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MEMORANDUM

SUBJECT: Drinking Water Assessment for the Registration Review of Terbufos

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This memorandum provides the estimated drinking water concentrations (EDWC) of terbufos and its two major oxidative degradates, terbufos sulfoxide and terbufos sulfone in surface water and groundwater in support of the human health risk assessment. Primarily formulated as granules, terbufos is applied at-planting, post emergent, or at cultivation to control many types of insect pests. Application procedures for terbufos require varying degrees of soil incorporation of terbufos. Registered use sites include corn (field, sweet, and popcorn), sugar beet, and sorghum. The maximum application rates are for corn 1.3 lbs a.i./A, for sorghum 1.68 lbs a.i./A, and for

sugar beet 1.98 lbs a.i/A. Terbufos applications are limited to one application per year for each crop.

This drinking water assessment was performed using a parent only approach (terbufos) as well as a total toxic residue approach (TTR; i.e. parent plus terbufos sulfoxide and terbufos sulfone), as recommended by the Residues of Concern Knowledgebase Subcommittee (ROCKS) of the Health Effects Division (US EPA 2014; DP417464). The surface water and groundwater modeling were conducted according to labeled use directions, which listed a maximum annual application rate of 1.30 lbs. a.i./A to 1.98 lbs a.i/A for various crops. Modeling for the ground application used the coupled models PRZM and EXAMS for surface water and SCI-GROW as well as PRZM-GW for groundwater. Recommended EDWCs for terbufos and total toxic residues of terbufos in surface water and groundwater are summarized in **Table 1.**

Table 1. Recommended EDWCs for Drinking Water Risk Assessment for Terbufos and its Degradates

Source of Drinking Water	Estimated Drinking Water Concentration (µg/L)		
	1-in-10-year Peak Exposure	1-in-10-year Annual Mean Exposure	30-year Mean Exposure
Total Toxic Residues of Terbufos (Terbufos plus Terbufos Sulfoxide and Terbufos Sulfone)			
Surface Water [a,b]	63.06	11.53	6.13
Groundwater [c]	33.54	--	14.02
Terbufos (Parent only)			
Surface Water [b,d]	46.02	0.28	0.12
Groundwater [e]	0.02	0.02	0.02

[a] EDWCs based on PRZM/EXAMS model and residue summation method for TX Sorghum OP Scenario
[b] PCA adjusted modeled values
[c] Highest EDWCs based summation of terbufos, terbufos sulfoxide and terbufos sulfone derived from PRZM-GW model for Delmarva scenario
[d] EDWCs based on PRZM/EXAMS model for parent terbufos alone for MS corn STD Scenario
[e] EDWCs for parent terbufos were derived from SCI-GROW model

Drinking Water Exposure Modeling

Surface Water

A Tier II drinking water assessment was performed using PRZM (v3.12.2)/EXAMS (v. 2.98.04.06) modeling with the index reservoir scenario. The EDWCs were generated for the parent only and for terbufos parent plus its two major degradates, terbufos sulfoxide and terbufos sulfone (TTR approach). Available environmental fate data for terbufos and individual degradates were used in exposure assessments. For the TTR approach, the residue summation method was used in estimating concentrations for individual residues of concern, which were then summated to represent the TTRs. Description of the residue summation method can be found in the document related to the methods for assessing ecological risks of pesticides with persistent, bioaccumulative and toxic characteristics (USEPA, 2008). Application rates for transformation products were adjusted to account for the parent and the normalized maximum percentage of transformation product formed as well as for molecular weight ratios of parent to the metabolite. The two scenarios with the highest EDWCs for the parent (i.e. MS corn STD and TX Sorghum OP scenarios) were simulated to generate EDWCs for the TTR. Post-processing of

estimated EDWCs generated for terbufos and its degradates was applied using EXCEL spreadsheet software in estimating the 1-in-10 year exposure concentrations for TTR.

The Pesticide Root Zone Model, (PRZM, Carsel *et al*. 1997) and the Exposure Analysis Modeling System (EXAMS, Burns 2000) were used in tandem to generate surface water EDWCs. PRZM (3.12.2 dated May 12, 2005) simulates fate and transport on the agricultural land whereas EXAMS (2.98.04.06, dated April 25, 2005) simulates the fate and resulting daily concentrations in the water body. Simulations were carried out with the linkage program shell, PE5V01.pl (dated November 15, 2006), which incorporates the standard agricultural scenarios developed by the Environmental Fate and Effects Division (EFED). The PRZM model simulates pesticide movement and transformation from crop application through soil residue processes. The EXAMS model simulates pesticide loading via runoff, erosion, and spray drift assuming a standard watershed of 172.8 ha that drains into an adjacent standard drinking water index reservoir of 5.26 ha with an average depth of 2.74 m. A more detailed description of the index reservoir watershed can be found in Jones *et al.*, 1998. Standard percent cropped areas (PCA) were used for proposed uses as estimates of the extent of watershed on which crops are grown. The default PCA of 0.91 was used for the proposed uses because currently terbufos can be used in agricultural settings only (USEPA 2012b).

PRZM/EXAMS input parameters are shown in **Tables 3**, **4** and **5** for the parent, terbufos sulfoxide and terbufos sulfone, respectively. Simulations are run for multiple (usually 30) years, and the EDWCs represent peak values that are expected once every ten years based on the thirty years of daily values generated during the simulation. Sample outputs and results of PRZM/EXAMS modeling are provided in **Appendix B**. The EDWCs for the parent and TTRs are provided in **Table 6**. PRZM/EXAMS generated "time series" files of terbufos for MS corn STD and TTR for TX sorghum OP scenarios are also attached in **Appendix B.** Additional information on these models can be found at: http://www.epa.gov/oppefed1/models/water/index.htm.

Table 3. PRZM/EXAMS Input Parameters for Terbufos

Parameter	Input Value	Source	Comment
Application Rate	Corn: 1.30 lbs a.i/A Sorghum: 1.68 lbs a.i./ Sugar beet: 1.98 lbs a.i/A	EPA Reg # 241-314 EPA Reg# 5481-562	These are maximum application rates for specified crops
Number of application/year	1	EPA Reg # 241-314 EPA Reg# 5481-562	Label directions
Application method	Ground	Current Labels	Label directions
CAM	6	PRZM Manual	To simulate subsurface incorporation of applied terbufos
Depth of Incorporation	1 inch	Current labels	Label direction for corn. For sorghum and sugar beet, incorporation depths were assumed based on seeding depths.

Table 3. PRZM/EXAMS Input Parameters for Terbufos			
Parameter	**Input Value**	**Source**	**Comment**
Use Site Scenario and Application Date (Month-Date)	**Corn** CA corn OP (04-01) IA corn STD (05-25 IL corn STD (05-01) IN corn STD (05-15) KS corn STD (05-10) MN corn STD (05-15) MS corn STD (04-10) NC CornE STD (04-15) NC CornW OP (04-25) ND Corn OP (05-05) NE corn STD (05-25) OH corn STD (05-01) PA corn STD (04-16) TX corn OP (03-16) FL sweetcorn OP (10-16) OR Sweetcorn OP (05-16) **Suger beets** CA Sugar Beet Wirrg OP (02-01) MN Sugar Beet STD (05-16) **Sorghum** KS Sorghum STD (05-20) TX Sorghum OP (05-10)	Label directions and available scenarios	The following scenarios were used in generating EDWCs. **Corn** 11 standard and 5 organo phosphate specific scenarios **Suger beets** 1 standard and 1 organo phosphate specific scenarios **Sorghum** 1 standard and 1 organo phosphate specific scenarios
Spray drift fraction	Not applicable	EFED Guidance (US 2013)	---
Molecular weight	288.4 g/mole	MRID 4104495-02	---
Solubility in water 25 °C)	5.4 mg/L	MRID 4104495-02	---
Vapor pressure	6.6E-04 (mmHg @25°C)	MRID 4104495-02	Additional parameters such as **DAIR** and **Enthalpy** were used for semi-volatile characteristic of terbufos
Henry's Law constant (20 °C)	2.46E-05 atm.m^3 /mol	Footprint	
DAIR	3372 cm^2/s	Estimated	Schwarzenbach et al, 1993
Enthalpy	12.88	http://www.chemicalbook.com/	MSDS for terbufos
Hydrolysis ($t_{1/2}$)[1]	1.5 days @ 25°C @ pH 7	MRID 44862501	Appendix A contains DT_{50} calculations
Aquatic photolysis ($t_{1/2}$)[1]	1.77 days	MRIDs 00161567 and 41181101	Appendix A contains DT_{50} calculations
Aerobic soil metabolism ($t_{1/2}$)[1]	14.7 days	MRIDs 00156853 and 41749801	Appendix A contains DT_{50} calculations. The 90% of the upper confidence limit (UCL) of the mean metabolism half-life[2].
Aerobic aquatic metabolism ($t_{1/2}$)[1]	36.2 days	MRID 44672004	

