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

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT:	Fenamiphos Tier 2 EEC's		
	DP Barcode:	D229077	
	DP Type:	102 (phase V review)	
	PC Code:	100601	
	Registration Numbers:	3125-236	3125-237
		3125-269	3125-283
		3125-333	

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Summary

This report describes the Tier II estimated environmental concentrations (EECs) for fenamiphos, ethyl-3-methyl-4-(methylthio)phenyl-1-methylethyl) phosphoramidate (Figure 1) as applied to the five crops: cotton, grapes peaches, peanuts, and tobacco. A tier 2 EEC for turf was also requested, but the Surface Water Section does not have confidence that the tools currently available adequately simulate pesticide fate on turf, so an EEC was not calculated for this crop. The purpose of this analysis is to generate aquatic exposure estimates for use in improving the ecological risk assessment for fenamiphos as part of the reregistration process.

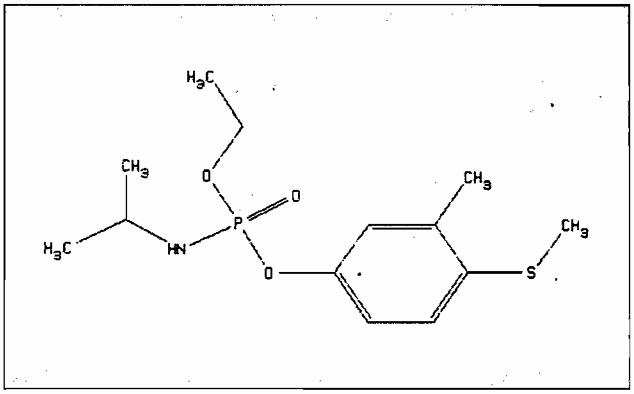

Figure 1. Molecular structure of fenamiphos.

A Tier II EEC uses a single site which represents a high exposure scenario for the use of the pesticide on a particular crop or non-crop use site. The weather and agricultural practice are simulated at the site over multiple (in this case, 20, 34 or 36) years so that the probability of an EEC occur-ring at that site can be estimated. EEC's were calculated for the Nemacur 3 formulation were calculated as this formulation was expected to produce the highest EEC's. All fenamiphos products are listed in Table 1.

Tier 1 screening EECs (Parker *et al.*, 1995) were calculated for fenamiphos for these products and crops (Table 2). These EECs were calculated with GENEEC, version 1.2, dated April 24, 1995. The chemical parameters except the K_{oc} used for the GENEEC EEC's are listed in Table 3. In cases were an incorporation depth was not specifically listed, 2 cm was used. The incorporation depths for each use are listed in Table 2 with the Tier 1 EEC's. K_{oc}'s were calculated from the adsorption Fruendlich equation for a clay loam soil (Daly, 1988) based on the application

Table 1. Fenamiphos products.

Registration Number	Product Name
3125-236	Nemacur 15% Granular
3125-237	Nemacur 10% Turf and Ornamental Nematicide
3125-269	Nemacur Technical
3125-283	Nemacur 3 (& Nemacur 3 Turf)
3125-333	Nemacur Concentrate

rate and the depth of incorporation. The calculation method is described in the Chemistry Section.

Table 2. Tier 1 EECs for fenamiphos calculated with GENEEC.

Crop	Incorporation Depth	K_{oc}	Peak	4 Day	21 Day	56 Day
	(cm)	L kg^{-1}	ug L^{-1}	ug L^{-1}	ug L^{-1}	ug L^{-1}
Cotton	2	129	84.3	80.8	64.0	42.3
Peanuts	2	129	84.3	80.8	64.0	42.3
Tobacco	5	132	85.2	81.7	64.7	42.8
Apple[b]	2	129	105.4	100.9	80.0	53.0
Cherry[b]	2	129	105.4	100.9	80.0	53.0
Nectarine[b]	2	129	105.4	100.9	80.0	53.0
Peach[b]	2	129	105.4	100.9	80.0	53.0
Grapes[b]	2	129	86.4	82.8	65.7	43.6
Kiwi Fruit	2	129	116.6	111.7	88.5	58.6
Citrus[b]	2	129	105.4	100.9	80.0	53.0
Pineapple[a]	0	106	370	355	282	188
Raspberries[b]	2	119	86.4	82.8	65.7	43.6
Strawberries	2	123	64.2	61.5	48.8	32.3
Asparagus[b]	in furrow	148	74.3	71.1	56.2	37.1
Eggplant	2	134	105.4	100.9	80.0	53.0
Table beets	2	128	87.3	83.6	66.3	43.9
Iris, Lily & Narcissus bulbs	2	122	139.0	133	105.5	70.0
Leatherleaf Fern	2	113	607	581	462	307
Protea	5	125	501	480	380	252

(3)

Table 2. Tier 1 EECs for fenamiphos calculated with GENEEC.						
Crop	Incorporation Depth	K_{oc}	Peak	4 Day	21 Day	56 Day
	(cm)	L kg^{-1}	ug L^{-1}	ug L^{-1}	ug L^{-1}	ug L^{-1}
Anthurium	2	113	529	507	403	268
Nursery Stock	2	113	529	507	403	268
Bok Choy	2	125	107.0	102.4	81.2	53.8
Cabbage[b]	2	129	41.8	40.0	31.7	21.0
Brussels Sprouts[b]	2	129	41.8	40.0	31.7	21.0
Garlic	in furrow	138	51.8	49.6	39.2	25.9
Okra	2	125	107.0	102.4	81.2	53.6
Non-bell Peppers	2	129	105.4	100.9	80.0	53.0
Turf	2	112	651	623	495	329

a watering in with rainfall allowed
b applied to 50% of acreage over each row

The Tier 2 EEC's generated in this analysis were calculated using PRZM 2.3 for simulating the agricultural field and EXAMS 2 for fate and transport in surface water. Spray drift was simulated using an assumption that 1% of the fenamiphos application rate (0.1% of the total application) reached surface water at the time of application. Furthermore, it was assumed that 90% of the application deposited on site. Hence, The other 9.9% either remained airborne or deposited on the ground beyond the pond.

Table 3. Fenamiphos chemistry input parameters for GENEEC.	
Parameter	Value
Aerobic Soil Metabolism	4.43 d
Solubility	400 mg L^{-1}
Aqueous Photolysis	0.218 d
Hydrolysis	706 d*
Aerobic Aquatic Metabolism	none available
* This value is in error; the correct value is 300 d. However, this change would not effect the results so the GENEEC EEC's have not been recalculated.	

The scenarios chosen were a cotton field in Yazoo, Mississippi, a grape vineyard in Chautauqua County, New York, a peach orchard in Peach County, Georgia, a peanut field in Coffee County, Georgia, and a tobacco field in Coffee County, Georgia. Scenarios were chosen to represent sites that were expected to produce runoff greater than 90% of the sites used for these crops. Calculations were made for the maximum application rate. Maximum applications for each use pattern for all crops and fenamiphos products are in Table 9. For the sites selected, a single application was made at the maximum rate was made. For some of the crops, some use patterns had multiple applications of a lower application rate. These use patterns may result in larger chronic EECs but the simulations were not done for these use patterns. For cotton, peanuts , and tobacco, the applications were made pre-plant, on April 12, April 20, and March 28 of each year, respectively. For peaches and grapes, the applications were made early in the spring when new growth for the season was starting: March 21 and May 20 of each year respectively. The Tier 2 upper tenth percentile EEC's are listed in Tables 5. The EEC's have been calculated so that in any given year, there is a 10% probability that the maximum average concentration of that duration in that year will equal or exceed the EEC at the site.

Table 4. Tier 2 upper tenth percentile EEC's for fenamiphos on selected crops.					
Product	Maximum	4 Day	21 Day	60 Day	90 Day
Cotton	112 $\mu g\ L^{-1}$	107 $\mu g\ L^{-1}$	92.11 $\mu g\ L^{-1}$	62.4 $\mu g\ L^{-1}$	46.7 $\mu g\ L^{-1}$
Grapes	6.5 $\mu g\ L^{-1}$	6.1 $\mu g\ L^{-1}$	5.0 $\mu g\ L^{-1}$	3.6 $\mu g\ L^{-1}$	2.9 $\mu g\ L^{-1}$
Peanuts	14.9 $\mu g\ L^{-1}$	14.2 $\mu g\ L^{-1}$	11.3 $\mu g\ L^{-1}$	7.3 $\mu g\ L^{-1}$	5.4 $\mu g\ L^{-1}$
Peaches	18.2 $\mu g\ L^{-1}$	17.5 $\mu g\ L^{-1}$	14.8 $\mu g\ L^{-1}$	10.6 $\mu g\ L^{-1}$	8.3 $\mu g\ L^{-1}$
Tobacco	60.7 $\mu g\ L^{-1}$	57.8 $\mu g\ L^{-1}$	47.8 $\mu g\ L^{-1}$	31.4 $\mu g\ L^{-1}$	23.2 $\mu g\ L^{-1}$

Pesticide Use and Application

Fenamiphos is an organophosphate that is primarily used as a nematicide , although there are also several insecticide uses registered. Tier 1 EECs were calculated for all uses (see Table 2). However, Tier 2 EEC were only calculated for crops with a substantial portion of the total use. All fenamiphos products are marketed under the tradename Nemacur®. There are several factors that determine the use rate and pattern for fenamiphos. These are crop, pest, and formulation. How each of these factors affect the use pattern of fenamiphos is discussed below.

Crop. Tier 2 EEC's were requested for the following crops/crop groupings: cotton, grapes, peanuts, stone fruits, tobacco, and turf. EEC's were desired for these sites because they represent the majority of use of fenamiphos. Nemacur 3 is registered for use on three stone fruits: cherries, nectarines, and peaches. Peaches have been selected as a stand-in for all three stone fruits as the EEC's for peaches would be expected to be larger than those for the cherries and nectarines. The vast majority of nectarines grown in the United States are from the Central Valley of California where there is little rainfall there during the growing season, so runoff is almost nil. Cherries are generally grown in more northern climes (such as Washington, and Michigan) as well as California. While there would be expected to be significant runoff in some of these places, it is expected that the runoff will be less than that in Georgia and South Carolina where a significant proportion of U.S. peaches are grown. Tier 2 EEC's are not being calculated for fenamiphos application to turf because we do have confidence that PRZM 2 can adequately reflect the fate and transport of pesticides on turf.

Formulation. There are 4 different fenamiphos end use products available (Table 1). They are all produced by Bayer, Inc. All the tier 2 EEC's in this analysis were generated from the Nemacur 3 (Reg. No. 3125-283) label. Cotton and peanuts have registered uses on the

Nemacur 15G label that is similar to that for the Nemacur 3 use pattern. However, since there is no spray drift with the granular application, the Nemacur 3 use would be expected to generate somewhat higher EEC's and was chosen for use in the simulations.

Pests. Fenamiphos is registered for both insecticidal uses and as a nematicide (Table 5). However, fenamiphos is primarily used as a nematicide. Because nematodes are more frequently (though not exclusively) a pest in sandier soils which are not prone to generate substantial amounts of runoff, fenamiphos loading from runoff should be reduced. However, there are sites with a sandy surface layer over a more restrictive subsoil that can generate substantial runoff when the surface soil saturates. Four of the five sites (all but cotton) chosen were of this type. While these types of soils do occur and are used for agriculture, they are not common. Hence the typical site would likely generate substantially lower EEC's than the high exposure site chosen for Tier 2 EEC calculations.

Models Used

The EEC's were calculated using two models: PRZM 2.3 (Mullins *et al.*, 1993), dated August 8, 1996 to simulate the transport of the pesticide off the field, and EXAMS II (Burns *et al.*, 1992), dated January 24, 1992, to simulate the fate of the chemicals in the water body. The PRZM version used, 2.3 is an unofficial release that has improved handling of pesticide extraction into runoff. These changes are being included in the next official release, version 3. The particular version used had been modified from the regular 2.3 code to provide 600 applications instead of 200. The version of EXAMS II used was part of the PIRANHA 3.0 shell (Burns *et al.*, 1992), dated January 30, 1992. PRZM 2 data was summarized and analyzed and the EXAMS run file generated using the SZ2 post-processor, version 1.1c, dated August 29, 1995. The EXAMS output was summarized using the PEO post-processor version 1.2b, dated April 18, 1994.

Table 5. Pests that fenamiphos can be used on.
thrips
nematodes
tobacco cyst nematode
aphids
citrus root weevil complex
Fuller rose beetle
Rotylenchulus sp. nematodes
Meloidogyne sp. nematodes
cyst nematode
mole cricket*
bulb and stem nematode
* Bayer has agreed to remove the mole cricket use from the label.

(2)

Scenarios

Five scenarios were used to represent high exposure sites for fenamiphos use on selected crops. All sites represent a 10 hectare field, orchard, or vineyard draining into a 1 hectare pond, 2 m deep with no outlet. The sites were selected to represent so that they were reasonable but likely to generate exposures to aquatic organisms larger than for most sites (about 90%) for each particular crop. Given the state of the art in computer modeling of agricultural production systems, these scenarios for orchards and vineyards is essentially the same as a meadow at the same site and is appropriate for modelling all meadow-like fields.

