives varied from about 1.6 to 4 months. A supplemental study on bare ground in Florida showed vertical movement of tebuconazole. In sand soil of Vero Beach, FL (sand = 92%, silt = 0.4%, clay = 7.6%, and organic matter = 1%) tebuconazole was detected up to 0.12 ppm in the depth of 6 to 12 inches 30 days after surface application of ≈ 1.5 lb. a.i./acre (lower depths were not sampled, MRID 40700963). In addition, tebuconazole has a low potential for bioaccumulation in fish tissues (BCFs = 25X, 228X, and 99X for edible, nonedible, and whole fish tissues).

Fate characteristics of tebuconazole are summarized in the following table. Further detail regarding environmental Fate study results is available in the appendices of this document.

Fate Parameters for Tebuconazole		
PARAMETER	**STUDY RESULTS or VALUE PROVIDED by REGISTRANT**	**SOURCE**
Hydrolysis at pH 5, 7, and 9	All treated test solutions were incubated at 25°C for 28 days. The material balances ranged from 97.3 to 106.9% of applied radioactivity during the testing period.	MRID 40700957
Aerobic Soil Metabolism	When applied to sandy loam soil and incubated at 23°C, chlorophenyl labeled tebuconazole degraded with a half-life of 796 days.	MRID # 40700959
Anaerobic Soil Metabolism	Chlorphenyl-labeled tebuconazole degraded with a half-life of 1063 days in a sandy loam soil treated at 10 ppm and incubated anaerobically (flooding) at 23 ± 2°C in the dark for 60 days following 30 days of aerobic incubation.	MRID # 40700959
Leaching, Adsorption/Desorption Organic Matter Partitioning Coefficient (K_d)	Phenyl-labeled tebuconazole, at equilibrium concentrations of 16.0, 11.0, 7.4, and 1.5 mg/L, was determined to be relatively immobile in silt, sand, and two sandy loam soils when equilibrated in the dark for 48 hours at 20 ± 1°C. K_{ads} values were 7.69 mL/g for the sand soil (organic carbon content 0.75%), 16.39 mL/g for the silt soil (organic carbon content 1.8%), and 15.89 and 12.69 mL/g for the two sandy loam soils (organic carbon content 1.3 and 1.4%); respective K_{oc} values were 1025, 911, 1251, and 906 mL/g. Desorption coefficients (K_{des}) were 11.83 mL/g for the sand soil, 22.27 mL/g for the silt soil, and 23.76 and 18.27 mL/g for the two sandy loam soils; respective K_{oc} values were 1577, 1237, 1871, and 1341 mL/g. The desorption 1/n values were 0.77 to 0.83. The material balance ranged from 96 to 104% recovery of applied radioactivity.	MRID # 40995922, 40700960
Field Dissipation	100.4 days - sand soil planted with Bermuda grass near Rowland, NC 163.2 days - turf plot of Dickinson sandy loam soil Belleville, WI 177 days - sandy loam soil planted with grape seedlings near Fresno, CA 178.8 days - peanut plot of Pocalla sand soil in North Carolina 216.3 days - Dickinson sandy loam - planted grass seed. Belleville, WI 340.5 days - bare ground plot of Pocalla sand soil in North Carolina 349.4 days - Lakeland sand soil planted in peanuts near Tifton, GA 857 days - sandy loam soil planted w/ grape seedlings Watsonville, CA. -Parent mostly detected in the 6- to 12-inch depths - less frequently detected in 12- to 24-inch depths.	MRID #s 44108309 44108310 44108311 44108312 44108313 44108314 44108315 44108316

Fate Parameters for Tebuconazole		
Molecular Weight	308	Product Chemistry
Solubility	320	Product Chemistry
Vapor Pressure	9.8E-9	Product Chemistry
Henry's Constant	1.24E-10	Calculated
Soil Photolysis	192.5 days. Tebuconazole photodegraded slowly on sandy loam soil (half-life=192.5 days when applied at a concentrations of 0.56 lb/A and exposed to sunlight with temperatures ranging from approximately 16 to 27°C.	MRID # 40700958
Aqueous Photolysis	590 days . Tebuconazole in sterile pH 7 buffered solution is relatively stable (calculated half-life=590 days) to photodegradation by sunlight.	MRID # 40700958

III. Water resources Summary

A. Surface Water

1) Ecological exposure

For the proposed uses of tebuconazole , exposure concentrations for aquatic organisms were estimated using Tier 1 modeling (GENEEC) on a selection of crops which were felt to be representative of the range of potential exposure scenarios. The model uses the soil/water partition coefficient and degradation half-life values to estimate runoff from a ten hectare field into a one hectare by two meter deep pond. The output parameters for GENEEC (Version 2.1, May 3, 1995) are listed in the table below. Input parameters are listed in Appendix IV.

GENEEC EECs (µg/L) for Tebuconazole at Selected Rates and Scenarios							
Crop	Application Method	Application Rate (lbs. ai/acre)	Number of Applications	Application Interval (days)	GENEEC Peak EEC (µg/l)	GENEEC 21 Day EEC (µg/l)	GENEEC 56 Day EEC (µg/l)
wheat	aerial	0.113	1	NA	1.75	1.52	1.27
nut tree	aerial	0.14	6	7	12.94	11.22	9.39
hops	ground	0.113	8	10	12.23	10.60	8.9
turf	ground	0.110	7	14	11.66	10.11	8.46
turf	ground	1.40	3	14	57.83	50.1	42.0

Estimated peak surface water concentrations of tebuconazole are not likely to exceed 13 µg/L for aerial applications and 12 µg/L for ground applications reflective of the majority of proposed uses. The average 56 day (chronic) concentration of tebuconazole in surface water is not likely

to exceed 9.5 µg/L for aerial applications and 9.0 µg/L for ground applications. Turf use at the higher rate would generate considerably higher values with an EEC range of 42 to 58 ppb.

(2)Drinking Water Concentration Estimates

Tier II Modeling with Crop Area Factor and Index Reservoir
Although the proposed use of tebuconazole on turf represents the highest annual use rate at 2.0 lbs ai/acre, lack of a Tier II scenario for turf prevented the Agency from performing the drinking water assessment on turf. Therefore, the registered use of tebuconazole on cherries, peaches, and nectarines which represents the second highest annual use rate of 1.35 lbs ai/acre was chosen for performing the drinking water assessment. Tier II PRZM-EXAM modeling using the index reservoir (IR) scenario and the percent crop area (PCA) adjustment factor for the use of tebuconazole on cherries with an application rate of 0.225 lbs ai/acre, six applications at 7 day intervals was modeled.