Table 3. PRZM/EXAMS Input Parameters for Terbufos			
Parameter	**Input Value**	**Source**	**Comment**
Anaerobic aquatic metabolism ($t_{1/2}$)	Stable[2]	---	Since terbufos is sensitive to hydrolytic degradation, anaerobic aerobic aquatic metabolism was assumed stable according to Input Parameter Guidance (USEPA 2009)[2]
Partition coefficient K_d	11.11 mL/g	MRID 41373604	Represent average K_d for 4 soils
[1] DT_{50s} were recalculated using NAFTA Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media (USEPA 2012). Appendix A contains revised estimated half-lives. [2] http://www.epa.gov/oppefed1/models/water/input_parameter_guidance.htm			

Table 4. PRZM/EXAMS Input Parameters for Terbufos Sulfoxide			
Parameter	**Input Value**	**Source**	**Comment**
Use Site Scenario[1] and Application (Month-Day)	**Corn** MS corn STD (05-10) **Sorghum** TX Sorghum OP (06-10)	---	Application dates were adjusted based on maximum terbufos sulfoxide formation in laboratory study
Application Rate	Corn: 0.72 lbs Sorghum: 0.93 lbs Sugar beet: 1.08 lbs	Estimated	See sample calculations below[2]
Number of applications per year	1	EPA Reg # 241-314 EPA Reg# 5481-562	---
Application method	Ground	---	Degradation product of terbufos
CAM	1	---	
Spray drift fraction	Not applicable	---	
Molecular weight	304.42 g/mole	EPISUITE 4.1	---
Solubility in water 25 °C)	3214 mg/L	MRIDS 44672001 and 44672002	Solubility of terbufos sulfoxide is higher terbufos
Vapor pressure	3.42E-05 (mmHg @25°C)	EPISUITE 4.1	Estimated using EPISUITE model
Henry's Law constant (25 °C)	9.13E-08 atm.m^3 /mol	EPISUITE 4.1	
Hydrolysis ($t_{1/2}$)	65.1 days @ 25°C	MRID 44862501	---
Aquatic photolysis ($t_{1/2}$)	Stable	---	In absence of data, assumed stable according to Input Parameter Guidance (USEPA 2009)[3]
Aerobic soil metabolism ($t_{1/2}$)	136 x 3 (408 days)	MRIDs 00156853	Single value is available. 3X was used according to Input Parameter Guidance (USEPA 2009)[3]

Table 4. PRZM/EXAMS Input Parameters for Terbufos Sulfoxide			
Parameter	**Input Value**	**Source**	**Comment**
Aerobic aquatic metabolism ($t_{1/2}$)	Stable	---	In absence of data, assumed stable
Anaerobic aquatic metabolism ($t_{1/2}$)	Stable	---	Since terbufos sulfoxide is sensitive to hydrolytic degradation, anaerobic aerobic aquatic metabolism was assumed stable according to Input Parameter Guidance (USEPA 2009)[3]
Partition coefficient K_d	1.12 mL/g	MRID 41373604	Represent average K_d for 4 soils
[1] The highest EDWCs for parent (i.e. MS corn STD and TX Sorghum OP scenarios) were used for generating TTR EDWCs [2]Terbufos Sulfoxide application rate = Terbufos application rate of [1.30 lbs x (0.523, the maximum conversion rate from the degradation of terbufos to terbufos sulfoxide in laboratory studies) x (1.055, the molecular weight ratio of terbufos sulfoxide to terbufos] [3]= http://www.epa.gov/oppefed1/models/water/input_parameter_guidance.htm			

Table 5. PRZM/EXAMS Input Parameters for Terbufos Sulfone			
Parameter	**Input Value**	**Source**	**Comment**
Use Site Scenario[1] and Application (Month-Day)	**Corn** MS corn STD (06-10) **Sorghum** TX Sorghum OP (07-10)	---	Application dates were adjusted based on maximum terbufos sulfone formation in the laboratory study
Application Rate[1]	Corn: 0.29 lbs Sorghum: 0.38 lbs Sugar beet: 0.44 lbs	Estimated	See a sample calculations below[2]
Number of applications per year	1	EPA Reg # 241-314 EPA Reg# 5481-562	
Application method	Ground	---	Degradation product of terbufos
CAM	1		
Spray drift fraction	Not applicable	---	
Molecular weight	320.42 g/mole	EPISUITE 4.1	---
Solubility in water 25 °C)	407 mg/L	MRIDS 44672001 and 44672002	More soluble than terbufos
Vapor pressure	7.88E-06 (mmHg @25°C)	EPISUITE 4.1	Estimated using EPISUITE model
Henry's Law constant (25 °C)	4.10E-08 atm.m^3 /mol	EPISUITE 4.1	
Hydrolysis ($t_{1/2}$)	43.8 days @ 25°C	MRID 444862501	
Aquatic photolysis ($t_{1/2}$)	Stable	---	Assumed stable

Table 5. PRZM/EXAMS Input Parameters for Terbufos Sulfone			
Parameter	**Input Value**	**Source**	**Comment**
Aerobic soil metabolism ($t_{1/2}$)	174 x 3 (522 days)	MRIDs 00156853	Single value is available. 3X was used according to Input Parameter Guidance (USEPA 2009)[2]
Aerobic aquatic metabolism ($t_{1/2}$)	Stable	----	In absence of data, assumed stable according to Input Parameter Guidance (USEPA 2009)[3]
Anaerobic aquatic metabolism ($t_{1/2}$)	Stable	---	Since terbufos sulfoxide is sensitive to hydrolytic degradation, anaerobic aerobic aquatic metabolism is assumed stable according to Input Parameter Guidance (USEPA 2009)[3]
Partition coefficient K_d	1.26 mL/g	MRID 41373604	Represent average K_d for 4 soils

[1]The highest EDWCs for parent (i.e. MS corn STD and TX Sorghum OP scenarios) were used for generating TTR EDWCs

[2]Terbufos Sulfone application rate = Terbufos application rate of [1.30 lbs x (0.201, the maximum conversion rate from the degradation of terbufos to terbufos sulfone in laboratory studies) x (1.11, the molecular weight ratio of terbufos sulfoxide to terbufos]

