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

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

June 15, 2006
PC Code: 081901
DP Barcodes: 328075,
[redacted] 301503, 301500,

MEMORANDUM

SUBJECT: Vischim Request to Register Chlorothalonil as a Technical Fungicide for Use on Turf and Ornamentals; Evaluation of Data Requirements for the Me Too Registration of Chlorothalonil

FROM: Lucy Shanaman, Chemist *Lucy Shanaman 6/15/06*
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TO: Anthony Kish, Product Manager
Registration Division/ Fungicide Branch

Attached please find EFED's review of the request by Vischim to register chlorothalonil as a technical for use on turf and ornamentals. The following data were taken into account in deriving drinking water EECs (separate memo) and assessing risk to aquatic organisms along with other data in EFED's files.

Vapor Pressure information
Label presenting the highest application rates for turf and other use sites
SDS 3701 adsorption/desorption and mobility studies
Additional data on storage stability.

The data were adequate to assess risk, however, some studies that are required were not referenced or submitted by Vischim. These are presented in Appendix G. Because some of the newly submitted aquatic toxicity data resulted in lower toxicity values (more toxic) and some environmental fate studies resulted in longer halflives and greater mobility, the risk for chlorothalonil has increased with this assessment compared to the risk identified in earlier assessments. Generally, the pattern of LOC exceedances has not changed, but the risk quotients are greater.

2050878

Ecological Risk Assessment for the Me-Too Registration of Chlorothalonil

CAS Name: 2,4,5,6-tetrachloroisophthalonitrile
Chemical Abstracts Registry Number: 1897-45-6
USEPA PC Code #: 081901
Environmental Fate and Effects Division Team Members:

I. Problem Formulation

A. Stressor Source and Distribution

1. Source and Intensity

Chlorothalonil is a broad spectrum, non-systemic pesticide used mainly as a foliar fungicide for vegetable, field and ornamental crops. It is also used as a wood protectorate, antimold and antimildew agent, bactericide, micorbiocide, algaecide, insecticide and acaricide.

While chlorothalonil is currently registered for food uses, this Me-Too assessment is only considering terrestrial non-food and non-feed uses, specifically: ornamental turf, sod, woody shrubs, herbaceous plants, vines and shade trees; Christmas trees; sod farms; golf courses and forest trees.

2. Summary of Chemical and Physical Properties of Chlorothalonil

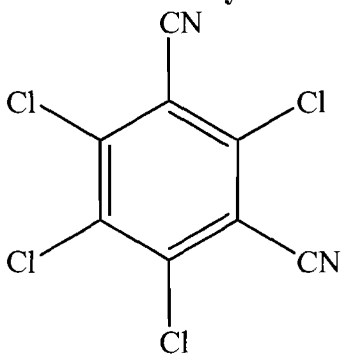


Figure 1: Chemical Structure of Chlorothalonil

The mobility of chlorothalonil in the open environment is expected to range from slightly mobile to moderately mobile. Chlorothalonil (**Figure 1**) degrades through both photolytic and microbial processes. Chlorothalonil degrades rapidly in clear, shallow water through aqueous photolysis. Chlorothalonil is more persistent under terrestrial aerobic conditions than under aerobic aquatic and anaerobic conditions. Biotic degradation rates for chlorothalonil are sensitive to the biogeochemical environment and ambient conditions, and may depart from first-order kinetics. Apparent initial aquatic half-lives range from a few hours to around two weeks, while overall half-lives for the total system are much longer. An identified major metabolite, SDS-3701 (4-hydroxy-2,5,6-trichloro-1,3-dicyanobenzene), forms under differing test conditions, and appears to be persistent. Other metabolites also exhibit a degree of persistence sufficient to allow their appearance in ground water. Evolution of volatile compounds, including carbon dioxide, was not significant in laboratory testing.