The cotton field is in Yazoo County, Mississippi. It has a Loring silt loam soil, a fine-silty, mixed, mesic Thermic Typic Fragiudalf, in MLRA O-134. The Loring silt loam is a Hydrologic Group C soil and SCS curve numbers were measured on a real field in Yazoo County, Mississippi under cotton culture. 101,000 acres of cotton is grown in Yazoo County, which is the most of any county in Mississippi (US Department of Commerce, 1994a). USLE C Factors were developed by George Foster at the University of Mississippi in consultation with Ronald Parker of the US EPA to represent a cotton field with one year tilled followed by two years under conservation tillage using RUSLE. The weather data is from weather station W03940 in Jackson, Mississippi. The weather data file is also part of the PIRANHA shell and is used to represent the weather for MLRA 131. This weather data was used rather than the MLRA 140 weather data as it was expected to better represent the weather in Yazoo County. The PRZM 2 parameters describing this site are in Appendix A.

The peach orchard is in Peach County, Georgia. It has a Boswell sandy loam soil, a fine, mixed, thermic Vertic Paleudalf, in MLRA P-133A. The Boswell soil is hydrologic group C soil and SCS curve numbers were generated based on this grouping and the plant cover as described above (Soil Conservation Service, 1972). 7862 acres of peaches were grown in Peach County in 1992 (US Department of Commerce, 1989c) which was the most of any county in Georgia. The weather data is from weather station W03820 in Augusta, Georgia. The weather data file is also part of the PIRANHA shell and is used to represent the weather for MLRA 137. This weather data was used rather than the data for MLRA 133A (Montgomery, Alabama) as is was thought to be more appropriate for this particular location. The PRZM 2 parameters describing this site are in Appendix B.

The grape vineyard is Chautauqua County, New York. It has a Bath loam soil, a coarse-loamy, mixed, mesic Typic Fragiaquept, in MLRA R-140. The Bath loam is a Hydrologic Group C and SCS curve numbers were generated based on this grouping (Soil Conservation Service, 1972) and the meadow plant cover which is used as a surrogate for orchards and vineyards as described above. 17,446 acres of grapes were grown in Chautauqua County in 1992 (US Department of Commerce, 1994b) which was the most of any county in New York. The weather data is from weather station W14735 in Binghamton, New York. The weather data file is also part of the PIRANHA shell and is used to represent the weather for MLRA 140. The

PRZM 2 parameters describing this site are in Appendix C.

The peanut field is in Coffee County, Georgia. It has a Tifton loamy sand, a fine-loamy, siliceous, thermic Plinthic Kandiudult, in MLRA T-153A. The Tifton loamy sand is a Hydrologic Group C and SCS curve numbers were generated based on this grouping and the row crop grouping with an intermediate soil hydrologic condition (Soil Conservation Service, 1972). 13,720 acres of peanuts were grown in Coffee County in 1992 (US Department of Commerce, 1994c). The weather data is from weather station W13748 in Wilmington, North Carolina. The weather data file is also part of the PIRANHA shell and is used to represent the weather for MLRA 153A. The PRZM 2 parameters describing this site are in Appendix D.

The tobacco field is also in Coffee County, Georgia, but in MLRA P133A (Coffee county has portions in both MLRA T153A and P133A.) It has a Dunbar sandy loam soil, a clayey, kaolinitic, thermic Aeric Paleaquult. The Dunbar sandy loam is a Hydrologic Group C soil and SCS curve numbers were generated based on this classification and the row crop grouping with an intermediate soil hydrologic condition (Soil Conservation Service, 1972). 3,309 acres of tobacco were grown in Coffee County in 1992 (US Department of Commerce, 1994c) which is the second highest of any county in Georgia. The weather data is from weather station W13895 in Montgomery, Alabama. The weather data file is also part of the PIRANHA shell and is used to represent the weather for MLRA 133A.

The grape vineyard is Chautauqua County, New York. It has a Bath loam soil, a coarse-loamy, mixed, mesic Typic Fragiaquept, in MLRA R-140. The Bath loam is a Hydrologic Group C and SCS curve numbers were generated based on this grouping (Soil Conservation Service, 1972) and the meadow plant cover which is used as a surrogate for orchards and vineyards as described above. 17,446 acres of grapes were grown in Chautauqua County in 1992 (US Department of Commerce, 1994b) which was the most of any county in New York. The weather data is from weather station W14735 in Binghamton, New York. The weather data file is also part of the PIRANHA shell and is used to represent the weather for MLRA 140. The PRZM 2 parameters describing this site are in Appendix E.

The ponds used are modified for generic use from the Richard Lee pond that is distributed with EXAMS and is the standard pond used for all EEC calculations. Modifications were made to convert the pond from 1 acre, 6 ft deep to 1 ha, 2 m deep. Additionally, adjustments were made to the standard pond by changing the water temperature to that which was more appropriate for the region being simulated. The temperature in the pond each month was set to the average monthly air temperature over all 36 years calculated from the meteorological file that was used in the simulation. Additionally, the latitude and longitude were changed for each pond to values appropriate for the site selected. Finally, all transport into and out of the pond has been set to zero. The non-chemical specific parameters describing the ponds are listed in Appendix F.

Chemistry

Fenamiphos is an organophosphate insecticide used on a wide variety of food and non-food crops, mostly to control nematodes. Fenamiphos environmental fate data used for generating model parameters are listed in Table 6. PRZM 2 parameters are in Table 7, and EXAMS parameters in Table 8. Descriptions of special considerations used to select environmental fate parameters or to generate modeling input values are described below.

Hydrolysis. The hydrolysis rates for fenamiphos have been recalculated from the original data (Mulford, D. J., 1987). These recalculated values result in half-life estimates of 247 d at pH 5, 300 d at pH 7, and 231 d at pH 9. These values are very close to the original values calculated by the study author. The differences are probably due to differences in the number of digits retained in the data for the calculation. Separate rate constants for acid, alkaline, and neutral hydrolysis were calculated from the pH dependent empirical rate constants for use in EXAMS. These values are listed in Table 8.

Soil-Water Partition Coefficient. Data on soil adsorption and desorption were reported in Daly, 1988. These values are in Table 6. There are three aspects of the data that affect how they can be used for modeling. In selecting a value for the soil-water partition coefficient to use in the simulations, four issues needed to be considered. Current policy is to use the desorption values in PRZM because the dominant process during a runoff event is desorption and to use the adsorption isotherm in EXAMS as that it is the dominant process in the pond. Secondly, the data for each of the four soils for which soil-water partitioning data are available (both adsorption and desorption processes) was fitted to a Fruendlich isotherm and the 1/n or "curvature" term in the equation was significantly different than 1. This indicates that concentration adsorbed to soil was not linearly related to concentration in solution. Unfortunately, the PRZM and EXAMS only have a linear (K_d) partition model for handling soil-water partitioning of pesticides. For the desorption isotherm, this was handled by calculating the partitioning between soil and water at a soil concentration equal to application rate of the chemical mixed into a soil to 2 cm or to the incorporation depth if it was deeper than 2 cm. The bulk density of the soil was assumed to be 1.3 kg L^{-1} and the water content of the soil was 0.3 L-H_2O L-soil^{-1}. The Fruendlich equation was solved for both the concentration in solution and adsorbed to the soil using the Optimizer tool in Quattro Pro for Windows. The Optimizer uses Newton's Method to find solutions to an equation numerically. Newton's method and other related numerical techniques can be used to find solutions to an equation when it cannot be solved algebraically. These methods are described in Press *et al.*, 1986, as well as other Numerical Analysis textbooks. The resulting K_d's are listed in Table 7. The partitioning under these conditions was used to calculate a K_d appropriate for this soil content. For the adsorption isotherm, an estimate of the concentration in the pond was made using GENEEC (see Table 2). The resulting value was used for the solution concentration and the sediment concentration was calculated with the Fruendlich equation, and a K_d was calculated from the two concentrations. While this method does not give the most accurate soil-water partitioning of the pesticide over the isotherm, it should be more accurate at time periods near application, when the greatest portion of the runoff occurs. For both adsorption and desorption, the K_d was developed by choosing the soil with texture closest to the texture of the surface horizon and using the Fruendlich parameters for that soil. Thirdly, a Pearson's Correlation Analysis of the calculated K_f's with soil-organic-carbon content was used to estimate a K_{oc} (See Appendix G). For neither adsorption nor desorption was there a significant correlation between the calculated K_f's and soil organic carbon content. Hence K_{oc} is not a good predictor of soil-water partitioning and the separate K_f's were used. Finally it should be noted that the concentrations in the soil-water partitioning study are only about 1 tenth the concentration of pesticide that could be found in the soil at the application rate. Hence, we are extrapolating considerably beyond the range of the experimental data for calculating the EEC and this usually results in substantial error.

Table 6. Environmental fate parameters for fenamiphos.

Fate Parameter	Value	Source
Molecular Mass	303.36 g mol^{-1}	EFGWB One-Liner
Aerobic Soil Metabolism Rate Constant	1.56×10^{-1} d^{-1}	Spiteller, 1989b
Anaerobic Soil Metabolism Rate Constant	1.04×10^{-2} d^{-1}	Spiteller, 1989b
K_f, n (adsorption)	2.86, 1.255 (sand) 0.958, 1.034 (sandy loam) 3.457, 1.140 (silt loam) 1.980, 1.110 (clay loam)	Daly, 1988
K_f, n (desorption)	2.612, 1.041 (sand) 0.682, 0.897 (sandy loam) 4.294, 1.111 (silt loam) 1.471, 0.927 (clay loam)	Daly, 1988.
Solubility	400 mg L^{-1}	EFGWB One-Liner
Vapor Pressure	9.97×10^{-10} torr	EFGWB One-Liner
Hydrolysis Rate Constant at pH 5	2.803×10^{-3} L $(mol\text{-}H^+)^{-1}$ d^{-1}	Mulford, 1987
Hydrolysis Rate Constant at pH 7	2.307×10^{-3} d^{-1}	Mulford, 1987
Hydrolysis Rate Constant at pH 9	2.969×10^{-3} L $(mol\text{-}OH^-)^{-1}$ d^{-1}	Mulford, 1987
Aqueous Photolysis Constant	3.173×10^{-1} d^{-1}	Press *et al.* 1984
Soil Photolysis Constant	5.15 d^{-1}	Hanlon, 1988

Soil Photolysis. The soil photolysis rate of 2.59×10^{-1} h^{-1} reported in Hanlon, 1988 was not adjusted to reflect significant degradation in the dark control. The corrected rate constant is 2.14×10^{-1} h^{-1} or a degradation half-life of 3.23 h. Note that the value in Table 6 has been converted to days. Soil photolysis is accounted for in PRZM 2 by adding the photolysis rate constant to the aerobic soil metabolism rate constant and applying this to a layer 0.2 cm deep at the top of the profile. Since this was the only value available, the half-life was multiplied by three to obtain the parameter used in PRZM 2.

Aqueous Photolysis. The aqueous photolysis study was done under a mercury arc lamp which otherwise does not usually produce acceptable data for environmental analysis but was found acceptable in this case. However, it is possible that degradation that occurs from light from a mercury arc lamp is associated with UV wavelengths that are present in sunlight at the earth's surface. Consequently, the real degradation rate in the environment may be considerably slower than that which is seen in this measurement. For this reason, and because other reasonable alternatives were not available, the aqueous photolysis rate was set to zero in the EXAMS simulations.

Soil and Aquatic Metabolism. The aerobic soil metabolism data provided by Bayer (Spiteller, 1989a) was used to recalculate the aerobic soil metabolism half life (see Appendix H). Using the standard technique (linear regression of the log transform of the concentration data with time) for estimating the half-life did not give the same estimate as was calculated by the original authors. However there was also obvious and considerable lack of fit of this curve to the data and the resulting half life obviously did not well describe the degradation of fenamiphos. An alternative technique, non-linear regression of the untransformed concentration data with time returns a half-life of 4.43 d. R^2 for this analysis was 99.8% and the curve can be seen to describe the structure of the data well (see Figure H-1.)

The anaerobic soil metabolism data (Spiteller, 1989b) was used to recalculate the anaerobic soil metabolism half-life. (See Appendix I) The resulting value was 92 d was similar to that (89 d) reported by the authors.

Only one anaerobic and one aerobic soil metabolism value was available for fenamiphos. No aquatic metabolism data are currently available. Current policy for generating input parameters for PRZM 2 when only one value is available is to multiply the half-life by three. The aerobic soil metabolism value is used for the A horizon of the soil and the anaerobic soil metabolism value is used for the lower horizons. This is not an entirely correct use of the anaerobic soil metabolism data as this data represents the metabolic degradation of the pesticide under anaerobic conditions *in a surface soil horizon*. However, in the absence of anaerobic degradation in the subsoil, it is judged to be the best surrogate.

Since no aquatic metabolism data was available, current policy is to use the value of the corresponding rate constant used in PRZM 2 and multiply by 2/3 for use in EXAMS. This is done as there is usually some correspondence between soil and aquatic metabolism rates and in the absence of aquatic data this is judged to be a reasonable conservative surrogate. The temperature response for metabolism in EXAMS (QTBAS and QTBAW) were set to 2, meaning that the degradation rate will increase by a factor of 2 for every 10 C rise in temperature. The base temperature in EXAMS 2.94 is 20° C and the metabolism studies were done at 25° C so the EXAMS parameters have been modified to account for the difference in base temperature.