[3] http://www.epa.gov/oppefed1/models/water/input_parameter_guidance.htm

Table 6. Surface Water EDWCs for Drinking Water Risk Assessment for Terbufos and its Total Toxic Residue			
Senarios	**Estimated Drinking Water Concentration (µg/L)**		
	1-in-10-year Peak Exposure	**1-in-10-year Annual Mean Exposure**	**30-year Mean Exposure**
Parent only			
CA corn OP	2.49	0.02	0.00
IA corn STD	15.58	0.12	0.04
IL corn STD	10.42	0.08	0.04
IN corn STD	11.50	0.08	0.03
KS corn STD	15.65	0.12	0.06
MN corn STD	4.97	0.04	0.02
MS corn STD	46.02	0.28	0.12
NC CornE STD	16.14	0.10	0.02
NC CornW OP	12.37	0.09	0.05
ND Corn OP	5.84	0.05	0.02
NE corn STD	28.95	0.22	0.10
OH corn STD	11.01	0.11	0.05
PA corn STD	4.32	0.04	0.02
TX corn OP	8.63	0.07	0.03
FL sweetcorn OP	22.99	0.17	0.09
OR Sweetcorn OP	1.18	0.01	0.00
KS Sorghum STD	14.59	0.12	0.06
TX Sourghum OP	36.71	0.23	0.09

Table 6. Surface Water EDWCs for Drinking Water Risk Assessment for Terbufos and its Total Toxic Residue			
Senarios	**Estimated Drinking Water Concentration (µg/L)**		
	1-in-10-year Peak Exposure	**1-in-10-year Annual Mean Exposure**	**30-year Mean Exposure**
CA Sugarbeet OP	10.52	0.08	0.02
MN Sugarbeet STD	7.31	0.05	0.03
Total Toxic Residue[1]			
MS corn STD	60.25	6.84	3.61
TX Sorghum OP	63.06	11.58	6.13
[1] Total Toxic residues are based on two scenarios with the highest EDWCs for parent (i.e. MS corn STD and TX Sorghum OP scenarios)			

Groundwater

Screening Concentration in Ground Water (SCI-GROW v2.3, Jul. 29, 2003) is a regression model used as a screening tool to estimate pesticide concentrations found in groundwater used as drinking water. The SCI-GROW model and user's manual may also be downloaded from the EPA Water Models web-page (http://www.epa.gov/oppefed1/models/water/#scigrow). A summary of the model input parameter values used in the SCI-GROW model is listed in **Table 7.** SCI-GROW EDWCs are presented in **Table 8**.

Table. 7. SCI-GROW Input Parameters for Terbufos, Terbufos Sulfoxide and Terbufos Sulfone			
Model Input Variable	**Input Values**	**Sources**	**Comments**
The following input parameters are applicable to parent terbufos			
Application Rate[1]	Corn: 1.30 lbs a.i/A Sorghum: 1.68 lbs a.i./A Sugar beet: 1.98 lbs a.i/A	EPA Reg # 241-314 EPA Reg# 5481-562	Label directions
Number of Applications	1	Product Label as above	Label directions
Aerobic Soil Metabolism Half-Life	8.03 days	MRIDs 00156853 and 41749801	Mean value
K_{oc}	1460 mL/g	MRID 41373604	Median value
The following input parameters are applicable to terbufos sulfoxide			
Application Rate[1]	Corn: 0.72 lbsA Sorghum: 0.93 lbs/A Sugar beet: 1.08 lbs/A	Estimated	See a sample calculation in Table 4
Number of Applications	1	EPA Reg # 241-314 EPA Reg# 5481-	---

Table. 7. SCI-GROW Input Parameters for Terbufos, Terbufos Sulfoxide and Terbufos Sulfone			
Model Input Variable	**Input Values**	**Sources**	**Comments**
Aerobic Soil Metabolism Half-Life	136 x 3 (408 days)	MRID 00156853	Single value is available. 3X was used according to Input Parameter Guidance (USEPA 2009)[2]
K_{oc}	112 mL/g	MRID 41373604	Median value
The following input parameters are applicable to terbufos sulfone			
Application Rates[1]	Corn: 0.29 lbs/A Sorghum: 0.38 lbs/A Sugar beet: 0.44 lbs/A	Estimated	See a sample calculation in Table 5
Aerobic Soil Metabolism Half-Life	174 x 3 (522 days)	MRIDs 00156853	Single value is available. 3X was used according to Input Parameter Guidance (USEPA 2009)[2]
K_{oc}	141 mL/g	MRID 41373604	Median value
[1] SCI-GROW modeling was performed based on the highest application rates for terbufos and its degradates [2] http://www.epa.gov/oppefed1/models/water/input_parameter_guidance.htm			

Table 8. SCI-GROW Simulated Groundwater EDWCs for Drinking Water Risk Assessment for Terbufos and its Total Toxic Residues		
Residue of Concern	**Estimated Drinking Water concentration (µg/L)[1]**	
	Peak Exposure	**Chronic Exposure**
Terbufos	0.02	0.02
Terbufos Sulfoxide	7.28	7.28
Terbufos Sulfone	2.76	2.76
Total toxic Residue[2]	10.06	10.06
[1] EDWCs were generated for the highest application rate of 1.98 lbs a.i./ A for sugar beet [2]Sum of residues of concern (i.e. terbufos, terbufos sulfoxide and terbufos sulfone)		

In addition, Tier 1 groundwater EDWCs for terbufos and its total toxic residues, resulting from its use on sugar beet for its highest application rate of 1.98 lbs a.i./A were estimated using the PRZM-GW model (USEPA, 2012c), with the GW-GUI (Graphical User Interface, version 1.0, August 31, 2012a). PRZM-GW is a one-dimensional, finite-difference model that estimates the concentrations of pesticides in groundwater. It accounts for pesticide fate in the crop root zone by simulating pesticide transport and degradation through the soil profile after a pesticide is applied to an agricultural field. PRZM-GW permits the assessment of multiple years of pesticide application (up to 100 years) on a single site. Six standard scenarios, each representing a different region known to be vulnerable to groundwater contamination, are available for use with PRZM-GW for risk assessment purposes. Each of these standard scenarios was used for PRZM-GW simulations. PRZM-GW output values represent pesticide concentrations in a vulnerable groundwater supply that is located directly beneath a rural agricultural field following many years of pesticide application. Breakthroughs were observed in all modeled scenarios. A

summary of the model input parameter values used in PRZM-GW model is listed in **Table 9.** PRZM-GW values are presented in **Table 10.** A sample output of PRZM-GW model can be found in **Appendix B**.

Table 9. PRZM-GW Input Parameters[1] for Terbufos, Terbufos Sulfoxide and Terbufos Sulfone

Variable Name	Data Value	Data Source MRID(s)	Comment
The following input parameters are applicable to parent Terbufos			
Application Method	Ground (Granular) potato	Current labels	See Table 4
Application Rate (lbs a.i./acre) [kg/ha]	1.98 [2.22] Sugar beet	Current labels	Used highest application rate
Application Frequency	1 time/year	Current labels	See Table 4
Application Interval (days)	Not Applicable	Current labels	See Table 4
Hydrolysis, DT_{50} (Days)	1.5 days @ 25°C	MRID 46902201	---
Aerobic Soil Metabolism DT_{50} (Days)	14.7 days	MRIDs 00156853 and 41749801	The 90% of the upper confidence limit (UCL) of the mean metabolism half-life.
Partition Coefficient K_d	11.11 mL/g	MRID 41373604	Represents average K_d for 4 soils
The following input parameters are applicable to Terbufos Sulfoxide			
Application Method	Ground (Granular) potato	Current labels	Application Method
Application Rate (lbs a.i./acre) [kg/ha]	1.08 [1.21] Sugar beet	Current labels	Application Rate (lbs a.i./acre) [kg/ha]
Application Frequency	1 time/year	Current labels	Label Directions
Hydrolysis, DT_{50} (Days)	65.1	MRID 46902201	---
Aerobic Soil Metabolism DT_{50} (Days)	136 x 3 (408 days)	MRID 00156853	Single value is available. 3X was used according to Input Parameter Guidance (USEPA 2009)[1]
Partition coefficient K_d	11.11 mL/g	MRID 41373604	Represents average K_d for 4 soils
The following input parameters are applicable to Terbufos Sulfone			