It has been demonstrated from submitted studies that chlorothalonil did not significantly bioconcentrate in either oysters or bluegill sunfish. However, recalcitrant metabolites did concentrate somewhat in the biochemical (carbon) pool of the tested organisms, and were slow to be eliminated

Table IA-1 Physical, Chemical and Environmental Fate Properties of Chlorothalonil

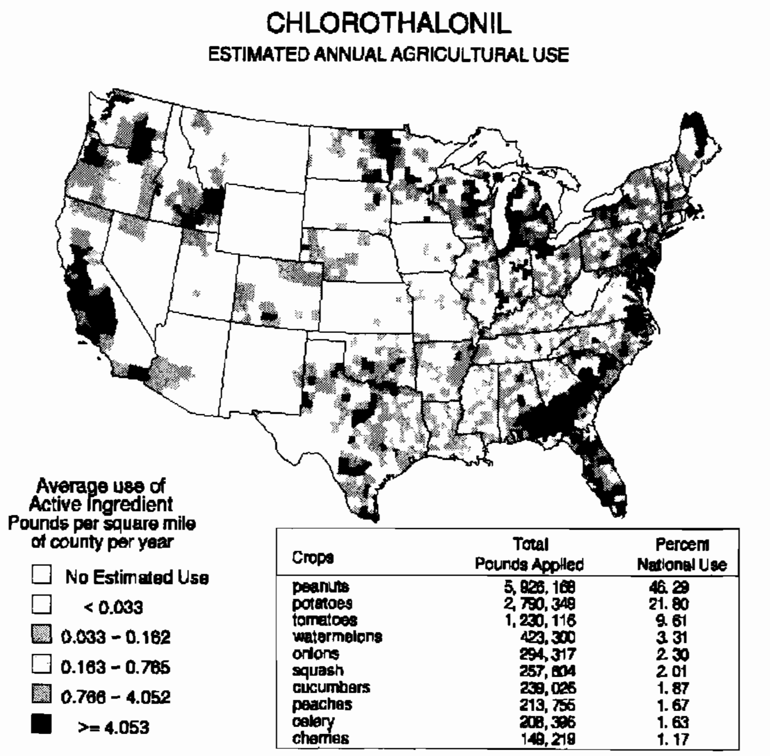
Physical and Chemical Properties	
Chemical Name (common)	chlorothalonil
Chemical Name (CAS)	2,4,5,6-tetrachloroisophthalonitrile
Chemical Abstract Number (CAS Number)	1897-45-6
Chemical Class	polychlorinated aromatic
Molecular Weight	265.91
Aqueous Solubility (25° C)	0.8 mg/L
pKa	Not determined
Vapor Pressure (26° C)	5.7×10^{-7} torr
Henry's Law Constant (20 ° C)	2.6×10^{-7} atm - m^3/mole
Octanol/water Partition Coefficient (K_{ow})	6277 (log K_{ow} = 3.8)
Environmental Fate Properties	
Hydrolysis Half-life (pH 5, 7)	$t_{1/2}$ = stable
Aqueous Photolysis Half-life	$t_{1/2}$ = 10 hours
Aerobic Metabolism Half-lives (total system)	$t_{1/2}$ = 5 – 68 days
Anaerobic Metabolism Half-lives (total system)	$t_{1/2}$ = 5 – 15 days
Soil-Water Distribution Coefficients (K_d)	3 – 29
Bioaccumulation in Fish	200 X (edible tissue) 3000 X (visceral tissue)
Bioaccumulation in Bivalves	2660 X
Terrestrial Field Dissipation (total system)	$t_{1/2}$ = 1 – 2 months

3. Pesticide Type, Class, and Mode of Action

Chlorothalonil is a broad spectrum, non-systemic chloronitrile pesticide used mainly as a foliar fungicide. Chlorothalonil is the second most widely used fungicide in the United States[1]. While the petitioner stated that the exact mechanism of action for chlorothalonil is unknown, open literature indicates that the chlorothalonil molecule combines glutathione within the fungus cell, tying up the available glutathione. Glutathione dependent enzymes are left unable to function in aiding cellular respiration[2].

4. Overview of Pesticide Usage

As stated previously, while chlorothalonil is currently registered for a variety of food uses, this Me-Too assessment is only considering terrestrial non-food and non-feed uses, specifically: ornamental uses, Christmas trees, sod farms, golf courses and forestry uses. Total agricultural use of chlorothalonil for all registered uses, based upon the 1992 Census of Agriculture data is mapped below[3].