Table 7. PRZM 2.0 input parameters for fenamiphos.	
Input Parameter	**Value**
Foliar Volatilization (PLVKRT)	0 d^{-1}
Foliar Decay Rate (PLDKRT)	0 d^{-1}
Foliar Washoff Extraction Coefficient (FEXTRC)	0 cm^{-1}
Plant Uptake Fraction (UPTKF)	0
Soil-Water Partition Coefficient (KD)	3.83 L kg-$soil^{-1}$ (cotton) 1.486 L kg-$soil^{-1}$ (peaches) 3.55 L kg-$soil^{-1}$ (grapes) 0.897 L kg-$soil^{-1}$(peanuts) 0.876 L kg-$soil^{-1}$ (tobacco)
Dissolved Phase Decay Rate: Photolysis Horizon (DWRATE)	1.769 d^{-1}
Adsorbed Phase Decay Rate: Photolysis Horizon (DSRATE)	1.769 d^{-1}
Dissolved Phase Decay Rate: A Horizon (DWRATE)	5.20×10^{-2} d^{-1}
Adsorbed Phase Decay Rate: A Horizon (DSRATE)	5.20×10^{-2} d^{-1}
Dissolved Phase Decay Rate: Lower Horizons (DWRATE)	2.50×10^{-3} d^{-1}
Adsorbed Phase Decay Rate: Lower Horizons (DSRATE)	2.50×10^{-3} d^{-1}
Vapor Phase Decay Rate (DGRATE) (all horizons)	0 d^{-1}

Soil Volatilization. The soil volatilization routines in PRZM 2 were deactivated by setting the relevant parameters (Vapor diffusion rate, Henry's Law Constant and the enthalpy of Vaporization) to zero. The ability to estimate some of the necessary parameters, particularly the enthalpy of vaporization for fenamiphos, is very poor, and there is there is lack of confidence in the validity of the PRZM 2 volatilization routines.

Table 8. EXAMS 2.0 Input parameters for fenamiphos.		
Input Parameter	**Value**	**Quality**
Aerobic Aqueous Metabolism Constant (KBACW)	1.44×10^{-3} h^{-1}	poor
Sediment Metabolism Constant (KBACS)	9.63×10^{-5} h^{-1}	poor
Acidic Hydrolysis Rate Constant (KAH)	2.00 $L \cdot (mol\text{-}H^{+})^{-1} \cdot h^{-1}$	good
Neutral Hydrolysis Rate Constant (KNH)	9.71×10^{-3} h^{-1}	good
Alkaline Hydrolysis Rate Constant (KBH)	2.84 $L \cdot (mol\text{-}OH^{-})\text{-}1 \cdot h^{-1}$	good
Photolysis Rate Constant (KDP)	0 h^{-1}	poor
Partition Coefficient (KPS)	4.68 $L \cdot kg^{-1}$ (cotton) 1.03 $L \cdot kg^{-1}$ (peach) 4.67 $L \cdot kg^{-1}$ (grapes) 1.04 $L \cdot kg^{-1}$ (peanuts) 1.04 $L \cdot kg^{-1}$ (tobacco)	fair
Molecular Mass (MWT)	303.36 $g \cdot mol^{-1}$	excellent
Solubility (SOL)	400 $mg \cdot L^{-1}$	good
Vapor Pressure (VAPR)	9.97×10^{-10} torr	good
Q10 For The water Column (QTBAW)	2	poor
Q10 For Sediment (QTBAS)	2	poor

Application Rates and Timing

Application data for all of the crops listed on Nemacur labels are in Table 9. These values were used to generate both the GENEEC EECs and the Tier 2 EECs. For the Tier 2 EECs, an EEC was only calculated for the product which was expected to generate the highest EECs. In all cases this was the Nemacur 3 product. All applications were assumed to have been made by ground spray, except those of the granular formulation. For the GENEEC calculations, it was assumed that 99% of the application rate reached the application site, and 1% of the application drifted into the pond. For the Tier 2 EEC's, it was assumed that 90% of the application rate stayed on site, and 1% drifted into the pond. Since there were 10 ha total, 90% of the total application stayed on site, 0.1% entered the pond, and the other 9.9% either deposited off-site outside the pond or remained suspended in the air. It was assumed for most applications that the application was incorporated to 2 cm unless the label specifically specified a deeper depth. It should be recognized that under most circumstances the real incorporation depth would be deeper than 2 cm. This value was used as minimum to be sure the estimate was conservative.

Application timing was chosen to be representative of agricultural practice for the crop in each state. For the field crops, cotton, peanuts, and tobacco, The application was made 3 days prior to planting. Planting dates are from USDA, 1984. For cotton the application date was April 12. For peanuts, the application date was April 20. For tobacco, the application date was March 28 each year. For grapes, the application was time to coincide with the beginning of the growing season.

Table 9. Label application and maximum rates for Nemacur products.

Crop	Product	Application Method	Restrictions	Application Rate (lb acre)	Annual Max App. Rate (lb acre)	Annual Maximum No. of Apps	Minimum App Interval	Harvest Interval
Cotton	Nemacur 3[a]	A, B		3[b]		1		
Cotton	Nemacur 3	A, H	1	3[b]		1		
Cotton	Nemacur 15G	A, I		1.63[b]		1		
Peanuts	Nemacur 3	N, AA		3[f]		1		
Peanuts	Nemacur 15G	N,AA		3[f]		1		
Tobacco	Nemacur 3	A, C, D	2	6		1		
Apple	Nemacur 3	E, G		7.5	7.5			72
Apple	Nemacur 3	F		3	6	4	30	72
Cherry	Nemacur 3	E, G		7.5	7.5		30	45
Cherry	Nemacur 3	F		3	6	4	30	45
Nectarine	Nemacur 3	E, G		7.5	7.5		30	45
Nectarine	Nemacur 3	F		3	6	4	30	45
Peach	Nemacur 3	E, G		7.5	7.5		30	45
Peach	Nemacur 3	F		3	6	4	30	45
Grapes	Nemacur 3	E, G		6	6			2
Grapes	Nemacur 3	F		3	6	4		2
Kiwi Fruit	Nemacur 3	F	1, 3	3	6	4		31
Citrus	Nemacur 3	E, G, N	4	7.5	7.5			30

Table 9 cont. Label application and maximum rates for Nemacur products.

Crop	Product	Application Method	Restrictions	Application Rate (lb acre)	Annual Max App. Rate (lb acre)	Annual Maximum No. of Apps	Minimum App. Interval	Harvest Interval
Citrus	Nemacur 3	F, N	4	3	6	4	30	30
Citrus	Nemacur 3	E, G, N	5	5	10	2	30	30
Citrus	Nemacur 3	F, N	5	3	4.5	4	30	30
Pineapple	Nemacur 3	A, E, N	6	9	24			
Pineapple	Nemacur 3	J, K, L, M	6	3	24		30	30
Pineapple	Nemacur 3	J, O, P	7	9	18		30 after first 90 after subsequent	225
Pineapple	Nemacur 15G	N or X	7	9	9	1[h]		
Raspberry	Nemacur 3	E, G	8, 9	6				180
Strawberries	Nemacur 3	A, N or W		4.5[j]		1		110
Strawberries	Nemacur 15G	A, N or W		4.5[j]		1		110
Strawberries[e]	Nemacur 15G	N or BB		3.5[g]		2	56	600
Asparagus	Nemacur 3	A, E, Q	10	2				
Asparagus	Nemacur 3.	E, I	10	2		3	270	270
Eggplant	Nemacur 3	A, N		3[g]		1		
Table beets	Nemacur 3	AA, N	11	3.1				90
Iris, Lily, & Narcissus bulbs	Nemacur 10G	I, R	8	4.9[g]		1		

Table 9 cont., Label application and maximum rates for Nemacur products								
Crop	Product	Application Method	Restrictions	Application Rate (lb acre)	Annual Max App. Rate (lb acre)	Annual Maximum No. of Apps.	Minimum App Interval	Harvest Interval
Leatherleaf fern	Nemacur 10G	R		10	no restriction	no restriction		
Leatherleaf Fern	Nemacur 3 Turf	Y		9	no restriction	no restriction		
Protea	Nemacur 10G	R, V	6	9.75		2		
Anthurium	Nemacur 10G	R		10		2		
Nursery Stock	Nemacur 10G	R		10		2		
Bok Choy	Nemacur 15G	A, AA, N		3.8[k]		1		
Cabbage	Nemacur 15G	A. AA, CC		3.0[l]		1		
Brussels Sprouts	Nemacur 15G	A. AA, CC		3.0[l]		1		
Garlic	Nemacur 15G	A, I		3.8[h]		1		
Okra	Nemacur 15G	A, N		3.8[k]		1		
Non-bell peppers	Nemacur 15G	A, N		3.0		1		
Turf[e]	Nemacur 10G	C, R, S, T, U		10	20		10	30
Turf[f]	Nemacur 3 Turf	C, R, S, T, U, X		10		2	3	30

Table 9 cont.

a application rate is for tank mix with Treflan and/or fertilizer

b assume 36 inch rows with 18 inch wide bands (36 in minimum row width based on personal communication with J. Breithaupt, EFGWB, July 30, 1996.

c golf courses, cemeteries, sod farms, and industrial grounds

d *Ajuga*, Azalea, Boxwood, Cactus, Clematis, Cotonester, Euonymys, Firethorn, Flowering crab, Flowering cherry, Gardenia, Holly, Hibiscus, Ivy, Juniper, Hostas, Pachysandra, Periwinkle, Pieris, Pine, Rhododendron, Roses, Sedum, Spruce, Viburnum, Yews, and Yucca. Other nursery stock must be tested for tolerance before use.

e Nursery stock

f Golf courses and sod farms

g based on 30 inch rows and 12 inch bands

h base on 24 inch rows and 12 inch bands

i Nemacur 3 applications can be made after Nemacur 15G applications

j based on 24 inch wide rows and 18 inch bands

k based on 24 inch wide rows and 12 to 15 inch row spacing

l based on 30 inch rows and 15 inch row spacing

Table 9., cont.

A Preplant
B Banded, 18 inches
C Broadcast
D Incorporated 2 to 4 in
E Apply in a band covering 50% of the row spacing
F Low pressure irrigation
G Apply in no less than 10 gal of water per acre
H Soil injection
I In furrow
J Post plant
K Apply in 50 to 150 gal of water per acre
L Foliar spray of drip irrigation
M Can be applied immediately after harvest to a ratoon crop
N Incorporate , depth unspecified
O Foliar Spray
P Can be applied immediately after application to *first* ratoon crop
Q Incorporate 2 to 6 inches
R Irrigate in with 0.5 inch water, complete within 6 hours of application. Do not allow water to puddle.
S Do not apply to more than 10 acres at a time
T Do not apply to saturated soil
U Do not apply between noon and sunset during thunderstorm season (June through September)
V Incorporate 2 to 3 inches
W Water in with sprinkler irrigation
X Apply in a minimum of 20 gal per acre
Y Apply only in fall or early spring
Z Apply in 25 to 50 gal of water per acre by sprinkler irrigation,, apply enough water prior to application to wet foliage, apply 0.5 inch after application to wash off foliage and into soil.
AA At planting
BB Water in with 1 inch of sprinkler irrigation
CC Pre-emergence

Table 9, cont.

1 California only
2 Apply in a minimum of 20 gal water per acre
3 Do not apply unless the soil temperature is above 55 degrees F
4 except in Florida
5 Florida only
6 Hawaii only
7 Puerto Rico
8 except California
9 Apply only between October 1 and December 31
10 Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Rhode, Island only
11 Illinois, Indiana, Michigan, New York, Ohio, Pennsylvania only
12 In California golf courses and sod farms only

Procedure

The PRZM 2 simulation was run for a period of years that varied with the scenario (see Table 10). All simulations started on January 1 of the first year and ended on December 31 of the end year. EXAMS was run for all the scenarios. Because ground application was assumed for all the crops, the applications (TAPP) in PRZM 2 were 90% of the application, as it is assumed only 90% of the total application reached the field. EXAMS loading (PRZM2EXA) files were reprocessed using the SZ2 post-processor to have 1% of each application rate applied to the pond. EXAMS was run for all years run in each scenario for PRZM 2 in mode 3. The yearly maximums, largest yearly 96-hour means and largest yearly 21-day means were extracted from the REPORT.XMS file produced by EXAMS. The largest yearly 60- and 90-day means were calculated by PEO from plot data dumped to the screen and captured in a file. . The 10 year return EEC's (or 10% yearly exceedence EEC's) listed in Tables 4 and 5 were calculated by linear interpolation between the third and fourth largest values by PEO. Input files for these analyses are listed in Appendix I.

Table 10. Starting and ending dates for fenamiphos simulations.