Table 9. PRZM-GW Input Parameters[1] for Terbufos, Terbufos Sulfoxide and Terbufos Sulfone			
Variable Name	**Data Value**	**Data Source MRID(s)**	**Comment**
Application Method	Ground (Granular) potato	Current labels	Application Method
Application Rate (lbs a.i./acre) [kg/ha]	0.44 [0.49] Sugar beet	Current labels	Application Rate (lbs a.i./acre) [kg/ha]
Application Frequency	1 time/year	Current labels	Application Frequency
Hydrolysis, DT_{50} (Days)	43.8	MRID 46902201	---
Aerobic Soil Metabolism DT_{50} (Days)	174 x 3 (408 days)	MRID 00156853	Single value is available. 3X was used according to Input Parameter Guidance (USEPA 2009)[2]
Partition coefficient K_d	11.11 mL/g	MRID 41373604	Represents average K_d for 4 soils
[1] http://www.epa.gov/oppefed1/models/water/input_parameter_guidance.htm			

Table 10. PRZM-GW Simulated Groundwater EDWCs for Drinking Water Risk Assessment for Terbufos and its Total Toxic Residues				
Crop	**Scenario**	**Highest Daily Value (µg/L)**	**Average (µg/L)**	**Average Simulation Breakthrough Time (days)**
Terbufos (Parent only)				
Sugar beet (1.98 lbs a.i./A x 1 application)	Delmarva sweet corn	3.16E-14	2.56E-15	475
	FL citrus	**0**	**0**	1170
	FL potato	1.61E-17	2.63E18	306
	GA peanut	**3.10E-13[1]**	**2.53E-14**	328
	NC cotton	0	0	1142
	WI corn	0	0	1043
Terbufos Sulfoxide				
Sugar beet (1.08 lbs a.i./A x 1application)	Delmarva sweet corn	**27.3**	**11.6**	224
	FL citrus	17.9	9.48	246
	FL potato	10.8	6.11	266
	GA peanut	0.952	0.0454	1007
	NC cotton	0.563	0.233	1062
	WI corn	0.658	0.00768	885
Terbufos Sulfone				
Sugar beet (0.44 lbs a.i./A x 1application)	Delmarva sweet corn	**6.24**	**2.42**	226
	FL citrus	3.36	1.61	246
	FL potato	2.08	1.04	269
	GA peanut	0.00324	0.00145	1010
	NC cotton	0.0366	0.0146	1063

Table 10. PRZM-GW Simulated Groundwater EDWCs for Drinking Water Risk Assessment for Terbufos and its Total Toxic Residues				
Crop	**Scenario**	**Highest Daily Value (µg/L)**	**Average (µg/L)**	**Average Simulation Breakthrough Time (days)**
	WI corn	0.00455	0.000502	885
Total Toxic Residue (EDWCs Summation of terbufos, terbufos sulfoxide and terbufos sulfone)				
Not applicable	Delmarva sweet corn	**33.54**	**14.02**	Not applicable
	FL citrus	21.26	11.09	
	FL potato	12.88	7.15	
	GA peanut	0.10	0.05	
	NC cotton	0.60	0.25	
	WI corn	0.07	0.01	
[1] Bolded values are the highest EDWCs for parent, terbufos sulfoxide, terbufos sulfone and total toxic residues.				

Monitoring Data

A surface water and groundwater monitoring study was conducted for terbufos and its degradates, terbufos sulfoxide and terbufos sulfone. The study was required by USEPA's Interim Reregistration Eligibility Decision (IRED) to confirm exposures of terbufos and its degradates terbufos sulfoxide and terbufos sulfone in drinking water sources (USEPA, 2008). For the surface water, a total of 502 samples were collected from 33 sites between 1999 and 2005. For the groundwater, 73 samples were collected from 2003 to 2005. From 1999 to 2003, samples from numerous watersheds were provided by the NAWQA (National Water Quality Assessment) program. In surface water, terbufos and terbufos oxon were not detected above the reporting limits in any samples. Terbufos sulfoxide was detected in four samples at 0.092 to 0.205 µg/L, with an additional nine estimated detections of 0.045 to 0.262 µg/L. Terbufos sulfone was detected in six samples at 0.046 to 0.114 µg/L, with 30 additional estimated detections of 0.012 to 0.034 µg/L. There were no detections of terbufos or any degradates in any of the groundwater samples.

Monitoring data from 2006 to up-to-date data from the USGS- NAWQA program were accessed on March 18, 2014 to evaluate the current trend of terbufos and its degradates concentrations in surface water and groundwater. All data of filtered surface water and groundwater was downloaded since the evaluation of a monitoring study of terbufos and its degradates in drinking water issued 2008 (USEPS, 2008). For surface water, a total of 6740 water samples were analyzed for terbufos. Terbufos was detected in only one sample and the concentration was 0.02 µg/L. There were two detections of 0.07 µg/L and 0.17 µg/L terbufos sulfone in surface water samples out of 6198 water samples. For groundwater, a total of 3582 water samples were analyzed for terbufos. Terbufos was detected in one sample with a concentration of 0.01 µg/L. There were no detections of terbufos sulfone in any of the groundwater samples.

The National Water-Quality Assessment Program of the U.S. Geological Survey began monitoring the quality of source water and finished water of aquifers and major rivers used by

some of the larger community water systems in the United States (USGS 2010). The 295 anthropogenic organic compounds (AOCs) including terbufos and terbufos sulfone were monitored for the Source Water-Quality Assessments (SWQAs) studies during 2002–2010 (Carter et al., 2010). The SWQA studies are intended to complement drinking-water monitoring required by Federal, State, and local programs, which focus primarily on post-treatment compliance monitoring. A total of 221 surface water samples were analyzed for terbufos and its oxygen analog, terbufos sulfone. There were no detections of terbufos and terbufos sulfone in any samples.

Monitoring data for surface water, groundwater, and sediment from the California Department of Pesticide Regulation (CDPR) were searched on March 18, 2014. Terbufos was detected in only one sample and the concentration was 0.04 µg/L out of 2538 surface water samples. There were no detections of terbufos or its degradates in any of the groundwater samples

Uncertainties

Current labels of terbufos require certain setback distances or vegetative buffers between treated areas and the bodies of surface water. A well maintained vegetative buffer could potentially intercept sediment laden pesticides via runoff from terbufos applied to the field. However, the current surface water model does not have the capability to account for prescribed setbacks or vegetative buffer distances, thus the PRZM/EXAMS model generated EDWCs are considered upper bound exposures. In addition, a lack of the full suite of environmental fate data for major degradates of terbufos is an uncertainty in this assessment. Selected persistence and mobility of terbufos sulfoxide and terbufos sulfone were estimated from registrant submitted environmental fate data. However, several fate parameters were assumed stable in absence of data. Selected physicochemical parameters were also estimated using the EPISUITE, which is a Windows®-based suite of physical/chemical properties and environmental fate estimation programs developed by the EPA's Office of Pollution Prevention Toxics and Syracuse Research Corporation (SRC). Additional environmental fate and physicochemical properties of major degradates can reduce the uncertainties in the drinking water assessment.

Conclusions

This assessment provides estimated drinking water concentrations (EDWCs) of terbufos and its major metabolites, terbufos sulfoxide and terbufos sulfone, in surface water and groundwater in support of human health risk assessment for use of terbufos in various crops. The surface water and groundwater modeling were conducted according to a label-recommended maximum annual application rate of 1.30 to 1.98 lbs a.i./A for granular applications using the coupled models PRZM and EXAMS for surface water and SCI-GROW for ground water. In addition, the PRZM-GW model was used in determining groundwater EDWCs for terbufos and its total toxic residues.