Based on the modeled results, the 1 in 10 year annual peak (acute) concentration of tebuconazole in drinking water is not expected to exceed **38.7** µg /L using a Wisconsin cherries index reservoir scenario adjusted for a default PCA factor of 0.87. The 1 in 10 year annual mean (chronic) concentration of tebuconazole in drinking water from this scenario is not expected to exceed **23.1** µg /L. However, since the cherry scenario does not represent the highest proposed labeled use rate for tebuconazole, EFED cannot be certain that these numbers represent the most conservative values.

3) Monitoring

There are no surface water monitoring data readily available for tebuconazole. Tebuconazole was not analyzed under the National Water-Quality Assessment Program of the U.S. Geological Survey.

B. Ground Water
There are no ground water monitoring data readily available for tebuconazole. Tebuconazole was not listed in the 1992 *Pesticides in Ground Water Database*, U.S. EPA/EFED/EFGWB, and was not included in the National Pesticide Survey, USEPA 1990. Therefore, the SCI-GROW screening model was used to estimate ground water concentrations. The model estimates upper-bound ground water concentrations of pesticides likely to occur when the pesticide is used at the maximum allowable rate in areas where ground water is vulnerable to contamination. The SCI-GROW model input parameters are located in the appendices.

The SCI-GROW model estimated the concentration of tebuconazole in drinking water from shallow ground water sources to be ***0.072*** µg/L. This concentration can be considered as both the acute and chronic value.

IV. Aquatic Organisms Risk Assessment

For aquatic organism exposure numbers the Tier II drinking water values were not used as the application rates on cherries is higher than those proposed for wheat, hops, cucurbits, tree nuts, sunflowers, and turnips. Tier II turf modeling could not be performed as there is no present PRZM EXAMS modeling program for this use. Tier I GENEEC predicted numbers were used first to determine the need for further modeling. The proposed new uses (other than turf) did not require further refinement.

In terms of acute toxicity tebuconazole is moderately toxic to both cold-water and warm-water organisms and highly toxic to estuarine/marine organisms. The risk quotients estimated for the proposed uses of tebuconazole do not exceed present safety levels for aquatic organism for the lower proposed application rates (≤0.225 lb ai/A).

Chronic and endangered species concern levels are exceeded by the high application rate on turf of 1.4 lbs ai/A (also for cherries, peaches and nectarines under Tier II). Some concern is also expressed for chronic effects to fish (marine and freshwater) and marine invertebrates for other crop uses adjacent to shallow habitats which are smaller than those used in standard model scenarios. However, it is not certain that 12 ppb no effect levels observed in fish early life stage testing will be reached under such circumstances. Fish full life cycle testing has not been conducted for this chemical and resulting effect levels may prove lower than early life stage test results presently indicate.

AQUATIC ORGANISMS Predicted Risk Quotients from multiple applications

Crops	GENEEC estimates in ppb	Toxicity Values in ppb			
Selected Scenarios	**Day 0 Day 21 Day 56**	**Freshwater Fish** 96 HR LC50 = 4400 83D NOEC =12	**Freshwater Invert.** 48 HR EC50= 4000 21D NOEC =120	**Marine Fish** 96 HR LC50= 5900 36 D NOEC= 22	**Marine Invert.** LC50= 490 28 D NOEC 35
Wheat 1 x 0.113 aerial	1.75 1.52 1.27	Acute RQ= <0.001 Chronic RQ =0.10	Acute RQ= <0.001 Chronic RQ = 0.013	Acute RQ= <0.001 Chronic RQ = 0.08	Acute RQ =0.004 Chronic RQ = 0.04
Almond 0.14 x 6 aerial 7 day interval	12.94 11.22 9.39	Acute RQ= 0.003 Chronic RQ=0.80	Acute RQ = 0.003 Chronic RQ = 0.09	Acute RQ = 0.002 Chronic RQ = 0.42	Acute RQ= 0.02 Chronic RQ = 0. 36
Hops 0.113 x 8 ground 10 day interval	12.23 10.60 8.9	Acute RQ= 0.003 Chronic RQ=0.79	Acute RQ = 0.003 Chronic RQ = 0.09	Acute RQ = 0.002 Chronic RQ = 0.40	Acute RQ= 0.02 Chronic RQ = 0.34
Turf 0.11 x 7 aerial 14 day interval	11.66 10.11 8.46	Acute RQ = 0.003 Chronic RQ = 0.68	Acute RQ = 0.003 Chronic RQ = 0.08	Acute RQ =< 0.002 Chronic RQ = 0.38	Acute RQ = 0.02 Chronic RQ = 0.34
Turf 3 x 1.4 ground 14 day interval	57.83 50.1 42.0	Acute RQ= 0.013 Chronic RQ = 3.4	Acute RQ = 0.014 Chronic RQ = 0.42	Acute RQ = 0.01 Chronic RQ = 1.9	Acute RQ= 0.12 Chronic RQ = 1.4

Aquatic Plant Risk Quotients For Tebuconazole Proposed Usage.
Based on the predicted environmental concentrations for surface water and toxicity to the pondweed, *Lemna gibba* risk quotients are calculated below. Based on this limited toxicity data the LOCs-(Levels of Concern) for aquatic plants would not be exceeded.

AQUATIC PLANTS Predicted Risk Quotients from multiple applications		
PRZM3/EXAM II	All EEC estimates in ppb - RQ s assuming EC50 toxicity value of 151 ppb	
Wheat - 1 x 0.113 aerial	1.75	Acute RQ = 0.01
Almond - 0.14 x 6 - aerial-7 day interval	12.94	Acute RQ = 0.09
Hops - 0.113 x 8- ground -10 day interval	12.23	Acute RQ = 0.08
Turf - 0.11 x 7- aerial - 14 day interval	11.66	Acute RQ = 0.08
Turf - 3 x 1.4 - ground - 14 day interval	57.8	Acute RQ = 0.4

V. Terrestrial Animal Risk Assessment

Terrestrial Exposure Assessment

Terrestrial exposure was evaluated using estimated environmental concentrations generated from a spreadsheet-based model that calculates the decay of a chemical applied to foliar surfaces for single or multiple applications. Input assumption for the model are presented in the table below along with toxicity and residue concentrations used in calculating the risk quotients for acute and chronic toxicity to birds.