Crop	Start Year	End Year
Cotton	1964	1983
Grapes	1948	1983
Peaches	1950	1983
Peanuts	1948	1983
Tobacco	1948	1983

Results

Annual exceedence curves for fenamiphos as applied to cotton, grapes, peaches, peanuts, and tobacco are in Figures 2 through 6. Ten percent exceedence values for each crop are listed in Table 4. Cotton has the highest EECs while grapes has the lowest. In general, the 60 day EECs are about half the peak EECs. An interesting feature of the exceedance probability curves is that for three of the crops, grapes, peaches and peanuts, there is a very steep drop off in concentration from the most extreme years (annual exceedance of less than 0.10) to the more frequently occurring years. This is likely do to an interaction between the storm frequency during around the time of application and the very short aerobic half-life of fenamiphos. The Yazoo County cotton scenario had 1.3 runoff-producing storms per year on average in the 10 days after application. By contrast, grapes in Chautauqua County had only 0.36 runoff-producing storms per year in the 10 days after application. In order to get a large EEC, a large storm must occur within a short time after application, or the chemical will have degraded to the extent where a large EEC cannot occur. If the runoff-producing storm frequency is low relatively less frequent around the application, it is less likely that the big storm will occur. This results in a fairly rapid drop off in the EEC for the most extreme years.

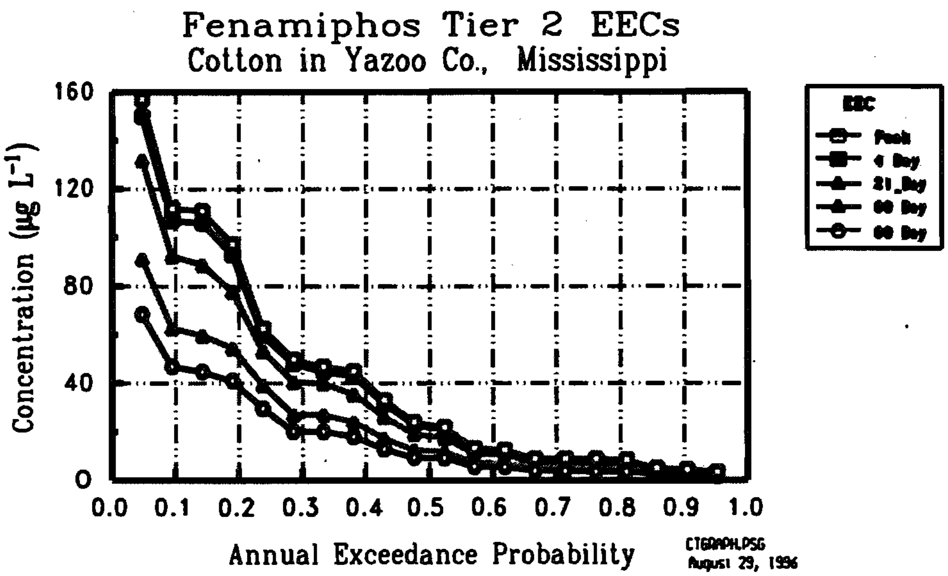

Figure 2. Annual exceedence probability of EEC's for Nemacur 3 on cotton in MS from a single preplant application. Annual maximum concentrations are the greatest concentrations of the given duration which occurred during the year.

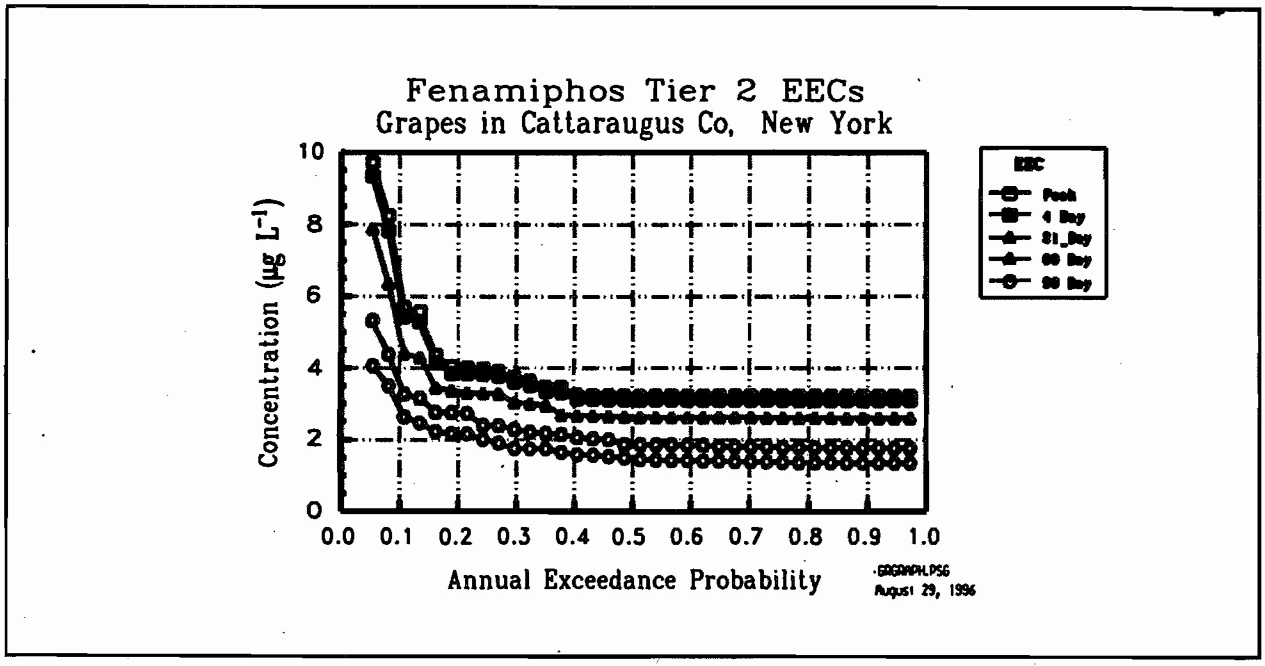

Figure 3. Annual exceedence probability of EEC's for Nemacur 3 application on grapes in Cattaraugus County, New York. Annual maximum concentrations are the greatest concentrations of the given duration which occurred during the year.

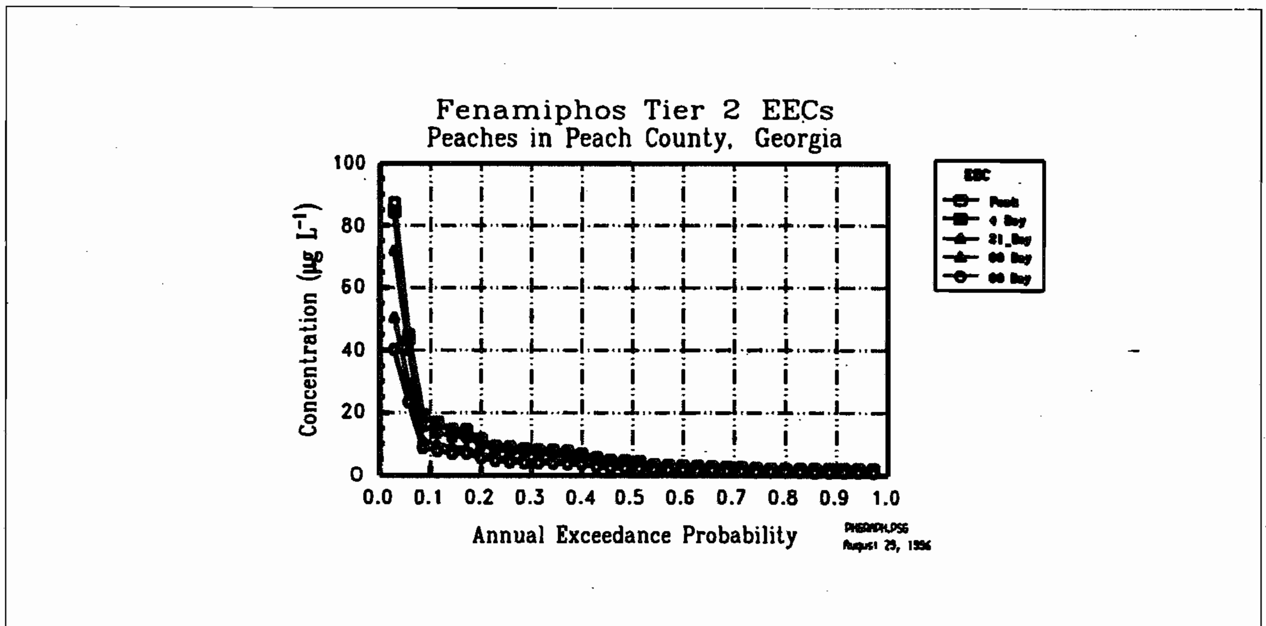

Figure 4. Annual exceedence probability of EEC's for Nemacur 3 on peaches in Georgia from a single annual application. Annual maximum concentrations are the greatest concentrations of the given duration which occurred during the year.

Runoff is the dominant source of loading of fenamiphos to aquatic environments in most of these scenarios. Grapes was an expception with 70% of the loading from spray drift. transport with eroded sediment was never a significant source of loading for fenamiphos. This suggests that buffer strips will not be a useful tool for mitiagation fenamiphos loading to aquatic environments. Mitigation from ground spray can be mitigated to some extent by keeping tall grass or wind breaks between the surface water body and the field. Mitigation strategies need to consider the relative risks of ground water versus surface water contamination, and the relative risks of alternative pesticides to aquatic, and terrestrial environents, as well as human health.

It should be remembered in interpreting these results that they represent the upper limit for possible exposure from these use patterns to aquatic environments at a single high exposure site. In actual practice, the true environmental concentrations will probably be less than indicated by this analysis because most sites will produce less loading to aquatic environemnts than these scenarios. Additional caveats on the interpretation and use of these results are discussed below.

Limitations of this Analysis

There are several factors which limit the accuracy and precision of this analysis including the selection of the high exposure scenarios, the quality of the input data, the ability of the models to represent the real world, and the number of years that were modeled.

Scenarios that are selected for use in Tier 2 EEC calculations are ones that likely to produce large concentrations in the aquatic environment. It should represent a site that really exists and would be likely to have the pesticide in question applied to it. It should be extreme enough to provide conservative estimates of the EEC, but not so extreme that the model cannot properly simulate the fate and transport processes at the site. Currently, sites are chosen by best professional judgement to represent sites which generally produce EEC's larger than 90% of all sites use for that crop. The EEC's in this analysis are accurate only to the extent that the site represents this hypothetical high exposure site. The most limiting part of the site selection is the use of the standard pond with no outlet. Obviously, a Georgia pond, even with appropriately modified temperature data is not the most appropriate water body for use in New York. It should be remembered that while the standard pond would be expected to generate lower EECs than most water bodies. Some water bodies would likely have higher concentrations. These would be shallow water bodies near agricultural fields that receive most of their water as runoff from agricultural fields that have been substantially treated with fenamiphos.

The quality of the analysis is directly related to the quality of the input parameters. In general, the fate data for fenamiphos is good. In particular, the quality of the aqueous photolysis data and the lack of aquatic metabolism data limit the accuracy of this analysis. While the aqueous photolysis data was found regulatorily acceptable, because there are substantial doubts about the study's environmental relevance, it was not considered in this analysis. Additional metabolism data would greatly increase or confidence, and likely reduce our EEC estimates. In particular, if aquatic metabolism data were available, it would greatly increase our confidence in this exposure assessment.

The models themselves represent a limitation on the analysis quality. While the models are some of the best environmental fate estimation tools available, they have significant limitations in their ability to represent some processes. Spray drift is estimated as a straight 1% of the application rate reaching the pond for each application fro ground application. In actuality, this value should vary with each application from zero to perhaps as high as 2 or 3%. A second major limitation of the models is the lack of validation at the field level for pesticide runoff. While several of the algorithms (volume of runoff water, eroded sediment mass) are well validated and well understood, no adequate validation has yet been made of PRZM 2.3 for the amount of pesticide transported in runoff events. This would result in conservative EEC estimates. Other limitations of the models used is the inability to handle within site variation (spatial variability), no crop growth algorithms, and an overly simple soil water transport algorithm (the "tipping bucket" method).

A final limitation is that only thirty-six years of weather data was available for the analysis at both sites. Consequently there is approximately 1 chance in 20 that the true 10% exceedence EEC's are larger than the maximum EEC in the calculated in the analysis. If the number of years of weather data could be increased in would increase the confidence that the estimated value for the 10% exceedence EEC was close to the true value.

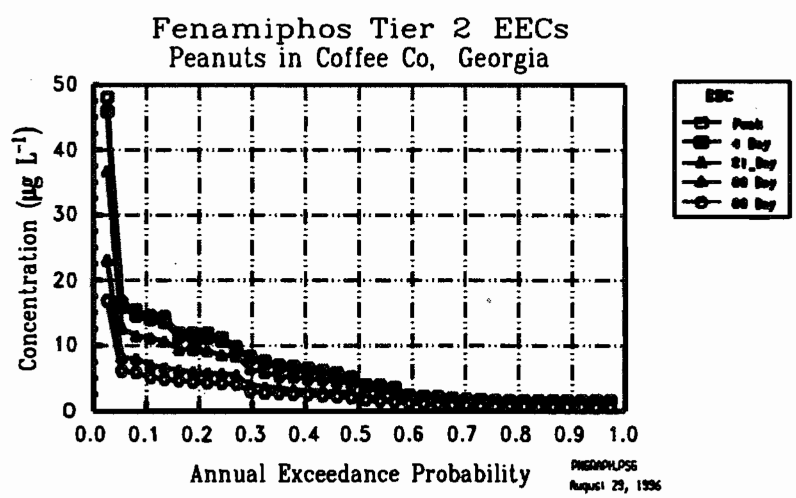

Figure 5. Annual exceedence probability of EEC's for a pre-plant fenamiphos application on peanuts in Georgia. Annual maximum concentrations are the greatest concentrations of the given duration which occurred during the year.