Recommended EDWCs for terbufos and total toxic residue of terbufos in surface water and groundwater are summarized in Table 1. The maximum acute concentration of 63.06 µg/L and chronic concentration of 6.13 µg/L for surface water were associated with application to sorghum. The maximum acute and chronic estimated concentrations of TTR in shallow

groundwater using PRZM-GW model are 33.54 and 14.02 µg/L, respectively. For parent terbufos, the maximum acute concentration of 46.02 µg/L and chronic concentration of 0.12 µg/L for surface water were associated with application to corn. The maximum acute and chronic estimated concentrations of terbufos in shallow groundwater is 0.02 µg/L, derived from SCIGROW model.

Since the review of terbufos and its degradates terbufos sulfoxide and terbufos sulfone in drinking water sources (USEPA, 2008), limited numbers of terbufos and terbufos sulfone have been detected in surface water and groundwater samples collected for NAWQA and CDPR. However, NAWQA monitoring data were not targeted specifically to terbufos use areas or during times of known terbufos use. Terbufos was not detected in sediment monitoring of the NAWQA program. For SQWA, a total of 221 surface water samples were analyzed for terbufos and its oxygen analog, terbufos sulfone. There were no detections of terbufos and terbufos sulfone in any samples.

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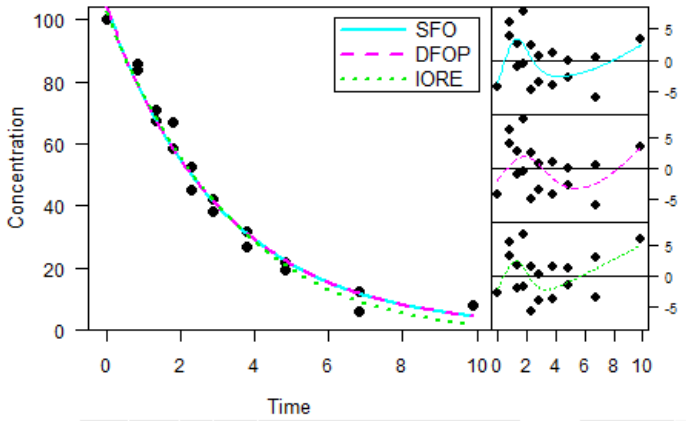
APPENDIX A

Terbufos

Hydrolysis (MRID 44862501

Terbufos pH 7 @ 20°C

DAT (day)	% of Applied
0	100.
0	100.
0.84	83.6
0.84	85.9
1.33	67.2
1.33	70.9
1.79	58.4
1.79	66.8
2.3	45.2
2.3	52.5
2.88	42.3
2.88	38.1
3.81	32.0
3.81	26.8
4.85	22.1
4.85	19.4
6.8	12.4
6.8	5.98
9.88	7.79



	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	2.17	7.22	4.7	104	k = 0.319
DFOP	2.17	7.22	5.2	104	f = 0.741, k_0 = 0.319, k_1 = 0.319
IORE	2.27	6.58	4.7	103	N = 0.819, k = 0.662

S_C	274
S_{SFO}	275
Slow $t_1/_2$	2.17
$t_{R\ IORE}$	1.98

Temperature adjusted DT_{50} @ 25º C 1.5 days
Following guidance was used in calculating temperature adjusted DT50s.

Guidance

When aerobic or anaerobic aquatic metabolism rates are derived from studies conducted at other than 25°, they should be adjusted before entering them into EXAMS or PE5. The adjustment should be as follows:

$$\mu_{input} = \left[2^{\left(\frac{25-T_{exp}}{10}\right)}\right]\mu_{measured} \qquad (2)$$

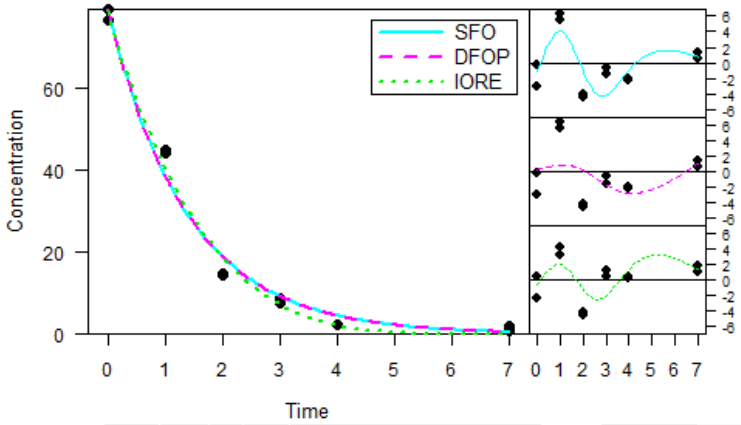
μ_{input} = input value for metabolism rate , [day^{-1}]
$\mu_{measured}$ = laboratory measured aerobic metabolism rate , [day^{-1}]
T_{exp} = temperature of laboratory study [°C].

http://www.epa.gov/oppefed/models/water/input_parameters_guidance.html

Aquatic Photolysis (MRID 41181101

Aquatic Photolysis (Irradiated)

DAT	% of Applied
0	76.5
0	79.2
1	44.2
1	45.1
2	14.8
2	14.4
3	8.60
3	7.70
4	2.50
4	2.30
7	1.00
7	1.80

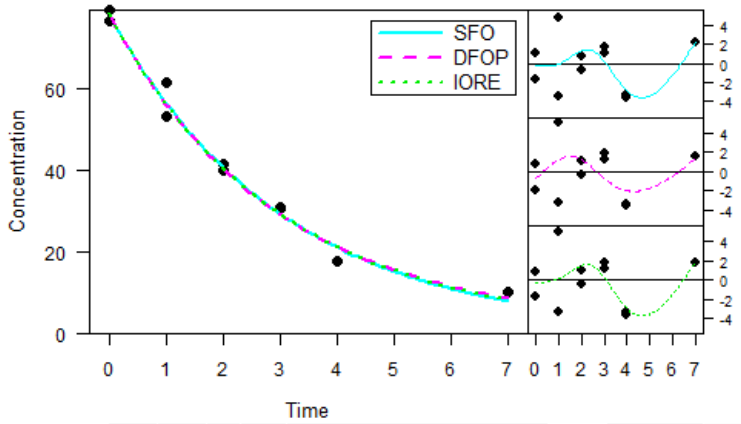


	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	0.966	3.21	10	79.5	k = 0.718
DFOP	0.966	3.21	13	79.5	f = 0.88, k_0 = 0.718, k_1 = 0.718
IORE	1.05	2.93	8.6	78.8	N = 0.765, k = 1.7

S_C	97.7
S_{SFO}	129
Slow $t_1/_2$	0.966
$t_{R\ IORE}$	0.882

Aquatic Photolysis (Dark Control)

DAT	% of Applied
0	76.5
0	79.2
1	52.9
1	61.2
2	41.4
2	40.0
3	31.0
3	30.4
4	17.9
4	17.6
7	10.1
7	10.1

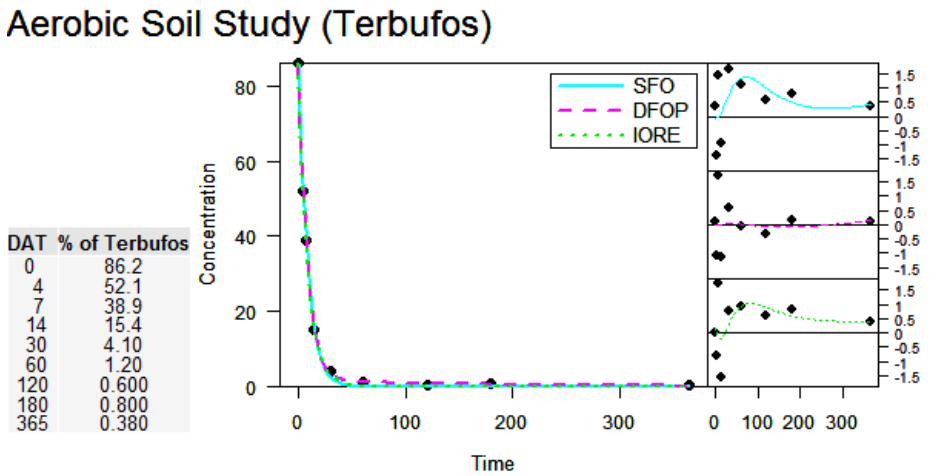


	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	2.12	7.04	3.6	78.2	k = 0.327
DFOP	2.09	7.31	4.5	78.4	f = 0.856, k_0 = 0.365, k_1 = 0.172
IORE	2.1	7.17	3.9	78.3	N = 1.03, k = 0.289