Estimated environmental concentrations on avian and mammalian food items (ppm)

Input Parameter	wheat/ aerial	sunflower/ aerial	almond /aerial	hops/ aerial	turf /ground
Application Rate	0.113	0.225	0.14	0.113	1.4
Number of Applications	1	2	6	8	3
Application Interval (days)	NA	14	7	10	14
Foliar Dissipation Half Life	30	30	30	30	30
EECs Short grass = SG Tall grass = TG Broadleaf plants and small insects = BI Fruits, pods, seeds, and large insects = FS	SG=27 TG =14 BI= 15 FS= 0.8	SG= 94 TG =49 BI= 53 FS= 1.5	SG=140 TG=64 BI=79 FS=8.7	SG=110 TG=51 BI=62 FS=7	SG=755 TG=346 BI=424 FS=47

[1]Foliar dissipation half life set at 35 days based on fate data indications of persistence

Vegetation/insect residues following a single application at 1 lb. ai/A are based on work by Hoerger and Kenaga, 1972, as modified by Fletcher *et al.*, 1994. Further explanation of the model is presented in Appendices.

Uncertainties in the terrestrial EECs are primarily associated with a lack of data on interception and subsequent dissipation from foliar surfaces. EFED assumes the foliar dissipation rate is based on a number of routes which include photolysis, hydrolysis and volatilization. In the case of tebuconazole, however, photolysis and hydrolysis would not appear to be an important routes of dissipation. It could also include uptake in plants as well as wash off. Given the persistence of tebuconazole and its resistance to photolysis, hydrolysis and volatilization, a half- life of 30 days has been assumed.

TERRESTRIAL RISK ASSESSMENT

Risk quotients were calculated for terrestrial organisms following the procedure outlined in **Appendix** . Acute levels of concern for the Restricted Use and Endangered Species were not exceeded for mammalian species at rates below 0.15 lb ai/A. However chronic risk levels for mammals were exceeded at 1.4 lb ai/A applications on turf.

The chronic risk levels of concern for birds feeding on vegetation and insects were exceeded for multi applications at maximum labeled rates and maximum permitted seasonal application numbers for several proposed crop uses. Turf use at a 1.4 lb ai/A rate would also exceed LOCs from a single application. In cases where acute and chronic toxicity data failed to establish definitive endpoints for terrestrial organisms, RQ values were based on the highest concentration tested in the respective acute and chronic toxicity tests. Estimated environmental concentrations (EECs) were based on the maximum proposed application rates and numbers of applications for tebuconazole as proposed for the new uses examined in this review.

Herbivorous/Insectivorous Mammals- Single Application RQs Acute and Chronic Rat LD_{50} (unfasted)>4264 (F)/3352 mg/kg(M) 2 generation reproductive study NOEL=300			
Acute risk is ≥0.5 Restricted use risk is ≥0.2 Endangered species risk is ≥0.1 Chronic risk is ≥1.0	**Single/Multi Application EEC in ppm**	Mammals @ estimated rat LC50 = 67,000 ppm	NOEL=300ppm
Crop Scenario	**Short grass = SG Tall grass = TG BI= Broadleaf plants small insects**	**Acute RQ range**	**Chronic**
Wheat 1 x 0.113 aerial	SG=27 / NA TG =14 / NA BI= 15 / NA	< 0.001	0.05 to 0.09
Sunflower 0.225 x 2 aerial 14 day interval	SG= 54/94 TG = 28/49 BI= 30/53	< 0.001	0.07 to 0.13
Almond 0.14 x 6 aerial 7 day interval	SG=34 / 140 TG=17 / 64 BI= 19 / 79	single < 0.001 multi < 0.002	0.26 to 0.47

Herbivorous/Insectivorous Mammals- Single Application RQs Acute and Chronic Rat LD_{50} (unfasted)>4264 (F)/3352 mg/kg(M) 2 generation reproductive study NOEL=300			
Acute risk is ≥0.5 Restricted use risk is ≥0.2 Endangered species risk is ≥0.1 Chronic risk is ≥1.0	**Single/Multi Application EEC in ppm**	Mammals @ estimated rat LC50 = 67,000 ppm	NOEL=300ppm
Hops 0.113 x 8 ground 10 day interval	SG=27 / 110 TG=14 / 51 BI=15 / 62	single < 0.001 multi < 0.002	0.2 to 0.36
Turf 0.11 x 7 aerial 14 day interval	similar to hops above	similar to hops above	similar to hops above
Turf 3 x 1.4 ground 14 day interval	SG=336 / 755 TG= 175 / 346 BI= 189 / 424	single < 0.005 multi < 0.011	0.63 to 1.12 single 1.4 to 2.5 multi

[1]Foliar dissipation half life set at 30 days based on fate data indications of persistence
Short grass =SG Tall grass = TG Broadleaf plants and small insects = BI

Acute risk is ≥0.5 Restricted use risk is ≥0.2 Endangered species risk is ≥0.1 Chronic risk is ≥1.0
Acute RQ = EEC / LD50 / function body-weigh consumed daily

Acute and chronic risk quotients for birds following exposure to tebuconazole applied at the proposed maximum application rates for wheat, almonds, hops, sunflowers and turf				
Acute risk is ≥0.5 Restricted use risk is ≥0.2 Endangered species risk is ≥0.1 Chronic risk is ≥1.0	**Single/Multi Application**	**Mallard duck LC50 = >4816 ppm**		**Bobwhite quail NOAEL=75.8 (28WKS) LOAEL < 158 ppm**
Crop Scenario	**Residues in ppm**	**Acute RQ - single**	**Acute RQ-multi appl. range**	**Chronic RQ Range**
Wheat 1 x 0.113 aerial	SG = 27 / NA TG = 14 / NA BI = 15 / NA	<0.005	NA	0.2 to 0.36
Sunflower 0.225 x 2 aerial 14 day interval	SG= 54 / 94 TG = 28 / 49 BI= 30 / 53	< 0.02	0.01 to 0.02	0.4 to 1.25
Almond 0.14 x 6 aerial 7 day interval	SG = 34 / 140 TG = 17 / 64 BI = 19 / 79	<0.007	0.016 to 0.03	0.2 to 0.4 single applic. 1.0 to 1.9 mult-applic.
Hops 0.113 x 8 ground 10 day interval	SG = 27 / 110 TG = 14 / 51 BI=15 / 62	< 0 005	0.012 to 0.02	0.2 to 0.4 single applic 0.8 to 1.3 multi applic.
Turf 0.11 x 7 aerial 14 day interval	similar to hops above	similar to hops above	similar to hops above	similar to hops above