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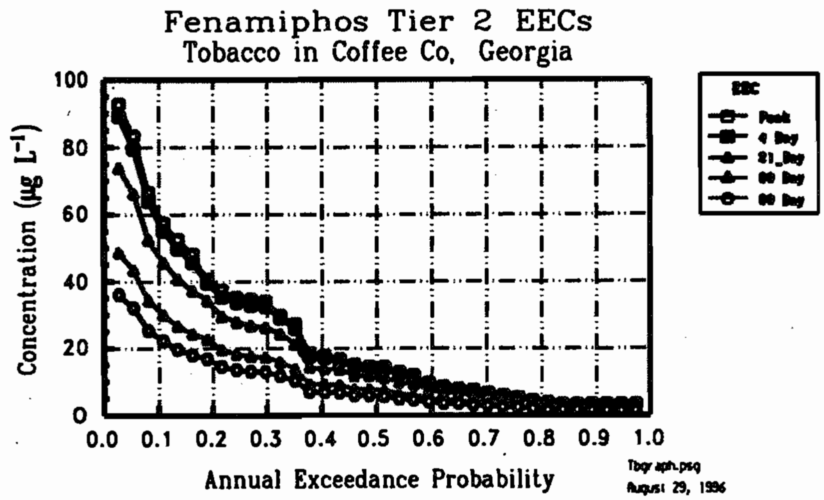

Figure 6. Annual exceedence probability of EEC's for a pre-plant Nemacur 3 application to tobacco in Coffee County, Georgia. Annual maximum concentrations are the greatest concentrations of the given duration which occurred during the year.

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Appendix A
PRZM 2 Scenario Parameters

Table A-1. PRZM 2 climate and time parameters for a cotton field in Yazoo County, Mississippi.

Parameter	Value	Source	Quality
Starting Date*	January 1, 1964		
Ending Date*	December 31, 1983		
Pan Evaporation Factor (PFAC)	0.760	PIC	good
Snowmelt Factor (SFAC)	$0.250\ cm \cdot K^{-1}$	PIC	good
Minimum Depth of Evaporation (ANETD)	17.0 cm	PIC	good
Average Duration of Runoff Hydrograph (TR)	5.80 h	PIC	good

* These values are in the RUN file rather than the INP file.

Table A-2. PRZM 2 model state flags for a cherry orchard in Yazoo County, Mississippi.

Parameter	Value
Pan Factor Flag (IPEIND)	0
Foliar Application Model Flag FAM)	4
Bulk Density Flag (BDFLAG)	0
Water Content Flag (THFLAG)	0
Kd Flag (KDFLAG)	0
Drainage model flag (HSWZT)	0
Method of characteristics flag (MOC)	0
Irrigation Flag (IRFLAG)	0
Soil Temperature Flag (ITFLAG)	0
Thermal Conductivity Flag (IDFLAG)	0
Biodegradation Flag (BIOFLAG)	0
Partition Coefficient Model (PCMC)	NA
Initial Pesticide Concentration Flag (ILP)	0

Table A-3. Erosion and landscape parameters for a cotton field in Yazoo County, Mississippi.			
Parameter	**Value**	**Source**	**Quality**
USLE K Factor (USLEK)	0.49 tons EI^{-1*}	PIC	good
USLE LS Factor (USLELS)	0.40	PIC	fair
USLE P Factor (USLEP)	0.75	**	fair
Field Area (AFIELD)	10 ha	standard	

* EI = 100 ft-tons * in/ acre*hr
** P Factor represent comprimise for 1 year of conventional tillage and two years of no till.

Table A-4. PRZM 2 crop parameters for a cotton field in Yazoo County, Mississippi.			
Parameter	**Value**	**Source**	**Quality**
Initial Crop (INICRP)	1		
Initial Surface Condition (ISCOND)	1 (fallow)		
Number of Different Crops (NDC)	3		
Number of Cropping Periods (NCPDS)	20		
Parameters For First Crop (ICNCN = 1)			
Maximum rainfall interception storage of crop (CINTCP)	0.20 cm	PIC	fair
Maximum Active Root Depth (AMAXDR)	125 cm	PIC	fair
Maximum Canopy Coverage (COVMAX)	98%		
Soil Surface Condition After Harvest (ICNAH)	3 (residue)	PIC	
Date of Crop Emergence (EMD, EMM, IRYEM)	May 1		
Date of Crop Maturity (MAD, MAM, IYRMAT)	September 7		
Date of Crop Harvest (HAD, HAM,IYRHAR)	September 22, 1983		
Maximum Dry Weight	0 kg m^{-2}		
Maximum canopy height (HTMAX)	120 cm		

(31)

	Fallow	Cropped	Residue		
SCS Curve Number (CN)	99	93	92	measurement	good
USLE C Factor (USLEC)	0.63	0.16	0.18	RUSLE*	good
Parameters For First Crop (ICNCN = 2)					
Maximum rainfall interception storage of crop (CINTCP)	0.20 cm			PIC	fair
Maximum Active Root Depth (AMAXDR)	125 cm			PIC	fair
Maximum Canopy Coverage (COVMAX)	98%				
Soil Surface Condition After Harvest (ICNAH)	3 (residue)*			PIC	
Date of Crop Emergence (EMD, EMM, IRYEM)	May 1				
Date of Crop Maturity (MAD, MAM, IYRMAT)	September 7				
Date of Crop Harvest (HAD, HAM,IYRHAR)	September 22, 1983				
Maximum Dry Weight	0 kg m^{-2}				
Maximum canopy height (HTMAX)	120 cm				
	Fallow	Cropped	Residue		
SCS Curve Number (CN)	94	84	83	PIC	fair
USLE C Factor (USLEC)	0.16	0.13	0.13	PIC	good
Parameters For First Crop (ICNCN = 3)					
Maximum rainfall interception storage of crop (CINTCP)	0.20 cm			PIC	fair
Maximum Active Root Depth (AMAXDR)	125 cm			PIC	fair
Maximum Canopy Coverage (COVMAX)	98%				
Soil Surface Condition After Harvest (ICNAH)	3 (residue)			PIC	
Date of Crop Emergence (EMD, EMM, IRYEM)	May 1				
Date of Crop Maturity (MAD, MAM, IYRMAT)	September 7				
Date of Crop Harvest (HAD, HAM,IYRHAR)	September 22, 1983				
Maximum Dry Weight	0 kg m^{-2}				
Maximum canopy height (HTMAX)	120 cm				

	Fallow	Cropped	Residue		
SCS Curve Number (CN)	99	83	83	Mesurement	good
USLE C Factor (USLEC)	0.16	0.12	0.09	RUSLE*	good

** developed by George Foster at the University of Mississippi, Oxford in consultation with Ronald Parker of US EPA using RUSLE.

Table A-5. PRZM 2 soil parameters for a coton field in Yazoo County, Missisppi.

Parameter	Value	Source	Quality
Total Soil Depth (CORED)	125 cm	PIC	good
Number of Horizons (NHORIZ)	4	PIC	good
First, Second and Third Soil Horizons (HORIZN = 1, 2 , 3)			
Horizon Thickness (THKNS)	0.2 cm (HORIZN = 1) 9.80 cm (HORIZN = 2) 10.0 cm (HORIZN = 3)	PIC	good
Bulk Density (BD)	1.6 g $\cdot$cm^{-3}	PIC	good
Initial Water Content (THETO)	0.294 cm^3-H_2O $\cdot$cm^3-soil	PIC	good
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1, 2) 0.5 cm (HORIZN = 3)	standard	
Field Capacity (THEFC)	0.294 cm^3-H_2O $\cdot$cm^3-soil	PIC	good
Wilting Point	0.094 cm^3-H_2O $\cdot$cm^3-soil	PIC	good
Organic Carbon Content	1.16%	PIC	good
Second Soil Horizon (HORIZN = 4)			
Horizon Thickness (THKNS)	105 cm	PIC	good
Bulk Density (BD)	1.8 g $\cdot$cm^{-3}	PIC	good
Initial Water Content (THETO)	0.291 cm^3-H_2O $\cdot$cm^3-soil	PIC	good
Compartment Thickness (DPN)	5 cm		
Field Capacity (THEFC)	0.147 cm^3-H_2O $\cdot$cm^3-soil	PIC	good
Wilting Point	0.087 cm^3-H_2O $\cdot$cm^3-soil	PIC	good
Organic Carbon Content	0.174%	PIC	good

Appendix B
PRZM 2 Scenario Parameters for a Peach Orchard in Peach County, Georgia

Table B-1. PRZM 2 climate and time parameters for a peach orchard in Peach County, Georgia.*

Parameter	Value	Source	Quality
Starting Date**	January 1, 1950		
Ending Date**	December 31, 1983		
Pan Evaporation Factor (PFAC)	0.75	PIC	good
Snowmelt Factor (SFAC)	0.15 cm $\cdot K^{-1}$	PIC	good
Minimum Depth of Evaporation (ANETD)	17 cm	PIC	good
Average Duration of Runoff Hydrograph (TR)	5.8 h	PRZM II Manual	good

* Monthly daylight hours (DT) are in Table A-2.
** These values are in the RUN file rather than the INP file.

Table B-2. PRZM 2 model state flags for a peach orchard in Peach County, Georgia.

Parameter	Value
Pan Factor Flag (IPEIND)	2
Foliar Application Model Flag FAM)	1
Bulk Density Flag (BDFLAG)	0
Water Content Flag (THFLAG)	0
Kd Flag (KDFLAG)	0
Drainage model flag (HSWZT)	0
Method of characteristics flag (MOC)	0
Irrigation Flag (IRFLAG)	0
Soil Temperature Flag (ITFLAG)	0
Thermal Conductivity Flag (IDFLAG)	0
Biodegradation Flag (BIOFLAG)	0
Partition Coefficient Model (PCMC)	NA
Initial Pesticide Concentration Flag (ILP)	0

Table B-3. PRZM 2 monthly daylight hours (DT) for a peach orchard in Peach County, Georgia.

Month	Value
January	10.3 h
February	11.0 h
March	12.0 h
April	13.1 h
May	13.9 h
June	14.3 h
July	14.2 h
August	13.4 h
September	12.4 h
October	11.3 h
November	10.5 h
December	10.0 h
Source	PRZM 2 Manual, p 5-28, interpolated for 46° N Latitude.
Quality	good

Table B-4. Erosion and landscape parameters for a peach orchard in Peach County, Georgia.			
Parameter	Value	Source	Quality
USLE K Factor (USLEK)	0.19 tons EI^{-1*}	PIC	good
USLE LS Factor (USLELS)	3.30	PIC	good
USLE P Factor (USLEP)	1.0	standard	
Field Area (AFIELD)	10 ha	standard	

* EI = 100 ft-tons * in/ acre*hr

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Table B-5. PRZM 2 crop parameters for a peach orchard in Peach County, Georgia.					
Parameter	**Value**			**Source**	**Quality**
Initial Crop (INICRP)	1				
Initial Surface Condition (ISCOND)	1				
Number of Different Crops (NDC)	1				
Number of Cropping Periods (NCPDS)	1				
Parameters For First Crop (ICNCN = 1)					
Maximum rainfall interception storage of crop (CINTP)	0.19 cm			PIC*	good
Maximum Active Root Depth (AMAXDR)	17 cm			PIC*	good
Maximum Canopy Coverage (COVMAX)	100%			**	good
Soil surface condition after harvest (ICNAH)	2 (cropping)				
Date of Crop Emergence (EMD, EMM, IRYEM)	April 1, 1948				
Date of Crop Maturity (MAD, MAM, IYRMAT)	May 15, 1948				
Date of Crop Harvest (HAD, HAM,IYRHAR)	December 31, 1983				
Maximum canopy height (HTMAX)	100 cm			**	
	Fallow	Cropped	Residue		
SCS Curve Number (CN)	91	91	93	PRZM 2 Manual‡	
USLE C Factor (USLEC)	0.74	0.01	0.01	PRZM 2 Manual‡	

* Values selected for MLRA A2, grass, pasture, and hay.
** selected as the best value by the judgement of the author.
‡ Values selected represent fallow for fallow period and meadow for cropped and residue periods.

Table B-6. PRZM 2 foliar model parameters for a peach orchard in Peach County, Georgia.

Parameter	Value
Harvest disposition flag (IPSCND)	1 (cropped)

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Table B-7. PRZM 2 soil parameters for a peach orchard in Peach County Georgia*.