S_C	97.9
S_{SFO}	76.7
Slow $t_1/_2$	4.02
$t_{R\ IORE}$	2.16

Estimated DT_{50} is 1.77 days @ 25º C

Aerobic Soil Metabolism (MRID 00156853)

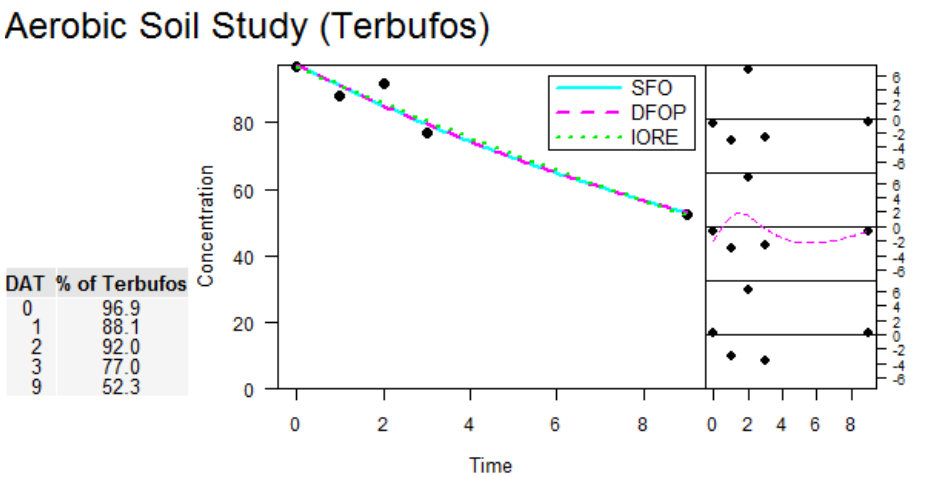


DAT	% of Terbufos
0	86.2
4	52.1
7	38.9
14	15.4
30	4.10
60	1.20
120	0.600
180	0.800
365	0.380

	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	5.85	19.4	3.8	85.9	k = 0.118
DFOP	5.77	20.1	3.3	86.1	f = 0.981, k_0 = 0.123, k_1 = 0.00505
IORE	5.74	20.4	3.7	86.2	N = 1.08, k = 0.086

S_C	12.5
S_{SFO}	10
Slow $t_1/_2$	137
$t_{R\ IORE}$	6.14

Aerobic Soil Metabolism (MRID 41181101)



DAT	% of Terbufos
0	96.9
1	88.1
2	92.0
3	77.0
9	52.3

	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	10.2	33.8	3.5	97.6	k = 0.0681
DFOP	10.2	33.8	5	97.6	f = 0.405, k_0 = 0.0681, k_1 = 0.0681
IORE	9.91	22.3	3.9	96.7	N = 0.439, k = 0.754

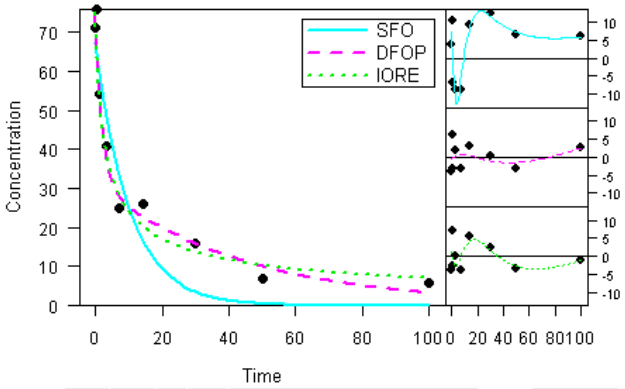
S_C	164
S_{SFO}	63.5
Slow $t_1/_2$	10.2
$t_{R\ IORE}$	6.71

90th %tile DT_{50} 14.7 days

Aerobic Aquatic Metabolism (MRID 44672204)

Loam Sediment

DAT	Terbufos In total System (%)
0	71.0
0.25	76.0
1	54.0
3	41.0
7	25.0
14	26.0
30	16.0
50	7.00
100	6.00

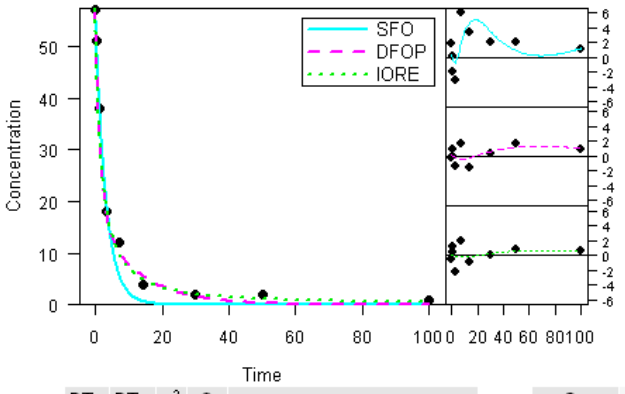


	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	7.04	23.4	19	67.1	k = 0.0985
DFOP	3.33	63	8.6	74.9	f= 0.583, k_0= 0.491, k_1= 0.0226
IORE	3.8	89.6	9.1	75	N = 2.76, k = 0.000181

S_C	195
S_{SFO}	645
Slow $t_{1/2}$	30.6
$t_{R\ IORE}$	27

Sand Sediment

DAT	Terbufos In total System (%)
0	57.0
0.25	51.0
1	38.0
3	18.0
7	12.0
14	4.00
30	2.00
50	2.00
100	1.00



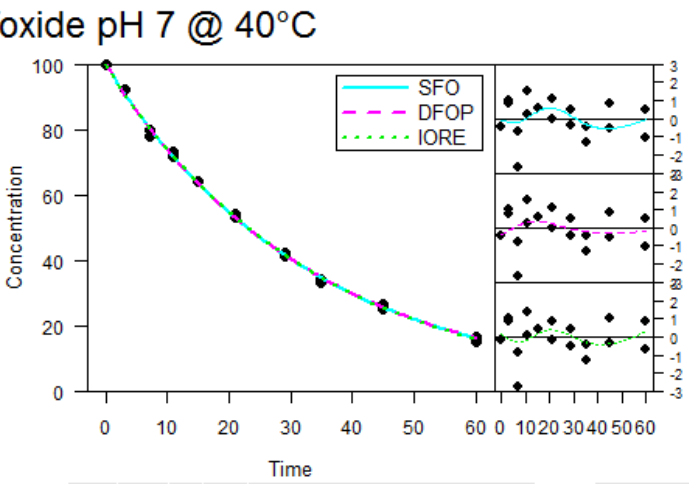
	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	2.17	7.22	11	55.1	k= 0.319
DFOP	1.69	13.8	5.2	57.3	f= 0.704, k_0= 0.633, k_1= 0.0789
IORE	1.72	12.2	5	57.5	N= 1.79, k= 0.022