Acute and chronic risk quotients for birds following exposure to tebuconazole applied at the proposed maximum application rates for wheat, almonds, hops, sunflowers and turf				
Acute risk is ≥0.5 Restricted use risk is ≥0.2 Endangered species risk is ≥0.1 Chronic risk is ≥1.0	**Single/Multi Application**	**Mallard duck LC50 = >4816 ppm**		**Bobwhite quail NOAEL=75.8 (28WKS) LOAEL < 158 ppm**
Turf 3 x 1.4 ground 14 day interval	SG=336 / 755 TG= 175 / 346 BI= 189 / 424	< 0.07	0.09 to 0.16	2.5 to 0.5 single applic. 5.6 to 10.0 multi applic.

[1]Foliar dissipation half life set at 30 days based on fate data indications of persistence
Short grass =SG Tall grass = TG Broadleaf plants and small insects = BI

Terrestrial Risk Conclusions

Chronic risk quotients calculated from estimated exposure to tebuconazole at the proposed application rates indicate that proposed multi-application label uses will exceed chronic risk concern levels for avian species. Eggshell cracking and effects on hatchling weight were observed at 158 ppm(NOEL= 75 ppm) in chronic studies. Other chronic effects were observed in studies with bobwhite quail as well at 158 ppm and 290 ppm residue levels (NOEL = 75 ppm). Corresponding application scenarios that might equate to the 75 ppm levels could include single applications at over 0.3 lb ai/acre or multiple applications at rates equal to or above 0.11 lb ai/acre (3 applications or more). Acute LOCs were not exceeded for avian species for wheat, sunflowers, hops, or almonds. Acute risk quotients for endangered avian species (such as geese) which feed heavily in turf may be exceeded at the highest proposed rate and chronic effect concern levels for endangered birds are exceeded for several multi-application scenarios. Strictly granivorous birds are not expected to be affected as residues on seeds would be low for most uses and turf use at the higher rate does not produce seed residues of over 75 ppm. This is particularly important for sunflower crop use which is highly attractive to a number of songbird species.

Acute risk to mammals is not indicated by calculated risk quotients. Potential for chronic effects is predicted for small high metabolism herbivorous/insectivorous mammals at the highest rates of application for turf (1.4 lb ai/A). Strictly granivorous mammals are not expected to be affected as residues on seeds would be low for most uses and turf use at the higher rate does not produce seed residues of over 75 ppm.

Hazard to Non-Target Insects

Based on LC_{50} value of 176 μg /bee (Reported in Bayer Report No. 99753, 1987) it can be concluded that there should be no acute risks to non-target insects from tebuconazole, though they are expected to receive exposure from the proposed uses.

Hazard To Terrestrial Plants

Since the terrestrial plant data are not available for tebuconazole, EFED can not make any predictions concerning potential risk to terrestrial plant species.

Recommended Label Restrictions

The present product label does not indicate that tebuconazole is toxic to freshwater fish. The label only indicates that it is toxic to estuarine and marine invertebrates.. Tebuconazole exhibits chronic toxicity to freshwater fish which should be reflected in the environmental hazard statement on the Elite 45 DF label as well as any other products containing tebuconazole. Though other portions of the hazard statement appear appropriate according to current policy, they will not be protective to birds exposed chronically and sensitive during reproductive periods. Presently guidance for labels do not reflect potential for chronic exposure to terrestrial or aquatic organisms.

The present Elite 45 DF foliar fungicide (EPA Reg. No. 3125-388) label states the following:

> **Environmental Hazards:**
> This pesticide is toxic to estuarine and marine invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwater or rinsate.

VI. Integrated Environmental Risk Characterization

A large portion of the potential exposure area in the U.S. from the new proposed uses is from wheat use. The single application use on wheat does not trigger ecological risk concerns. Sunflower, tree nuts, turf, hops and curcurbit uses present the highest potential wildlife exposure acreage where chronic effects to birds are predicted to occur if the maximum treatments and application rates are employed. However, chronic levels for birds are unlikely to be reached until the 3rd application at the lower rates, after which time subsequent application residues would continue to increase and potentially persist on soils for over 1 year. Turf use at the highest rate triggers both chronic avian and non-target small mammal concerns. Banana and turnip or turnip green uses may exceed avian chronic concern levels with multiple applications, but the total U.S. acreage is less than 13,000 acres. The persistence of tebuconazole on soils and vegetation will make residues available for long periods of time to non-target terrestrial species. Should low rainfall conditions exist foliar washoff will not aid significantly in removal from vegetation surfaces. Hydrolysis and photolysis also appear unlikely to contribute significantly to terrestrial dissipation from food sources.

Persistence in aqueous environments is expected and moderate sorption to sediments appears likely. EEC levels expected for wheat and most of the proposed IR4 uses are not expected to lead to acute or chronic hazard for aquatic invertebrates or fish. Turf use at 1.4 lbs ai/A may lead to predicted EECs which exceed freshwater fish, marine fish and marine invertebrate chronic effect levels under label permitted scenarios. On the other hand, the uncertainty of exposure predictions for an estuarine environment from Tier I screen modeling is a factor which must also be considered when looking at the exposure potential for estuarine species risk. Though chronic

hazards to these groups should be considered for uses on commercial turf such as golf courses when located adjacent to estuarine or freshwater habitats, they should also be further refined when new Tier II modeling procedures are developed for turf uses.

Tebuconazole does not appear likely to leach appreciably to groundwater based drinking water sources. Concentrations, based on Tier II modeling results, are not expected to exceed 38 ppb for acute and 23 ppb for chronic exposure in drinking water drawn from surface water sources. These estimated levels must be conditioned with the fact that Tier II modeling scenarios for turf use are not presently available. This use pattern has a higher rate than the 1.35 lb ai/A used for drinking water analysis.