Parameter	Value	Quality
Total Soil Depth (CORED)	100 cm	good
Number of Horizons (NHORIZ)	2	poor
First Soil Horizon (HORIZN = 1)		
Horizon Thickness (THKNS)	12 cm	good
Bulk Density (BD)	1.70 $g \cdot cm^{-3}$	good
Initial Water Content (THETO)	0.213 cm^3-$H_2O \cdot cm^3$-soil	good
Compartment Thickness (DPN)	0.1 cm	
Field Capacity (THEFC)	0.213 cm^3-$H_2O \cdot cm^3$-soil	good
Wilting Point	0.063 cm^3-$H_2O \cdot cm^3$-soil	good
Organic Carbon Content	2.32 %	good
Second Soil Horizon (HORIZN = 2)		
Horizon Thickness (THKNS)	88 cm	poor
Bulk Density (BD)	1.7 $g \cdot cm^{-3}$	good
Initial Water Content (THETO)	0.354 cm^3-$H_2O \cdot cm^3$-soil	good
Compartment Thickness (DPN)	2 cm	
Field Capacity (THEFC)	0.354 cm^3-$H_2O \cdot cm^3$-soil	good
Wilting Point	0.213 cm^3-$H_2O \cdot cm^3$-soil	good
Organic Carbon Content	0.29%	good

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Appendix C.
PRZM Input Parameters for Chautauqua County Grape Vineyard

Table C-1. PRZM 2 climate and time parameters for a grape vineyard in Chautauqua County, New York.

Parameter	Value	Source	Quality
Starting Date*	January 1, 1948		
Ending Date*	December 31, 1983		
Pan Evaporation Factor (PFAC)	0.760	PIC	fair
Snowmelt Factor (SFAC)	0.3 cm · K^{-1}	PIC	fair
Minimum Depth of Evaporation (ANETD)	25 cm	PIC	fair
Average Duration of Runoff Hydrograph (TR)	4.40 h	PIC	fair

* These values are in the RUN file rather than the INP file.

Table C-2. PRZM 2 model state flags for a grape vineyard in Chautauqua County, New York.	
Parameter	Value
Pan Factor Flag (IPEIND)	0
Foliar Application Model Flag FAM)	4
Bulk Density Flag (BDFLAG)	0
Water Content Flag (THFLAG)	0
Kd Flag (KDFLAG)	0
Drainage model flag (HSWZT)	0
Method of characteristics flag (MOC)	0
Irrigation Flag (IRFLAG)	0
Soil Temperature Flag (ITFLAG)	0
Thermal Conductivity Flag (IDFLAG)	0
Biodegradation Flag (BIOFLAG)	0
Partition Coefficient Model (PCMC)	NA
Initial Pesticide Concentration Flag (ILP)	0

Table C-3. Erosion and landscape parameters fora grape vineyard in Chautauqua County, New York.			
Parameter	Value	Source	Quality
USLE K Factor (USLEK)	0.20 tons EI^{-1*}	PIC	good
USLE LS Factor (USLELS)	0.10	PIC	good
USLE P Factor (USLEP)	1.00	PIC	good
Field Area (AFIELD)	10 ha	standard	
* EI = 100 ft-tons * in/ acre*hr			

Table C-4. PRZM 2 crop parameters for a grape vineyard in Chautauqua County, New York.

Parameter	Value			Source	Quality
Initial Crop (INICRP)	1				
Initial Surface Condition (ISCOND)	1				
Number of Different Crops (NDC)	1				
Number of Cropping Periods (NCPDS)	1				
Parameters For First Crop (ICNCN = 1)					
Maximum rainfall interception storage of crop (CINTCP)	0.25 cm			fair	PIC
Maximum Active Root Depth (AMAXDR)	63 cm			fair	PIC
Maximum Canopy Coverage (COVMAX)	89%			fair	PIC
Soil surface condition after harvest (ICNAH)	1				
Date of Crop Emergence (EMD, EMM, IRYEM)	January 20, 1948				
Datae of Crop Maturity (MAD, MAM, IYRMAT)	September 22, 1948				
Date of Crop Harvest (HAD, HAM,IYRHAR)	October 25, 1983				
Maximum crop dry weight (WFMAX)	0 kg $\cdot m^{-2}$			poor	PIC
Maximum canopy height (HTMAX)	0cm			poor	PIC
	Fallow	Cropped	Residue		
SCS Curve Number (CN)	79	71	71	fair	PRZM 2 manual
USLE C Factor (USLEC)	0.6	0.01	0.01	fair	PIC

Table C-5. PRZM 2 soil parameters for a Bath loam soil in a Chautauqua County, New York vineyard.			
Parameter	Value	Source	Quality
Total Soil Depth (CORED)	100 cm	PIC	good
Number of Horizons (NHORIZ)	4	PIC	good
First Three Soil Horizons (HORIZN = 1, 2, 3)			
Horizon Thickness (THKNS)	0.2 cm (HORIZN = 1) 9.8 cm (HORIZN = 2) 70 cm (HORIZN = 3)	PIC	good
Bulk Density (BD)	1.25 g $\cdot cm^{-3}$	PIC	good
Initial Water Content (THETO)	0.314cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Soil Drainage Parameter (AD)	0 d^{-1}	PIC	NA
Compartment Thickness (DPN)	0.1 cm (HORIZN =1,2) 1 cm (HORIZN = 3)	standard	
Field Capacity (THEFC)	0.314 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Wilting Point	0.148 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Organic Carbon Content	2.610%	PIC	good
Fourth Soil Horizon (HORIZN = 4)			
Horizon Thickness (THKNS)	20cm	PIC	good
Bulk Density (BD)	1.8 g $\cdot cm^{-3}$	PIC	good
Initial Water Content (THETO)	0.16cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Soil Drainage Parameter (AD)	0 d^{-1}	NA	
Compartment Thickness (DPN)	1 cm	standard	
Field Capacity (THEFC)	0.16 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Wilting Point	0.081 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Organic Carbon Content	0.174%	PIC	good

Appendix D.
PRZM Input Parameters for Coffee County, Georgia Peanut Field

Table D-1. PRZM 2 climate and time parameters for a peanut field in Coffee County, Georgia.

Parameter	Value	Source	Quality
Starting Date*	January 1, 1948		
Ending Date*	December 31, 1983		
Pan Evaporation Factor (PFAC)	0.750	PIC	good
Snowmelt Factor (SFAC)	$0.150\ cm \cdot K^{-1}$	PIC	good
Minimum Depth of Evaporation (ANETD)	30 cm	PIC	good
Average Duration of Runoff Hydrograph (TR)	7.3 h	PIC	good

** These values are in the RUN file rather than the INP file.

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Table D-2. PRZM 2 model state flags for a peanut field in Coffee County, Georgia.	
Parameter	**Value**
Pan Factor Flag (IPEIND)	0
Foliar Application Model Flag FAM)	4
Bulk Density Flag (BDFLAG)	0
Water Content Flag (THFLAG)	0
Kd Flag (KDFLAG)	0
Drainage model flag (HSWZT)	0
Method of characteristics flag (MOC)	0
Irrigation Flag (IRFLAG)	0
Soil Temperature Flag (ITFLAG)	0
Thermal Conductivity Flag (IDFLAG)	0
Biodegradation Flag (BIOFLAG)	0
Partition Coefficient Model (PCMC)	NA
Initial Pesticide Concentration Flag (ILP)	0

Table D-3. Erosion and landscape parameters for a peanut field in Coffee County, Georgia..			
Parameter	**Value**	**Source**	**Quality**
USLE K Factor (USLEK)	0.17 tons EI^{-1*}	PIC	good
USLE LS Factor (USLELS)	0.54	PIC	fair
USLE P Factor (USLEP)	0.5	**	good
Field Area (AFIELD)	10 ha	standard	

* EI = 100 ft-tons * in/ acre*hr
** value represents a field tilled on the countour.

Table D-4. PRZM 2 crop parameters for a peanut field in Coffee County, Georgia.

Parameter	Value			Source	Quality
Initial Crop (INICRP)	1				
Initial Surface Condition (ISCOND)	3			PIC	good
Number of Different Crops (NDC)	1				
Number of Cropping Periods (NCPDS)	36				
Parameters For First Crop (ICNCN = 1)					
Maximum rainfall interception storage of crop (CINTCP)	0.10 cm			PIC	good
Maximum Active Root Depth (AMAXDR)	45 cm			PIC	good
Maximum Canopy Coverage (COVMAX)	80%			PIC	good
Soil surface condition after harvest (ICNAH)	3 (residue)			PIC	good
Date of Crop Emergence (EMD, EMM, IRYEM)	May 1			PIC	good
Datae of Crop Maturity (MAD, MAM, IYRMAT)	September 9			PIC	good
Date of Crop Harvest (HAD, HAM,IYRHAR)	October 1			PIC	good
Maximum crop dry weight (WFMAX)	0 kg $\cdot m^{-2}$			NA	
Maximum canopy height (HTMAX)	unset				
	Fallow	Cropped	Residue		
SCS Curve Number (CN)	91	83	87	PRZM 2 manual	good
USLE C Factor (USLEC)	0.46	0.45	0.46	PRZM 2 manual	good

Table D-5. PRZM 2 soil parameters for a Tifton loamy sand in a peanut field in Coffee County, Georgia.

Parameter	Value	Source	Quality
Total Soil Depth (CORED)	150 cm	PIC	good
Number of Horizons (NHORIZ)	4	PIC*	
First Three Soil Horizons (HORIZN = 1, 2, 3)			
Horizon Thickness (THKNS)	0.2 cm (HORIZN = 1) 9.8 cm (HORIZN = 2) 15 cm (HORIZN = 3)	PIC	good
Bulk Density (BD)	1.3 g $\cdot cm^{-3}$	PIC	good
Initial Water Content (THETO)	0.16 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Soil Drainage Parameter (AD)	0 d^{-1}	PIC	good
Compartment Thickness (DPN)	0.1 cm (HORIZN =1,2) 1 cm (HORIZN = 3)	PIC	good
Field Capacity (THEFC)	0.16 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Wilting Point	0.08 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Organic Carbon Content	0.58%	PIC	good
Fourth Soil Horizon (HORIZN = 4)			
Horizon Thickness (THKNS)	125 cm	PIC	good
Bulk Density (BD)	1.6 g $\cdot cm^{-3}$	PIC	good
Initial Water Content (THETO)	0.317 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Soil Drainage Parameter (AD)	0 d^{-1}	PIC	good
Compartment Thickness (DPN)	5 cm	PIC	good
Field Capacity (THEFC)	0.317 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Wilting Point	0.197 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Organic Carbon Content	0.174%	PIC	good

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Appendix E.
PRZM Input Parameters for Coffee County, Georgia Tobacco Field

Table E-1. PRZM 2 climate and time parameters for a tobacco field in Coffee County, Georgia.

Parameter	Value	Source	Quality
Starting Date*	January 1, 1948		
Ending Date*	December 31, 1983		
Pan Evaporation Factor (PFAC)	0.750	PIC	good
Snowmelt Factor (SFAC)	$0.150\ cm \cdot K^{-1}$	PIC	good
Minimum Depth of Evaporation (ANETD)	17 cm	PIC	good
Average Duration of Runoff Hydrograph (TR)	6.20 h	PIC	good

* These values are in the RUN file rather than the INP file.

Table E-2. PRZM 2 model state flags for tobacco field in Coffee County, Georgia.	
Parameter	Value
Pan Factor Flag (IPEIND)	0
Foliar Application Model Flag FAM)	4
Bulk Density Flag (BDFLAG)	0
Water Content Flag (THFLAG)	0
Kd Flag (KDFLAG)	0
Drainage model flag (HSWZT)	0
Method of characteristics flag (MOC)	0
Irrigation Flag (IRFLAG)	0
Soil Temperature Flag (ITFLAG)	0
Thermal Conductivity Flag (IDFLAG)	0
Biodegradation Flag (BIOFLAG)	0
Partition Coefficient Model (PCMC)	NA
Initial Pesticide Concentration Flag (ILP)	0

Table E-3. Erosion and landscape parameters for a tobacco field in Coffee County, Georgia.			
Parameter	Value	Source	Quality
USLE K Factor (USLEK)	0.24 tons EI^{-1*}	PIC	good
USLE LS Factor (USLELS)	0.33	PIC	fair
USLE P Factor (USLEP)	1.0	standard	
Field Area (AFIELD)	10 ha	standard	
* EI = 100 ft-tons * in/ acre*hr			

Table E-4. PRZM 2 crop parameters for a tobacco field in Coffee County, Georgia.					
Parameter	Value			Source	Quality
Initial Crop (INICRP)	1			PIC	good
Initial Surface Condition (ISCOND)	3			PIC	good
Number of Different Crops (NDC)	1			PIC	
Number of Cropping Periods (NCPDS)	1			PIC	
Parameters For First Crop (ICNCN = 1)					
Maximum rainfall interception storage of crop (CINTCP)	0.10 cm			PIC	good
Maximum Active Root Depth (AMAXDR)	45.0 cm			PIC	good
Maximum Canopy Coverage (COVMAX)	80%			PIC	good
Soil surface condition after harvest (ICNAH)	3 (residue)			PIC	good
Date of Crop Emergence (EMD, EMM, IRYEM)	April 11			PIC	good
Datae of Crop Maturity (MAD, MAM, IYRMAT)	July 6			PIC	good
Date of Crop Harvest (HAD, HAM,IYRHAR)	July 16			PIC	good
Maximum crop dry weight (WFMAX)	0 kg $\cdot m^{-2}$			NA	
Maximum canopy height (HTMAX)	not set				
	Fallow	Cropped	Residue		
SCS Curve Number (CN)	91	85	88	PRZM 2 manual	good
USLE C Factor (USLEC)	0.41	0.41	0.41	PIC	good