Crops	Total Pounds Applied	Percent National Use
peanuts	5, 926, 168	46. 29
potatoes	2, 790, 349	21. 80
tomatoes	1, 230, 116	9. 61
watermelons	423, 300	3. 31
onions	294, 317	2. 30
squash	257, 604	2. 01
cucumbers	239, 026	1. 87
peaches	213, 755	1. 67
celery	208, 396	1. 63
cherries	149, 219	1. 17

Figure 3. Estimated Agricultural Chlorothalonil Uses

[1] http://www.pesticide.org/chlorothalonil.pdf
[2] http://www.pesticide.org/chlorothalonil.pdf
[3] http://ca.water.usgs.gov/pnsp/use92/chlorthlnl.html

B. Ecosystems at Risk

The terrestrial ecosystems potentially at risk include the treated area and areas immediately adjacent to the treated area that might receive drift or runoff, and might include other cultivated fields, fence rows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats and other uncultivated areas. The assessed commodities are grown throughout the United States. For Tier 1 assessment purposes, risk will be assessed to terrestrial animals assumed to exclusively occur in or adjacent to the treated area.

Aquatic ecosystems potentially at risk include water bodies adjacent to, or down stream from the treated field and might include impounded bodies such as ponds, lakes and reservoirs, or flowing waterways such as streams or rivers. The assessed commodities may be located either near freshwater or saltwater habitats. For uses in coastal areas, aquatic habitat also includes marine ecosystems including estuaries. For Tier 1 assessment purposes, risk will be assessed to aquatic animals and plants assumed to occur in small, static ponds receiving runoff and drift from treated areas.

C. Ecological Receptors and Assessment Endpoints

Ecological receptors are organisms within the ecosystem potentially at risk that may be exposed to the stressor (chlorothalonil). The surrogate species used to assess potential risk to all ecological receptors from chlorothalonil use include two species of birds (mallard ducks and bobwhite quails), one mammalian species (laboratory rat), terrestrial plants (10 species), fish (two freshwater and one saltwater species), aquatic invertebrates (one freshwater and two saltwater species), and aquatic plant species.

Assessment endpoints include survival, growth, and reproductive success of the surrogate ecological receptors. Toxicity values used to assess survival from short-term (acute) exposures are chlorothalonil levels associated with statistically estimated 50% survival rates. Toxicity values used to assess potential reproductive effects are the highest levels tested that did not induce any reproductive or growth effects (NOAEC; No Observable Adverse Effect Concentrations). Table II-2 below summarizes the ecosystems at risk, the assessment endpoints used assess risk to the ecosystems, and the surrogate species and toxicity values used to assess risk to the surrogate species.

Table IB-1. Summary of Ecosystems, Taxa, and Assessment Endpoints Used to Evaluate Potential Ecological Effects from the Proposed New Chlorothalonil Uses			
Ecosystem at Risk	**Taxonomic group (surrogate species)**	**Assessment Endpoints**	**Toxicity Value Used to Evaluate Assessment Endpoints**
Terrestrial ecosystems: for tier 1 assessment, the treated field is the ecosystem of concern	Birds and Reptiles (Mallard duck and bobwhite quail)	Survival reproduction, and growth of individuals and populations	**Parent** Survival LD_{50}: >2000 mg/kg-bw (mallard duck) Dietary LC_{50}: >5200 ppm (both species) Growth and Reproduction NOAEC: 1200 ppm (mallard duck) **Degradate SDS 3701** Survival: LD_{50} 158 mg/kg Growth/Reproduction NOAEC 50 ppm
	Mammals (Laboratory Rat)		**Parent** Survival: LD_{50}: >10000 mg/kg-bw Growth and Reproduction: NOAEC: 2000 ppm **Degradate SDS 3701** Survival: LD_{50} 332 mg/kg Growth/Reproduction: NOAEC 125 ppm
	Terrestrial plants [d]	Growth and Survival	Growth and Survival: **Parent** EC_{25}: >16 lb ai/acre for both monocots and dicots, both vegetative vigor and seedling emergence
Aquatic ecosystems: for tier 1 assessments the assessed environment is a 1 hectare, 20,000,000 L pond adjacent to 10 hectares of treated	Freshwater fish and amphibians (Rainbow trout)	Survival, growth, and reproduction of individuals and communities	Survival: **Parent** LC_{50}: 18 ppb (TGAI) **TEP** Bravo 720 61 ppb (33.2 ppb ai) **Degradate** SDS 3701 LC_{50} 15 ppm Growth and Reproduction: TGAI only NOAEC: 147 ppb