X. References

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2. Effland, W., N. Thurman, I. Kennedy, and S. Abel. 1999. " *Proposed Methods for Determining Watershed-derived Percent Crop Areas and Considerations for Applying Crop Area Adjustments to Surface Water Screening Models*, presented to the FIFRA Science Advisory Panel, March 1999. http://www.epa.gov/pesticides/SAP/1999/pca_sap.pdf

3. Jones, R.D., S.W. Abel, W. Effland, R. Matzner, and R. Parker. 1998. "An Index Reservoir for Use in Assessing Drinking Water Exposures. Chapter IV in *Proposed Methods for Basin-Scale Estimation of Pesticide Concentrations in Flowing Water and Reservoirs for Tolerance Reassessment.*, presented to the FIFRA Science Advisory Panel, July 1998. http://www.epa.gov/pesticides/SAP/1998/index.htm

Appendix I

Aquatic Organism Toxicity Data

Common Name	% ai	Acute Toxicity (mg/L)	Chronic NOEC (mg/L)	MRID #
Green algae, *Selenastrum capricornutum*	95.8	5 Day EC50=2.73		42905401
Green algae, *Scendesmus subspicatus*	97.5	4 day EC50 =1.45		0995908
Duckweed, *Lemna gibba*	96.7	14 day EC50=0.151	0.034	44246901
Water flea, *Daphnia magna*	96.3	48 Hr. EC50 =4.0		40700913
Water flea, *Daphnia magna*	96.3	21 day LOEC=0.23	0.12	40700915
Mysid, *Mysidopsis bahia*	96.3	96 hr. LC50 = 0.49		40995902
Mysid , *Mysidopsis bahia*	97.5	28 D LOEC 0.061	0.035	42038201
Rainbow trout, *Oncorhynchus mykiss*	96.3	96 HR LC50 4.4		40700911
Rainbow trout, *Oncorhynchus mykiss*	96.3	83D LOEC 0.025	0.012	40700914
Sheepshead minnow, *Cyprinodon variegatus*	96.3	96 HR LC50 5.9	<1.2	40995904
Sheepshead minnow, *Cyprinodon variegatus*	96.4	36 D LOEC 0.047	0.022	42038202
Sheepshead minnow, *Cyprinodon variegatus*	96.4	203 Day LOEC=0.043	0.019	43009601
Eastern oyster, *Crassostrea virginica*	96.3	96 Hr. EC50=2.7		40995903

Table 6. Terrestrial Wildlife Toxicity Data

Common Name	% ai	LD_{50} and LOEL in ppm	MRID #
Rat - oral acute	97.1 tech	LD_{50}(fasted)>5000(F)/3933mg/kg(M) (unfasted)>4264 (F)/3352 mg/kg(M)	40700917
Rat (Wistar)	95.2	2 generation reproductive study with dose 1, 100, 300, & 1000 ppm for 2 generation NOEL=300	40700946
Bobwhite quail	96.3	8 D LC50>5000 ppm NOEL< 325 ppm	40700908
Mallard duck	96.3	8 D LC50 >4816 ppm NOEL<4816 ppm	40700907
Bobwhite quail	97	28WK avian reproduction LOEL <156 NOEL=73 ppm	41624201
Mallard Duck	97.4	28WK avian reproductive study LOEC<156 NOEL=75.8 ppm	40700909

Terrestrial Residue Concentration Estimates Based on Kenaga/Fletcher

RUN No. 1 FOR Tebuconazole ON Hops *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	HALF-LIFE (DAYS)	AVERAGING PERIOD (DAYS)
.113(.461)	8 10	30.0	80

MAX & 80 DAY AVERAGE KENAGA/FLETCHER RESIDUES:95Th% (MEAN) in PPM

SHORT GRASS MAXIMUM		BROADLEAF & INSECT MAXIMUM		TALL GRASS MAXIMUM		SEED FRUIT MAXIMUM	
110.76	39.23	62.30	20.77	50.76	16.61	6.92	3.23

AVERAGE		AVERAGE		AVERAGE		AVERAGE	
70.63(	25.01)	39.73(	13.24)	32.37(	10.59)	4.41(	2.06)

RUN No. 2 FOR Tebuconazole ON Turf *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	HALF-LIFE (DAYS)	AVERAGING PERIOD (DAYS)
1.400(3.146)	3 14	30.0	45

MAX & 45 DAY AVERAGE KENAGA/FLETCHER RESIDUES:95Th% (MEAN) in PPM

SHORT GRASS MAXIMUM		BROADLEAF & INSECT MAXIMUM		TALL GRASS MAXIMUM		SEED FRUIT MAXIMUM	
755.09	267.43	424.74	141.58	346.08	113.26	47.19	22.02

AVERAGE		AVERAGE		AVERAGE		AVERAGE	
484.71(	171.67)	272.65(	90.88)	222.16(	72.71)	30.29(	14.14)

RUN No. 3 FOR Tebuconazole ON Almond *INPUT VALUES*

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	HALF-LIFE (DAYS)	AVERAGING PERIOD (DAYS)
.140(.582)	6 7	30.0	45

MAX & 45 DAY AVERAGE KENAGA/FLETCHER RESIDUES:95Th % (MEAN) in PPM

SHORT GRASS MAXIMUM		BROADLEAF & INSECT MAXIMUM		TALL GRASS MAXIMUM		SEED FRUIT MAXIMUM	
139.74	49.49	78.60	26.20	64.05	20.96	8.73	4.08

AVERAGE		AVERAGE		AVERAGE		AVERAGE	
88.23(	31.25)	49.63(	16.54)	40.44(	13.24)	5.51(	2.57)

SHORT GRASS MAXIMUM		BROADLEAF & INSECT MAXIMUM		TALL GRASS MAXIMUM		SEED FRUIT MAXIMUM	
139.74	49.49	78.60	26.20	64.05	20.96	8.73	4.08
AVERAGE		AVERAGE		AVERAGE		AVERAGE	
88.23(	31.25)	49.63(	16.54)	40.44(	13.24)	5.51(	2.57)

Appendix III. Environmental Fate Summary

Hydrolysis (MRID 40700957, EBC;06/09/89-Acceptable)
Tebuconcazole labeled in the phenyl ring was stable to hydrolysis in pH 5, 7, and 9 buffered solutions. Parent, which was the only residue discernible, remained at 100% of applied radioactivity in all pH buffered solutions during the testing period. The study was preformed using a tebuconazole concentration of 18 mg/L. All treated test solutions were incubated at 25°C for 28 days.