S_C	19
S_{SFO}	75.3
Slow $t_{1/2}$	8.79
$t_{R\ IORE}$	3.66

Temperature adjusted 90th %tile DT_{50} @ 25° C 36.2 days

Terbufos Sulfoxide

Hydrolysis (MRID 44862501



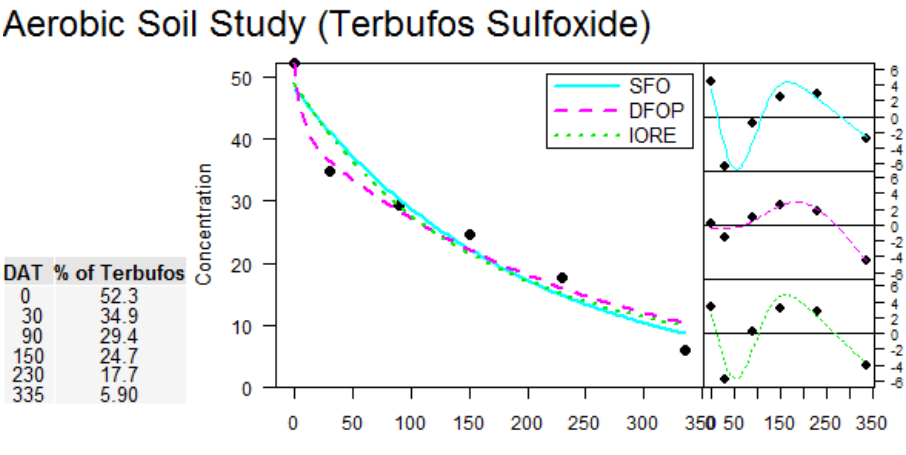
DAT (day)	% of Applied
0	100.
0	100.
3.05	92.4
3.05	92.6
7.06	78.5
7.06	80.4
11	73.6
11	72.3
15	64.4
15	64.4
21	54.4
21	53.3
29	42.3
29	41.4
35	34.5
35	33.6
45	26.7
45	25.3
60	16.9
60	15.4

	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	23	76.3	1.1	100	k = 0.0302
DFOP	23	76.3	1.2	100	f = 0.625, k_0 = 0.0302, k_1 = 0.0302
IORE	23.2	74.8	1.1	100	N = 0.966, k = 0.0346

S_C	20.5
S_{SFO}	18.6
Slow $t_{1/2}$	23
$t_{R\ IORE}$	22.5

Temperature adjusted DT_{50} @ 25º C 65.1 days

Aerobic Soil Metabolism (MRID 00156853)



DAT	% of Terbufos
0	52.3
30	34.9
90	29.4
150	24.7
230	17.7
335	5.90

	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	136	450	11	47.9	k = 0.00511
DFOP	110	502	8.5	52.2	f = 0.213, k_0 = 0.158, k_1 = 0.00411
IORE	124	548	12	49	N = 1.33, k = 0.00175

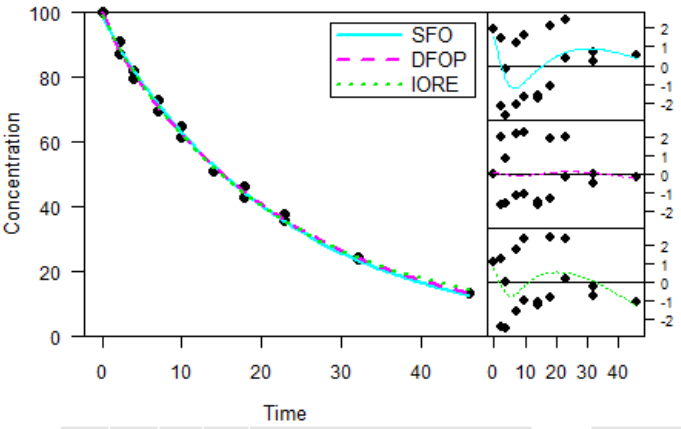
S_C	158
S_{SFO}	80.4
Slow $t_{1/2}$	168
$t_{R\ IORE}$	165

Terbufos Sulfone

Hydrolysis (MRID 44862501

Terbufos Sulfone pH7@ 40°C

DAT (day)	% of Applied
0	100.
0	100.
2.13	90.6
2.13	87.0
4.03	81.7
4.03	79.3
7.01	72.9
7.01	69.6
9.97	64.5
9.97	61.2
14	50.8
14	51.0
17.9	46.2
17.9	43.0
22.9	37.7
22.9	35.6
32.1	24.1
32.1	23.6
45.9	13.2



	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	15.5	51.6	1.5	98.1	k = 0.0446
DFOP	15.1	52.7	0.96	100	f = 0.0465, k_0 = 0.497, k_1 = 0.0428
IORE	15.1	56	1.3	98.9	N = 1.13, k = 0.0263

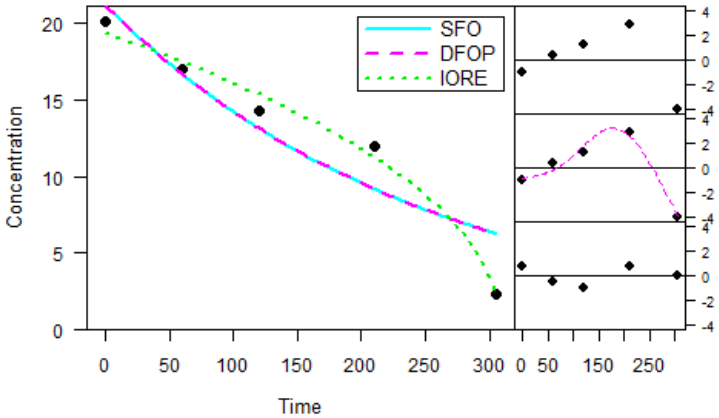
S_C	49.7
S_{SFO}	50.8
Slow $t_{1/2}$	16.2
$t_{R\ IORE}$	16.9

Temperature adjusted DT_{50} @ 25º C 43.8 days

Aerobic Soil Metabolism (MRID 00156853)

Aerobic Soil Study (Terbufos Sulfone)

DAT	% of Terbufos
0	20.1
60	17.0
120	14.3
210	12.0
305	2.30



	DT_{50}	DT_{90}	χ^2	C_0	Parameters
SFO	174	579	14	21.1	k = 0.00398
DFOP	174	579	20	21.1	f = 0.637, k_0 = 0.00398, k_1 = 0.00398
IORE	237	306	4.8	19.3	N = -1.11, k = 0.793

S_C	6.38
S_{SFO}	26.5
Slow $t_{1/2}$	174
$t_{R\ IORE}$	92.2

APPENDIX B

Table 6. Surface Water EDWCs for Drinking Water for Terbufos and its Total Toxic Residue							
Scenario	**Peak**	**96 hr**	**21 Day**	**60 Day**	**90 Day**	**Yearly**	**Average of yearly averages**
	Estimated Drinking Water concentration (µg/L)						
Terbufos							
CA corn OP	2.49	1.08	0.29	0.10	0.07	0.02	0.00
IA corn STD	15.58	6.88	2.08	0.73	0.49	0.12	0.04
IL corn STD	10.42	4.48	1.23	0.47	0.32	0.08	0.04
IN corn STD	11.50	4.89	1.34	0.50	0.34	0.08	0.03
KS corn STD	15.65	7.58	1.93	0.72	0.49	0.12	0.06
MN corn STD	4.97	2.09	0.73	0.27	0.18	0.04	0.02
MS corn STD	46.02	19.49	4.25	1.71	1.14	0.28	0.12
NC CornE STD	16.14	6.91	1.59	0.59	0.40	0.10	0.02
NC CornW OP	12.37	5.60	1.42	0.53	0.35	0.09	0.05
ND Corn OP	5.84	3.52	0.91	0.33	0.22	0.05	0.02
NE corn STD	28.95	13.89	3.52	1.34	0.90	0.22	0.10
OH corn STD	11.01	5.57	1.78	0.66	0.45	0.11	0.05
PA corn STD	4.32	1.84	0.67	0.24	0.16	0.04	0.02
TX corn OP	8.63	4.02	1.14	0.42	0.29	0.07	0.03
FL sweetcorn OP	22.99	10.25	2.71	0.99	0.67	0.17	0.09
OR Sweetcorn OP	1.18	0.66	0.20	0.07	0.05	0.01	0.00
KS Sorghum STD	14.59	6.19	1.52	0.74	0.49	0.12	0.06
TX Sourghum OP	36.71	15.63	4.03	1.42	0.95	0.23	0.09
CA Sugarbeet OP	10.52	5.01	1.28	0.48	0.32	0.08	0.02
MN Sugarbeet STD	7.31	3.79	0.91	0.32	0.22	0.05	0.03
Total Toxic Residue[1]							
MS corn STD	60.25	56.74	33.15	23.69	18.58	6.84	3.61
TX Sorghum OP	63.06	60.59	53.58	38.54	30.85	11.58	6.13