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Table E-5. PRZM 2 soil parameters for a Dunbar sandy loam in a tobacco field in Coffee County, Georgia .			
Parameter	Value	Source	Quality
Total Soil Depth (CORED)	100 cm	PIC	good
Number of Horizons (NHORIZ)	5	PIC*	good
First Three Soil Horizons (HORIZN = 1, 2, 3)			
Horizon Thickness (THKNS)	0.2 cm (HORIZN = 1) 9.8 cm (HORIZN = 2) 15 cm (HORIZN = 3)	PIC	good
Bulk Density (BD)	1.7 g $\cdot cm^{-3}$	PIC	good
Initial Water Content (THETO)	0.209 cm^3-H_2O $\cdot cm^3$-soil	standard	
Soil Drainage Parameter (AD)	0 d^{-1}	PIC	
Compartment Thickness (DPN)	0.1cm (HORIZN = 1,2) 1 cm (HORIZN = 3)	standard	
Field Capacity (THEFC)	0.209 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Wilting Point	0.069 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Organic Carbon Content	3.48%	PIC	good
Fourth Soil Horizons (HORIZN = 4)			
Horizon Thickness (THKNS)	54 cm	PIC	good
Bulk Density (BD)	1.8 g $\cdot cm^{-3}$	PIC	good
Initial Water Content (THETO)	0.302 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Soil Drainage Parameter (AD)	0 d^{-1}	NA	
Compartment Thickness (DPN)	1cm		
Field Capacity (THEFC)	0.209 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Wilting Point	0.069 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Organic Carbon Content	0.174%	PIC	good
Fifth Soil Horizon (HORIZN = 5)			
Horizon Thickness (THKNS)	8 cm	PIC	good
Bulk Density (BD)	1.8 g $\cdot cm^{-3}$	PIC	good
Initial Water Content (THETO)	0.195 cm^3-H_2O $\cdot cm^3$-soil	standard	–
Soil Drainage Parameter (AD)	0 d^{-1}	NA	
Compartment Thickness (DPN)	1 cm		
Field Capacity (THEFC)	0.195 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Wilting Point	0.55 cm^3-H_2O $\cdot cm^3$-soil	PIC	good
Organic Carbon Content	0.116%	PIC	good

Appendix F
EXAMS Scenario Input Parameters

Table F-1. EXAMS II pond geometry for standard pond.		
	Littoral	Benthic
Area (AREA)	10000 m^2	10000 m^2
Depth (DEPTH)	2 m	0.05 m
Volume (VOL)	20000 m^3	500 m^3
Length (LENG)	100 m	100 m
Width (WIDTH)	100 m	100 m

Table F-2. EXAMS II dispersive transport parameters between benthic and littoral layers in each segment for standard pond.

Parameter	Pond*	Stream 1**	Stream 2***
Turbulent Cross-section (XSTUR)	10000 m^2	300 m^2	1200 m^2
Characteristic Length (CHARL)	1.01, 1.025 m	0.275 m	0.275 m
Dispersion Coefficient for Eddy Diffusivity (DSP)	3.0×10^{-5}	3.0×10^{-5}	3.0×10^{-5}

* JTURB = 1, ITURB = 2; ** JTURB = 3, ITURB = 4; *** JTURB = 5, ITURB = 6

Table F-3. EXAMS II sediment properties for standard pond.

	Littoral	Benthic
Suspended Sediment (SUSED)	30 mg L^{-1}	
Bulk Density (BULKD)		1.85 g cm^{-3}
Per cent Water in Benthic Sediments (PCTWA)		137%
Fraction of Organic Matter (FROC)	0.04	0.04

Table F-4. EXAMS II external environmental parameters for standard pond.

Precipitation (RAIN)	90 mm $\cdot$month^{-1}
Atmospheric Turbulence (ATURB)	2.00 km
Evaporation Rate (EVAP)	90 mm $\cdot$month^{-1}
Wind Speed (WIND)	1 m $\cdot$sec^{-1}
Air Mass Type (AMASS)	Rural (R)

Table F-5. EXAMS II biological characterization parameters for standard pond.		
Parameter	Limnic	Benthic
Bacterial Plankton Population Density (BACPL)	1 cfu $\cdot cm^{-3}$	
Benthic Bacteria Population Density (BNBAC)		37 cfu $\cdot(100\ g)^{-1}$
Bacterial Plankton Biomass (PLMAS)	0.40 mg $\cdot L^{-1}$	
Benthic Bacteria Biomass (BNMAS)		$6.0x10^{-3}$ g $\cdot m^{-2}$

Table F-6. EXAMS water quality parameters for standard pond.	
Parameter	Value
Optical path length distribution factor (DFAC)	1.19
Dissolved organic carbon (DOC)	5 mg $\cdot L^{-1}$
chlorophylls and pheophytins (CHL)	$5x10^{-3}$ mg $\cdot L^{-1}$
pH (PH)	7
pOH (POH)	7

Table F-7. EXAMS mean monthly water temperatures and location parameters for a cotton field pond in Yazoo County, Missisippi.	
Month	Temperature (Celsius)
January	6
February	9
March	12
April	16
May	20
June	24
July	26
August	28
September	25
October	18
November	13
December	10
Latitude	34° N
Longitude	83° W

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Table F-8. EXAMS mean monthly water temperatures for peach orchard pond, Peach County, Georgia.	
Month	Temperature (Celsius)
January	7.19
February	8.75
March	12.60
April	17.26
May	12.78
June	21.67
July	25.33
August	27.03
September	26.56
October	23.51
November	17.52
December	12.11
Latitude	34° N
Longitude	83° W

Table F-9. EXAMS mean monthly water temperatures for grape vineyard pond, Chautauqua County, New York.	
Month	Temperature (Celsius)
January	0
February	0
March	0
April	6.9
May	13.03
June	18.03
July	20.65
August	19.62
September	15.44
October	9.59
November	3.47
December	0
Latitude	42° N
Longitude	78° W

Table F-10. EXAMS mean monthly water temperatures for a tobacco field pond, Coffee County, Georgia.	
Month	**Temperature (Celsius)**
January	8.32
February	10.14
March	13.80
April	19.37
May	22.51
June	26.18
July	27.60
August	27.74
September	24.66
October	18.70
November	12.89
December	9.41
Latitude	31° N
Longitude	82.5° W

Appendix G.
Statistical Analysis For the Relationship Between Fenamiphos Fruendlich K_f Values and Soil Organic Carbon Content

Data

Organic Carbon %	Adsorption Kf	Desorption Kf
0.580	2.860	2.612
0.638	0.959	0.683
1.682	3.457	4.294
1.276	1.980	1.471

Regression Statistics

Multiple R	0.549
R Square	0.301
Adjusted R Square	-0.048
Standard Error	1.114
Observations	4

Organic Carbon vs Adsorption

Analysis of Variance

	df	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	1.070	1.070	0.862	0.451
Residual	2	2.483	1.242		
Total	3	3.554			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95.00%*	*Upper 95.00%*
Intercept	1.136	1.385	0.820	0.472	-4.825	7.097
x1	1.128	1.215	0.928	0.422	-4.100	6.356

Organic Carbon vs Desorption

Regression Statistics

Multiple R	0.639
R Square	0.409
Adjusted R Square	0.113
Standard Error	1.476
Observations	4

Analysis of Variance

	df	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	3.013	3.013	1.382	0.361
Residual	2	4.359	2.180		
Total	3	7.372			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95.00%*	*Upper 95.00%*
Intercept	0.289	1.836	0.157	0.885	-7.609	8.187
x1	1.893	1.610	1.176	0.325	-5.034	8.819

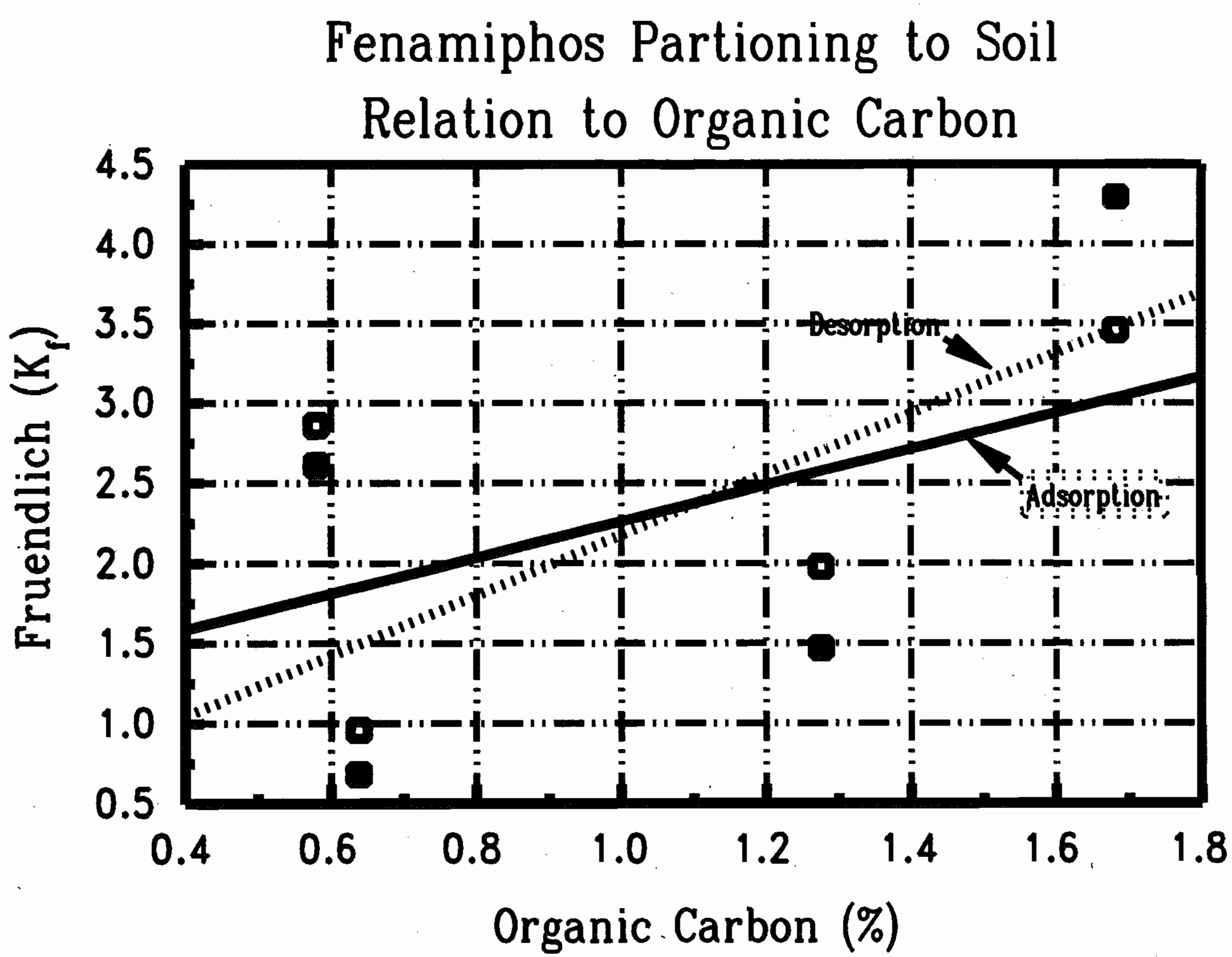

Figure G-1. Dependence of adsorption and desorption K_f values on the organic carbon content of the soil. There is is no statitiscally significant relationship of either adsorption or desorption to organic carbon content.