The material balances ranged from 97.3 to 106.9% of applied radioactivity during the testing period.

Aqueous Photolysis (MRID 40700958, EBC;06/09/89-Acceptable)
Tebuconazole in sterile pH 7 buffered solution is relatively stable (calculated half-life=590 days) to photodegradation by sunlight. The incubation temperature for the light exposed and dark control solutions ranged from approximately 22 to 32°C. In both the light exposed and dark controls, parent tebuconazole remained at 95% of applied radioactivity during the 30 day testing period and was the only discernible residue in the test samples during the duration of the testing period.

The material balances ranged from 100% at initiation of study to 94 to 97% of applied radioactivity at all other sampling intervals.

Soil Photolysis (MRID 40700958, EBC;06/09/89-Acceptable)
Tebuconazole photodegraded slowly on sandy loam soil (half-life=192.5 days when applied at a concentrations of 0.56 lb/A and exposed to sunlight with temperatures ranging from approximately 16 to 27°C. Dark control soil samples where incubated under similar conditions. After 35 days of light exposure, tebuconazole comprised 86% of the applied radioactivity, two unidentified (nonvolatile) degradates each comprised ≤3%, and unextractable radioactivity comprised 5.5%. There were no radioactive volatiles detected. In the dark control samples, parent tebuconazole remained at approximately 100% of applied radioactivity during the 35 day testing period.

The material balances ranged from 94.5 to 103.6% and 98.7 to 101.7% of the applied radioactivity for the light exposed soil samples and for the dark control soil samples, respectively.

Aerobic Soil Metabolism (MRID 40700959, EBC;06/09/89 -Acceptable after reevaluation (ECB;10/09/91) The triazole-labeled portion was variable and determined to not be acceptable (ECB;06/09/89)
When applied to sandy loam soil and incubated at 23°C, chlorophenyl labeled tebuconazole degraded with a half-life of 796 days. At termination of study (1 year post treatment)),

tebuconazole comprised 67.4% of the recovered radioactivity, unidentified extractable radioactive residues comprised 2.1% of recovered radioactivity, extractable polar compounds (residues remaining at the origin) comprised 1.1% of recovered radioactivity, and unextractable radioactivity residues comprised 29.1% of recovered radioactivity. In addition, during the testing period, radioactive CO_2 comprised ≤0.7% of applied radioactivity. Furthermore, at the termination of the study, the unextractable radioactivity were found to contain 12.1% humin, 9.9% humic acid, and 7.1% fulvic acid..

The same aerobic soil metabolism study was repeated using triazole labeled tebuconazole, but this study was terminated at 58 days. Tebuconazole increased from 86.8% of applied radioactivity at initiation of testing period to 91.6% of applied radioactivity at 30 days post treatment. Tebuconazole then decreased to 79.3% of applied radioactivity at 58 days post treatment. At 58 days post treatment, unextractable radioactivitiy residues were 13.5% of applied radioactivity. Analysis of the radioactive unextractable from the 58 day soil samples found 5.6% of applied radioactivity was in the humic acid fraction, 4.8% was in the humin fraction, and 3.2% was in the fulvic acid fraction. Radioactive CO_2 was not discernible in the trapping solutions during the testing period..

The aerobic soil metabolism average material balance for the chlorphenyl and triazole labeled tebuconazole were 94.4 ± 11.0% and 94.8 ± 7.1%, respectively.

Anaerobic Soil Metabolism (MRID 40700959, EBC;06/09/89-Acceptable)
Chlorphenyl-labeled tebuconazole degraded with a half-life of 1063 days in a sandy loam soil treated at 10 ppm and incubated anaerobically (flooding) at 23 ± 2°C in the dark for 60 days following 30 days of aerobic incubation. Tebuconazole comprised 74%, an unidentified degradate comprised 2.1%, and unextractable radioactivity residues comprised 18.5% of applied radioactivity. Analysis of the unextractable radioactive residues form the 60 day soil samples found 8.7% was in the humin acid fraction, 7.1% was in the humin fraction, and 2.7% was in the fulvic acid fraction. Acid hydrolysis of the unextractable radioactivity showed 76.7% of recovered radioactivity remained bound to the soil. No radioactive CO_2 was detected during the testing period.

The anaerobic soil metabolism average material balance was 97.7 ± 2.2%.

Leaching, Adsorption/Desorption
(MRID 40995922(EBC;08/22/90) -A batch equilibrium study fulfills the data requirement on the mobility of unaged tebuconazole in silt, sand, and two sandy loam soils.
MRID 40700960(EBC;06/09/89) -A column leaching study fulfills the data requirement on the mobility of aged tebuconazole in sand, sandy loam, silt loam, and silty clay loam soils.
MRID 40700961 is unacceptable for several reasons.

Phenyl-labeled tebuconazole, at equilibrium concentrations of 16.0, 11.0, 7.4, and 1.5 mg/L, was determined to be relatively immobile in silt, sand, and two sandy loam soils when equilibrated in

the dark for 48 hours at 20 ± 1°C. K_{ads} values were 7.69 mL/g for the sand soil (organic carbon content 0.75%), 16.39 mL/g for the silt soil (organic carbon content 1.8%), and 15.89 and 12.69 mL/g for the two sandy loam soils (organic carbon content 1.3 and 1.4%); respective K_{oc} values were 1025, 911, 1251, and 906 mL/g. The adsorption 1/n values for all soils ranged from 0.71 to 0.74. Correlation analysis (SAS Institute, Cary, NC, 1999) revealed no significant ($p>0.05$) correlation with organic carbon, pH, CEC, clay, and silt.

Desorption coefficients (K_{des}) were 11.83 mL/g for the sand soil, 22.27 mL/g for the silt soil, and 23.76 and 18.27 mL/g for the two sandy loam soils; respective K_{oc} values were 1577, 1237, 1871, and 1341 mL/g. The desorption 1/n values were 0.77 to 0.83.

The material balance ranged from 96 to 104% recovery of applied radioactivity.

MRID 40700960 (EBC;06/09/89);A column leaching study fulfills the data requirement on the mobility of aged tebuconazole in sand, sandy loam, silt loam, and silty clay loam soils.