[1] Total Toxic residues are based on two scenarios with the highest EDWCs for parent (i.e. MS corn STD and TX Sorghum OP scenarios)

An Example of Non-Adjusted PCA PRZM/EXAMS modeling Output

stored as MScornDW.out
Chemical: Terbusfos
PRZM environment: MScornSTD.txt, modified Tueday, 29 May 2007 at 2:57:40
EXAMS environment: ir298.exv, modified Tueday, 26 August 2008 at 05:14:08
Metfile: w03940.dvf, modified Tueday, 26 August 2008 at 05:14:14

Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	3.44	1.48	0.33	0.16	0.12	0.03
1962	41.63	19.19	4.43	1.59	1.06	0.26
1963	4.71	1.99	0.54	0.19	0.15	0.04
1964	20.89	8.69	2.89	1.03	0.69	0.17
1965	0.94	0.40	0.09	0.03	0.02	0.01
1966	8.42	4.20	1.29	0.59	0.39	0.10
1967	7.61	3.25	1.10	0.54	0.36	0.09
1968	4.19	1.94	0.76	0.30	0.20	0.05
1969	30.06	12.66	3.95	1.40	0.93	0.23
1970	3.10	1.30	0.40	0.24	0.16	0.04
1971	16.51	8.07	2.35	0.93	0.62	0.15
1972	4.00	1.70	0.50	0.20	0.13	0.03
1973	40.85	18.26	4.09	1.51	1.01	0.25
1974	41.50	17.40	4.08	1.47	0.98	0.24
1975	6.43	2.96	1.09	0.47	0.32	0.08
1976	3.38	1.44	0.62	0.29	0.20	0.05
1977	6.59	3.89	1.08	0.39	0.26	0.07
1978	4.29	1.82	0.73	0.50	0.34	0.08
1979	88.51	48.86	11.28	4.20	2.81	0.70
1980	76.11	45.88	11.28	4.09	2.73	0.67
1981	3.30	1.59	0.44	0.18	0.12	0.03
1982	17.91	8.44	2.09	0.75	0.51	0.13
1983	51.56	21.67	4.69	1.91	1.28	0.32
1984	4.19	1.76	0.60	0.23	0.16	0.04
1985	1.20	0.59	0.15	0.06	0.04	0.01
1986	1.99	0.97	0.53	0.22	0.15	0.04
1987	1.81	0.81	0.34	0.15	0.10	0.03
1988	8.81	3.74	0.91	0.32	0.22	0.05
1989	9.57	4.17	1.17	0.45	0.31	0.08
1990	6.12	2.60	0.92	0.38	0.25	0.06

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	88.51	48.86	11.28	4.20	2.81	0.70

0.06	76.11	45.88	11.28	4.09	2.73	0.67
0.10	51.56	21.67	4.69	1.91	1.28	0.32
0.13	41.63	19.19	4.43	1.59	1.06	0.26
0.16	41.50	18.26	4.09	1.51	1.01	0.25
0.19	40.85	17.40	4.08	1.47	0.98	0.24
0.23	30.06	12.66	3.95	1.40	0.93	0.23
0.26	20.89	8.69	2.89	1.03	0.69	0.17
0.29	17.91	8.44	2.35	0.93	0.62	0.15
0.32	16.51	8.07	2.09	0.75	0.51	0.13
0.35	9.57	4.20	1.29	0.59	0.39	0.10
0.39	8.81	4.17	1.17	0.54	0.36	0.09
0.42	8.42	3.89	1.10	0.50	0.34	0.08
0.45	7.61	3.74	1.09	0.47	0.32	0.08
0.48	6.59	3.25	1.08	0.45	0.31	0.08
0.52	6.43	2.96	0.92	0.39	0.26	0.07
0.55	6.12	2.60	0.91	0.38	0.25	0.06
0.58	4.71	1.99	0.76	0.32	0.22	0.05
0.61	4.29	1.94	0.73	0.30	0.20	0.05
0.65	4.19	1.82	0.62	0.29	0.20	0.05
0.68	4.19	1.76	0.60	0.24	0.16	0.04
0.71	4.00	1.70	0.54	0.23	0.16	0.04
0.74	3.44	1.59	0.53	0.22	0.15	0.04
0.77	3.38	1.48	0.50	0.20	0.15	0.04
0.81	3.30	1.44	0.44	0.19	0.13	0.03
0.84	3.10	1.30	0.40	0.18	0.12	0.03
0.87	1.99	0.97	0.34	0.16	0.12	0.03
0.90	1.81	0.81	0.33	0.15	0.10	0.03
0.94	1.20	0.59	0.15	0.06	0.04	0.01
0.97	0.94	0.40	0.09	0.03	0.02	0.01
0.10	50.57	21.42	4.67	1.88	1.26	0.31
					Average of yearly averages:	0.14

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:

Output File: MScornDW

Metfile: w03940.dvf

PRZM scenario: MScornSTD.txt

EXAMS environment file: ir298.exv

Chemical Name:	Terbusfos			
Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	288.4	g/mol	
Henry's Law Const.	henry	2.46E-05	atm-m^3/mol	
Vapor Pressure	vapr	6.60E-04	torr	
Solubility	sol	5.4	mg/L	
Kd	Kd	11.11	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	1.77	days	Half-life
Aerobic Aquatic Metabolism	kbacw	36.2	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	0	days	Halfife
Aerobic Soil Metabolism	asm	14.7	days	Halfife
Hydrolysis:	pH 7	1.5	days	Half-life
Method:	CAM	6	integer	See PRZM manual
Incorporation Depth:	DEPI	2.56	cm	
Application Rate:	TAPP	1.46	kg/ha	
Application Efficiency:	APPEFF	1	fraction	
Spray Drift	DRFT		fraction of application rate applied to pond	
Application Date	Date	4-Oct	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0.5		

Flag for Index Res. Run	IR	Reservoir	
Flag for runoff calc.	RUNOFF	total	none, monthly or total(average of entire run)

Time Series Files


MS corn_Parent.csv


Sorghum_TTR.csv

Groundwater

SciGrow version 2.3
chemical:Terbufos
time is 2/28/2014 9:53:25

Application rate (lb/acre)	Number of applications	Total Use (lb/acre/yr)	Koc (ml/g)	Soil Aerobic metabolism (days)
1.980	1.0	1.980	1.46E+03	8.0

groundwater screening cond (ppb) = 1.95E-02

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SciGrow version 2.3
chemical:Terbufos SO
time is 2/28/2014 9:55:31

Application rate (lb/acre)	Number of applications	Total Use (lb/acre/yr)	Koc (ml/g)	Soil Aerobic metabolism (days)
1.080	1.0	1.080	1.12E+02	408.0

groundwater screening cond (ppb) = 7.28E+00

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SciGrow version 2.3
chemical:Terbufos SO
time is 2/28/2014 9:56: 3

Application rate (lb/acre)	Number of applications	Total Use (lb/acre/yr)	Koc (ml/g)	Soil Aerobic metabolism (days)
0.440	1.0	0.440	1.41E+02	522.0

groundwater screening cond (ppb) = 2.76E+00

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Example Output of PRZM-GW modeling for Terbufos Sulfoxide for Delmarva Scenario