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Appendix I
Input File Names

Table I-1. Input files archived for fenamiphos Tier 2 EECs.		
File Name	Date	Description
MET131.MET	March 22 1991	MRLA O131 weather data
MET133A.MET	March 22, 1991	MLRA P133A weather data
MET137.MET	March 22, 1991	MLRA 137 weather data, used for Georgia peach scenario
MET140.MET	March 22, 1991	MLRA R140 weather data
MET153A.MET	March 22, 1991	MLRA 153A weather data
O134POND.EXV	February 5, 1993	Pond data for MLRA O134
P133APND.EXV	August 6, 1996	Pond data for MLRA P133A
R140POND.EXV	August 7, 1996	Pond data for MLRA R140
GAPEACH.EXV	March 21, 1995	Pond data for Peach County, Georgia.
T153APND:EXV	August 7, 1996	Pond data for MLRA 153A
FENMFOS1.EXC	August 28, 1996	fenamiphos chemistry data for EXAMS peach simulation
FENMFOS2.EXC	August 27, 1996	fenamiphos chemistry data for EXAMS cotton simulation
FENMFOS3.EXC	August 27, 1996	fenamiphos chemistry data for EXAMS tobacco simulation
FENMFOS4.EXC	August 27, 1996	fenamiphos chemistry data for EXAMS grapes simulation
FENMFOS5.EXC	August 27, 1996	fenamiphos chemistry data for EXAMS peanuts simulation
Input Data File Sets*		
CT134E00	CFG: August 6, 1996 INP: August 27, 1996 RUN: August 5, 1996	Files set for Nemacur 3 on cotton
GR140F00	CFG: August 7, 1996 INP: August 27, 1996 RUN: August 7, 1996	File set for Nemacur 3 on grapes
PH133C00	CFG: August 6, 1996 INP: August 28, 1996 RUN: August 5, 1996	File set for Nemcaur 3 use on peaches
PN153C00	CFG: August 7, 1996 INP: August 27, 1996 RUN: August 7, 1996	File set for Nemacur 3 use on peanuts
TB133C00	CFG: August 7, 1996 INP: August 27, 1996 RUN: August 7, 1996	File set for Nemacur 3 use on tobacco

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* File sets consist of a run configuration (CFG) file, a PRZM 2 input (INP) file, a PRZM 2 run (RUN).

cc: Laura Parsons
reading file

EEC Modelling Summary

Chemical Common Name	fenamiphos
PC Code	100601
Formulation	Nemacur 3
Registration Number	3125-283
Runoff Model	PRZM 2.3
Receiving Water Model	EXAMS II
Registrant(s)	Bayer, Inc.
Modeller	R. David Jones
Date	August 27, 1996
Chemical Parameters	
Hydrolysis Half-Life - pH 5	247 d
Hydrolysis Half-Life - pH 7	300 d
Hydrolysis Half-Life - pH 9	231 d
Aqueous Photolysis Half-Life	0 d
Aerobic Soil Half-Life	13.2 d
Anaerobic Soil Half-Life	366 d
Solubility	400 mg $\cdot L^{-1}$
Vapor Pressure	1.3 x 10^{-6} torr
Henry's Law Constant	9.97 x 10^{-10} atm m^3 mol^{-1}

Location	
Crop	cotton
County	Yazoo
State	Mississippi
MLRA	O-134
Soil Series	Loring
Soil Texture	silt loam
Site Justification: reasonable high exposure scenario for cotton	
Management	
Application Method	ground spray
Crop Emergence Date	May 1
Crop Maturity Date	September 7
Crop Harvest Date	September 22
Spray Drift Per Cent	1%
Pesticide Application	
Application Rate	3 lb/acre
Application Dates	April 12
Application Justification: maximum application rate and number for Nemacur 3	
Results - 10 Year Return (10% Exceedence) EEC's	
Maximum	112 $\mu g \cdot L^{-1}$
96 Hour	107 $\mu g \cdot L^{-1}$
21 Day	92.1 $\mu g \cdot L^{-1}$
60 Day	62.4 $\mu g \cdot L^{-1}$
90 Day	46.7 $\mu g \cdot L^{-1}$
Average Yearly Rainfall	147 cm
Average Yearly Runoff	44.9 cm
Average Erosion Rate	126 Mg
Loading Breakdown:	
Runoff	95.7%
Erosion	0.9%
Spray Drift	3.4%

Chemical Common Name	fenamiphos
PC Code	100601
Formulation	Nemacur 3
Registration Number	3125-283
Runoff Model	PRZM 2.3
Receiving Water Model	EXAMS II
Registrant(s)	Bayer, Inc.
Modeller	R. David Jones
Date	August 28, 1996
Chemical Parameters	
Hydrolysis Half-Life - pH 5	247 d
Hydrolysis Half-Life - pH 7	300 d
Hydrolysis Half-Life - pH 9	231 d
Aqueous Photolysis Half-Life	0 d
Aerobic Soil Half-Life	13.2 d
Anaerobic Soil Half-Life	366 d
Solubility	400 mg $\cdot L^{-1}$
Vapor Pressure	1.3 x 10^{-6} torr
Henry's Law Constant	9.97 x 10^{-10} atm m^3 mol^{-1}

Location	
Crop	grapes
County	Chautauqua
State	New York
MLRA	R140
Soil Series	Bath
Soil Texture	loam
Site Justification: reasonable high exposure scenario for grapes	
Management	
Application Method	ground spray
Crop Emergence Date	January 20 , 1948
Crop Maturity Date	September 22, 1948
Crop Harvest Date	October 10, 1983
Spray Drift Per Cent	1%
Pesticide Application	
Application Rate	6 lb/acre
Application Dates	May 20
Application Justification: maximum application rate and number for Nemacur 3.	
Results - 10 Year Return (10% Exceedence) EEC's	
Maximum	6.5 $\mu g \cdot L^{-1}$
96 Hour	6.1 $\mu g \cdot L^{-1}$
21 Day	5.0 $\mu g \cdot L^{-1}$
60 Day	3.6 $\mu g \cdot L^{-1}$
90 Day	2.9 $\mu g \cdot L^{-1}$
Average Yearly Rainfall	92.9 cm
Average Yearly Runoff	2.8 cm
Average Erosion Rate	0.3 Mg
Loading Breakdown:	
Runoff	30.5%
Erosion	0%
Spray Drift	69.5%

Chemical Common Name	fenamiphos
PC Code	100601
Formulation	Nemacur 3
Registration Number	3125-283
Runoff Model	PRZM 2.3
Receiving Water Model	EXAMS II
Registrant(s)	Bayer, Inc.
Modeller	R. David Jones
Date	August 27, 1996
Chemical Parameters	
Hydrolysis Half-Life - pH 5	247 d
Hydrolysis Half-Life - pH 7	300 d
Hydrolysis Half-Life - pH 9	231 d
Aqueous Photolysis Half-Life	0 d
Aerobic Soil Half-Life	13.2 d
Anaerobic Soil Half-Life	366 d
Solubility	400 mg $\cdot L^{-1}$
Vapor Pressure	1.3 x 10^{-6} torr
Henry's Law Constant	9.97 x 10^{-10} atm m^3 mol^{-1}

Location	
Crop	peaches
County	Peach
State	Georgia
MLRA	P133A
Soil Series	Boswell
Soil Texture	sandy loam
Site Justification: reasonable high exposure scenario for peaches	
Management	
Application Method	ground spray
Crop Emergence Date	April 10, 1950
Crop Maturity Date	May 15, 1950
Crop Harvest Date	December 31, 1983
Spray Drift Per Cent	1%
Pesticide Application	
Application Rate	3.75 lb/acre
Application Dates	March 21
Application Justification: maximum number of applications and rate for Nemacur 3 on peaches	
Results - 10 Year Return (10% Exceedence) EEC's	
Maximum	18.2 $\mu g \cdot L^{-1}$
96 Hour	17.5 $\mu g \cdot L^{-1}$
21 Day	14.8 $\mu g \cdot L^{-1}$
60 Day	10.6 $\mu g \cdot L^{-1}$
90 Day	8.3 $\mu g \cdot L^{-1}$
Average Yearly Rainfall	110 cm
Average Yearly Runoff	7.2 cm
Average Erosion Rate	6.1 Mg
Loading Breakdown:	
Runoff	80.5%
Erosion	0%
Spray Drift	19.5%

Chemical Common Name	fenamiphos
PC Code	100601
Formulation	Nemacur 3
Registration Number	3125-283
Runoff Model	PRZM 2.3
Receiving Water Model	EXAMS II
Registrant(s)	Bayer, Inc.
Modeller	R. David Jones
Date	August 27, 1996
Chemical Parameters	
Hydrolysis Half-Life - pH 5	247 d
Hydrolysis Half-Life - pH 7	300 d
Hydrolysis Half-Life - pH 9	231 d
Aqueous Photolysis Half-Life	0 d
Aerobic Soil Half-Life	13.2 d
Anaerobic Soil Half-Life	366 d
Solubility	400 mg $\cdot L^{-1}$
Vapor Pressure	1.3 x 10^{-6} torr
Henry's Law Constant	9.97 x 10^{-10} atm m^3 mol^{-1}

Location	
Crop	peanutss
County	Coffee
State	Georgia
MLRA	P 153A
Soil Series	Tifton
Soil Texture	loamy sand
Site Justification: reasonable high exposure scenario for peanuts	
Management	
Application Method	ground spray
Crop Emergence Date	May 1
Crop Maturity Date	September 16,
Crop Harvest Date	October 1
Spray Drift Per Cent	1%
Pesticide Application	
Application Rate	3 lb/acre
Application Dates	April 20
Application Justification: maximum application rate and number for Nemacur 3	
Results - 10 Year Return (10% Exceedence) EEC's	
Maximum	14.9 $\mu g \cdot L^{-1}$
96 Hour	14.2 $\mu g \cdot L^{-1}$
21 Day	11.3 $\mu g \cdot L^{-1}$
60 Day	11.3 $\mu g \cdot L^{-1}$
90 Day	7.3 $\mu g \cdot L^{-1}$
Average Yearly Rainfall	136.4 cm
Average Yearly Runoff	16.1 cm
Average Erosion Rate	37.9 Mg
Loading Breakdown:	
Runoff	79.7%
Erosion	0%
Spray Drift	20.3%

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Chemical Common Name	fenamiphos
PC Code	100601
Formulation	Nemacur 3
Registration Number	3125-283
Runoff Model	PRZM 2.3
Receiving Water Model	EXAMS II
Registrant(s)	Bayer, Inc.
Modeller	R. David Jones
Date	August 27, 1996
Chemical Parameters	
Hydrolysis Half-Life - pH 5	247 d
Hydrolysis Half-Life - pH 7	300 d
Hydrolysis Half-Life - pH 9	231 d
Aqueous Photolysis Half-Life	0 d
Aerobic Soil Half-Life	13.2 d
Anaerobic Soil Half-Life	366 d
Solubility	400 mg $\cdot L^{-1}$
Vapor Pressure	1.3 x 10^{-6} torr
Henry's Law Constant	9.97 x 10^{-10} atm m^3 mol^{-1}

Location	
Crop	tobacco
County	Coffee
State	Georgia
MLRA	P133A
Soil Series	Dunbar
Soil Texture	sandy loam
Site Justification: reasonable high exposure scenario for tobacco	
Management	
Application Method	ground spray
Crop Emergence Date	April 11
Crop Maturity Date	July 6
Crop Harvest Date	July 16
Spray Drift Per Cent	1%
Pesticide Application	
Application Rate	6 lb/acre
Application Dates	March 28
Application Justification: Maximum number of applications and rate for Nemacur 3 on tobacco.	
Results - 10 Year Return (10% Exceedence) EEC's	
Maximum	60.7 $\mu g \cdot L^{-1}$
96 Hour	57.8 $\mu g \cdot L^{-1}$
21 Day	47.8 $\mu g \cdot L^{-1}$
60 Day	31.4 $\mu g \cdot L^{-1}$
90 Day	23.2 $\mu g \cdot L^{-1}$
Average Yearly Rainfall	129 cm
Average Yearly Runoff	17.6 cm
Average Erosion Rate	69.7 Mg
Loading Breakdown:	
Runoff	86.9%
Erosion	0.1%
Spray Drift	13%

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Attachment 2

DP BARCODE: D229077 REREG CASE # 0333

CASE: 819346 DATA PACKAGE RECORD DATE: 09/09/96
SUBMISSION: S510350 BEAN SHEET Page 1 of 1

* * * CASE/SUBMISSION INFORMATION * * *

CASE TYPE: REREGISTRATION ACTION: 623 INITIATE RED CHAPTER
CHEMICALS: 100601 Fenamiphos

ID#: 100601
COMPANY:
PRODUCT MANAGER: 51 KATHLEEN DEPUKAT 703-308-8587 ROOM: CS1 4F6
PM TEAM REVIEWER: RON KENDALL 703-308-8068 ROOM: CS1 4L3
RECEIVED DATE: 08/12/96 DUE OUT DATE: 09/11/96

* * * DATA PACKAGE INFORMATION * * *

DP BARCODE: 229077 EXPEDITE: Y DATE SENT: 08/22/96 DATE RET.: / /
CHEMICAL: 100601 Fenamiphos
DP TYPE: 102 Phase V Review
CSF: N LABEL: N

ASSIGNED TO	DATE IN	DATE OUT	
DIV : EFED	08/26/96	9/26/96	ADMIN DUE DATE: 09/21/96
BRAN: EFGB	08/28/96	/ /	NEGOT DATE: / /
SECT: SWS	08/28/96	/ /	PROJ DATE: / /
REVR : DJONES	08/28/96	09/09/96	
CONTR:	/ /	/ /	

* * * DATA REVIEW INSTRUCTIONS * * *

PLease coordinate revisions to the EFED RED section with SACs

* * * DATA PACKAGE EVALUATION * * *

No evaluation is written for this data package

* * * ADDITIONAL DATA PACKAGES FOR THIS SUBMISSION * * *

DP BC	BRANCH/SECTION	DATE OUT	DUE BACK	INS	CSF	LABEL
229075	SACS/IO	08/22/96	09/21/96	Y	N	N
229076	EEB/RS1	08/22/96	09/21/96	Y	N	N
229078	EFGB/GTS	08/22/96	09/21/96	Y	N	N
229079	EFGB/CRS1	08/22/96	09/21/96	Y	Y	Y