MRID 40700961 (EBC;06/09/89) is unacceptable for several reasons.
The column leaching study indicated that the main residue was parent and that the radioactive tebuconazole residues were immobile. The majority of the radioactivity (71.0 to 128.2% of applied radioactivity) remained in the upper 6 cm of soil column. At termination of the column leaching study, tebuconazole comprised 69.2 to 110% of applied, unextractable radioactive residues were 11.2 to 21.1% of applied, and ≤6.1% of applied radioactivity was unidentified. tebuconazole residues.

Field Dissipation Studies for Tebuconazole
Guideline # (164-1)
The registrant conducted a number of field dissipation studies using different formulations of tebuconazole, different types of soil, and different application rates for different crops. The registrant-calculated half-lives were: 100.4 days on sand soil planted with Bermuda grass near Rowland, NC, 163.2 days on a turf plot of Dickinson sandy loam soil near Belleville, WI, 177 days on a plot of sandy loam soil planted with grape seedlings near Fresno, CA, 178.8 days on a peanut plot of Pocalla sand soil in North Carolina, 216.3 days on a plot of Dickinson sandy loam soil planted with grass seed near Belleville, WI, 340.5 days on a bare ground plot of Pocalla sand soil in North Carolina, 349.4 days on a plot of Lakeland sand soil planted with peanuts near Tifton, GA, and 857 days on sandy loam soil planted with grape seedlings near Watsonville, CA. The parent was mostly detected in the 6- to 12-inch depths and less frequently detected in 12- to 24-inch depths. In two studies where samples were analyzed for tebuconazole degradates (MRID 44108315 and 44108316), the degradate 1,2,4-triazole was detected at concentrations ≤0.02 μg/g.

Study 1 (MRID # 44108309)
Half-life of 100.4 days sand soil planted with Bermuda grass near Rowland, NC.
The parent was detected in the 3- to 6-inch depth at 0.01-0.05 μg/g from 1 to 119 days posttreatment. The parent was detected only once in the 6- to 12-inch depth, at 0.01 μg/g (90 days posttreatment), and was not detected in the 12- to 18-inch depth. Soil samples were not analyzed for degradates of tebuconazole. Grass samples were not analyzed for degradates of tebuconazole.

Study 2 (MRID # 44108310)
Half-life of 349.4 days on a plot of Lakeland sand soil planted with peanuts near Tifton, GA.
The parent was present in the 0- to 6-inch depth and was only detected once in the 6- to 12-inch depth. Soil samples were not analyzed for degradates of tebuconazole. Peanut plants were not analyzed for the parent or degradates.

Study 3 (MRID # 44108311)
Half-life of 178.8 days on a peanut plot of Pocalla sand soil in North Carolina.
The parent compound was present in the 0- to 6-inch depth and was also detected in the 6- to 12-inch depth. The parent compound was not detected below the 6- to 12-inch soil depth. No degradates were identified from the soil. Peanut plants were not analyzed for the parent or degradates.

Study 4 (MRID # 44108312)
Half-life of 340.5 days on a bareground plot of Pocalla sand soil in North Carolina.
The parent compound was present in the 0- to 6-inch depth and was also detected in the 6- to 12-inch depth. The parent compound was not detected below the 6- to 12-inch soil depth. No degradates were identified from the soil.

Study 5 (MRID # 44108313)
Half-life of 177 days a plot of sandy loam soil planted with grape seedlings near Fresno, CA.
The parent was present in the 0- to 6-inch depth and was also detected in the 6- to 12-inch depth. The parent compound was detected in the 12- to 24-inch depth at $\leq$ 0.06 μg/g and was not detected below that depth. No degradates were identified from the soil. Grape seedlings were not analyzed for the parent or degradates.

Study 6 (MR ID 44108314)
Half-life of 857 days onto a plot of sandy loam soil (planted with grape seedlings) near Watsonville, CA. The parent compound was present in the 0- to 6-inch depth and was also detected in the 6- to 12-inch depth. The parent compound was detected in the 12- to 24-inch depth at $\leq$ 0.06 μg/g and was not detected below that depth. No degradates were identified from the soil. Grape seedlings or weeds were not analyzed for the parent or degradates.

Study 7 (MRID 44108315)
Half-life of 163.2 days on a turf plot of Dickinson sandy loam soil near Belleville, WI..

the parent was present in the 0- to 3-inch, 3- to 6-inch, 6- to 12-inch, and 12- to 18-inch soil depths. The degradate 1,2,4-triazole was isolated from the soil. This degradate was detected sporadically in the 0- to 3-inch depth at ≤0.02 μg/g and was not detected below that depth.

Study 8 (MRID 44108316)

Half-life of 216.3 days onto a plot of Dickinson sandy loam soil planted with grass seed near Belleville, WI. The parent was present in the 0- to 6-inch depth and was also sporadically detected in the 6- to 12-inch, 12- to 18-inch, and 18- to 24-inch depths at ≤0.06 μg/g. T the parent was detected once in the 24- to 36-inch depth at 0.03 μg/g at 363 days posttreatment and was not detected below that depth. The degradate 1,2,4-triazole was isolated from the soil. This degradate was detected in the 0- to 6-inch depth, at ≤0.02 μg/g at 29 and 62 days posttreatment, and was not detected at any other sampling interval or depth.

Appendix IV

GENEEC Input Parameters for Tebuconazole Proposed Uses		
MODEL INPUT VARIABLE	**INPUT VALUE**	**SOURCE**
Application Rate	0.11 to 0.14 lb. a.i./acre for IR4 crops and 0.11 to 1.4 lb ai/A for turf use	Proposed Label (EPA Reg. No. 3125-394)
Maximum Number of Applications	1 for wheat 4 to 8 for IR4 crops 3 to 7 for turf	Proposed Label (EPA Reg. No. 3125-394)
Interval between Applications	7 to 14 days	Proposed Label (EPA Reg. No. 3125-394)
Soil Organic Carbon Partitioning Coefficient (K_{oc})	906 ml/g (min. value)	MRID 40995922
Aerobic Soil Metabolism	$t_{1/2}$=796 days	MRID 40700959
Water Solubility	32 mg/L @ 20°C	One-Liner
Aerobic Aquatic Metabolism	Assumed to be stable	Not submitted
pH 7 Hydrolysis	$t_{1/2}$=stable	MRID 40700957
Photolysis	$t_{1/2}$=stable (590 days)	MRID 40700958

PRZM/EXAMS INPUT PARAMETERS FOR Tebuconazole		
MODEL PARAMETER	VALUE	SOURCE
Application Rate	0.225 lb ai/acre	Label EPA Reg. # 3125-388
Number of Applications	6 applications	Label EPA Reg. # 3125-388
Interval Between Application	7 days	Label EPA Reg. # 3125-388
Aerobic Soil Metabolism $t_{1/2}$	796 days	MRID # 40700959
Anaerobic Soil Metabolism $t_{1/2}$	1063	MRID # 40700959
Organic Matter Partitioning Coefficient (K_d)	7.69	MRID # 40995922, 40700960
Molecular Weight	308	Product Chemistry
Solubility	320	Product Chemistry
Vapor Pressure	9.8E-9	Product Chemistry
Henry's Constant	1.24E-10	Calculated
Soil Photolysis	192.5 days	MRID # 40700958
Aqueous Photolysis $t_{1/2}$	590 days	MRID # 40700958

TABLE 2. IR/PCA TIER II CONCENTRATION OF TEBUCONAZOLE IN SURFACE WATER FROM SIX APPLICATIONS ON WISCONSIN CHERRIES

PEAK	96 HOUR	21 DAYS	60 days	90 DAYS	YEARLY
38.7 µg /L	38.4 µg /L	37.4 µg /L	35.7 µg /L	34.0 µg /L	23.1 µg /L

Table 4. SCI-GROW Input Parameters for Tebuconazole	
MODEL INPUT VARIABLE	**INPUT VALUES**
Koc	1023 ml/g
Application Rate	0.0.225 lb. a.i./acre
Number of Applications / Season	6
Aerobic Soil Metabolism Half-life	796 days
Hydrolysis	stable

Assumptions and Uncertainties

Index Reservoir

The index reservoir represents potential drinking water exposure from a specific area (Illinois) with specific cropping patterns, weather, soils, and other factors. Use of the index reservoir for areas with different climates, crops, pesticides used, sources of water (e.g. rivers instead of reservoirs, etc), and hydrogeology creates uncertainties. In general, because the index reservoir represents a fairly vulnerable watershed, the exposure estimated with the index reservoir will likely be higher than the actual exposure for most drinking water sources. However, the index reservoir is not a worst case scenario, communities that derive their drinking water from smaller bodies of water with minimal outflow, or with more runoff prone soils would likely get higher drinking water exposure than estimated using the index reservoir. Areas with a more humid climate that use a similar reservoir and cropping patterns may also get more pesticides in their drinking water than predicted using this scenario.

A single steady flow has been used to represent the flow through the reservoir. Discharge from the reservoir also removes chemical so this assumption will underestimate removal from the reservoir during wet periods and overestimates removal during dry periods. This assumption can both underestimate or overestimate the concentration in the pond depending upon the annual precipitation pattern at the site.

The index reservoir scenario uses the characteristics of a single soil to represent the soil in the basin. In fact, soils can vary substantially across even small areas, and this variation is not reflected in these simulations.

The index reservoir scenario does not consider tile drainage. Areas that are prone to substantial runoff are often tile drained. Tile drainage contributes additional water and in some cases, additional pesticide loading to the reservoir. This may cause either an increase or decrease in the pesticide concentration in the reservoir. Tile drainage also causes the surface soil to dry out faster. This will reduce runoff of the pesticide into the reservoir. The watershed used as the model for the

index reservoir (Shipman City Lake) does not have tile drainage in the cropped areas.

EXAMS is unable to easily model spring and fall turnover. Turnover occurs when the temperature drops in the fall and the thermal stratification of the reservoir is removed. Turnover occurs again in the spring when the reservoir warms up. This results in complete mixing of the chemical through the water column at these times. Because of this inability, the Index Reservoir has been simulated without stratification. There is data to suggest that Shipman City Lake, upon which the Index Reservoir is based, does indeed stratify in the deepest parts of the lake at least in some years. This may result in both over and underestimation of the concentration in drinking water depending upon the time of the year and the depth the drinking water intake is drawing from.

Percent Crop Area Correction Factor

The PCA is a watershed-based modification. Implicit in its application is the assumption that currently-used field-scale models reflect basin-scale processes consistently for all pesticides and uses. In other words, we assume that the large field simulated by the coupled PRZM and EXAMS models is a reasonable approximation of pesticide fate and transport within a watershed that contains a drinking water reservoir. If the models fail to capture pertinent basin-scale fate and transport processes consistently for all pesticides and all uses, the application of a factor that reduces the estimated concentrations predicted by modeling could, in some instances, result in inadvertently passing a chemical through the screen that may actually pose a risk. Some preliminary assessments made in the development of the PCA suggest that PRZM/EXAMS may not be realistically capturing basin-scale processes for all pesticides or for all uses. A preliminary survey of water assessments which compared screening model estimates to readily available monitoring data suggest uneven model results. In some instances, the screening model estimates are more than an order of magnitude greater than the highest concentrations reported in available monitoring data; in other instances, the model estimates are less than monitoring concentrations. Because of these concerns, the SAP recommended using the PCA only for "major" crops in the Midwest. For other crops, development of PCA's will depend on the availability of relevant monitoring data that could be used to evaluate the result of the PCA adjustment.

The spatial data used for the PCA came from readily-available sources and have a number of inherent limitations:

- The size of the 8-digit HUC [mean = 366,989 ha; range = 6.7-2,282,081 ha; n = 2,111] may not provide reasonable estimates of actual PCA's for smaller watersheds. The watersheds that drain into drinking water reservoirs are generally smaller than the 8-digit HUC and may be better represented by watersheds defined for drinking water intakes.
- The conversion of the county level data to watershed-based percent crop areas assumes the distribution of the crops within a county is uniform and homogeneous throughout the county area. Distance between the treated fields and the water body is not addressed.

- The PCA's in Table 1 were generated using data from the 1992 Census of Agriculture. However, recent changes in the agriculture sector from farm bill legislation may significantly impact the distribution of crops throughout the country. The methods described in this report can rapidly be updated as more current agricultural crops data are obtained. The assumption that yearly changes in cropping patterns will cause minimal impact needs to be evaluated.

The PCA adjustment is only applicable to pesticides applied to agricultural crops. Contributions to surface waters from non-agricultural uses such as urban environments are not well-modeled. Currently, non-agricultural uses are not included in the screening model assessments for drinking water.

The PCA does not consider percent crop treated because detailed pesticide usage data are extremely limited at this time. Detailed pesticide usage data are currently available for only a few states.