Table IB-1. Summary of Ecosystems, Taxa, and Assessment Endpoints Used to Evaluate Potential Ecological Effects from the Proposed New Chlorothalonil Uses			
	Freshwater invertebrates (Water fleas)		Survival: **Parent** LC_{50}: 54 ppb **TEP** Bravo 720 180 ppb **Degradate** EC_{50} 26 ppm Growth and Reproduction: **Parent** NOAEC: 6 ppb
	Estuarine/ marine fish and amphibians (Sheepshead minnow)		Survival :**Parent** LC_{50}: 32 ppb
	Estuarine/ marine invertebrates (mysid shrimp)		Survival: **Parent** EC_{50}: 3.6 ppb (oyster) Growth and Reproduction: **Parent** NOAEC: 0.83 ppb
	Aquatic plants and algae (Navicula)	Survival and reproduction of aquatic plants	Growth and reproduction: **Parent** EC_{50} = 190 ppb **Parent** NOAEC: 50 ppb

[a] Bird data are used as surrogate for amphibians (terrestrial phase) and reptiles.
[c] Freshwater fish data are used as surrogate for amphibians (aquatic phase).
[d] Four species of two families of monocots, of which one is corn; six species of at least four dicot families, of which one is soybeans.

D. Conceptual Model

In order for a chemical to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. For an ecological exposure pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure. In addition, the potential mechanisms of transformation (i.e., which degradates may form in the environment, in which media, and how much) must be known, especially for a chemical whose metabolites/degradates are of greater toxicological concern. The assessment of ecological exposure pathways, therefore, includes an examination of the source and potential migration pathways for constituents, and the determination of potential exposure routes (e.g., ingestion, inhalation, dermal absorption).

Ecological receptors that may potentially be exposed to chlorothalonil and its degradates include terrestrial and semi-aquatic wildlife (i.e., mammals, birds, and reptiles), plants (terrestrial semi-aquatic environments), and soil invertebrates. In addition to terrestrial ecological receptors, aquatic receptors (e.g., freshwater and estuarine/marine fish and invertebrates, amphibians, and aquatic plants) may also be exposed to potential migration of pesticides from the site of application to various watersheds and other aquatic environments via runoff, soil erosion, or spray drift. The Agency is particularly concerned with potential risk to non-target aquatic organisms based on chlorothalonil's high toxicity to aquatic organisms and potential risk to birds and mammals because of the toxicity of the primary degradate SDS 3701.

Adequate protection is defined as protection of growth, reproduction, and survival of aquatic and terrestrial ecological populations, and individuals of listed species, as needed.

1. Risk Hypotheses

Risk hypotheses are specific assumptions about potential adverse effects (i.e., changes in assessment endpoints) and may be based on theory and logic, empirical data, mathematical models, or probability models (EPA, 1998). For this assessment, the risk is stressor-linked, where the stressor is the release of chlorothalonil to the environment. The following risk hypothesis is presumed for this screening level assessment:

Based on the mobility and persistence of chlorothalonil, the mode of action, and the food-web of the target aquatic and terrestrial ecosystems, chlorothalonil has the potential to cause reduced survival, and reproductive and growth impairment for both aquatic and terrestrial animal and plant species.

2. Diagram

The conceptual model used to depict the potential ecological risk associated with chlorothalonil is fairly generic and assumes that as a pesticide, chlorothalonil, is capable of affecting terrestrial and aquatic organisms provided that environmental concentrations are sufficiently elevated as a result of proposed label uses. However, through a preliminary iterative process of examining fate and effects data, the conceptual model, *i.e.*, the risk hypothesis, has been refined to reflect the most significant exposure pathways and the organisms potentially at risk (**Figure 2**).

This conceptual model only considers potential environmental exposures as a result of the proposed non-food uses of chlorothalonil. It is assumed that the proposed spray applications of chlorothalonil on non-food uses crops may result in aquatic exposures via spray drift and/or runoff. Terrestrial animals have the potential to be exposed to chlorothalonil via dietary, inhalation, dermal, drinking water routes.

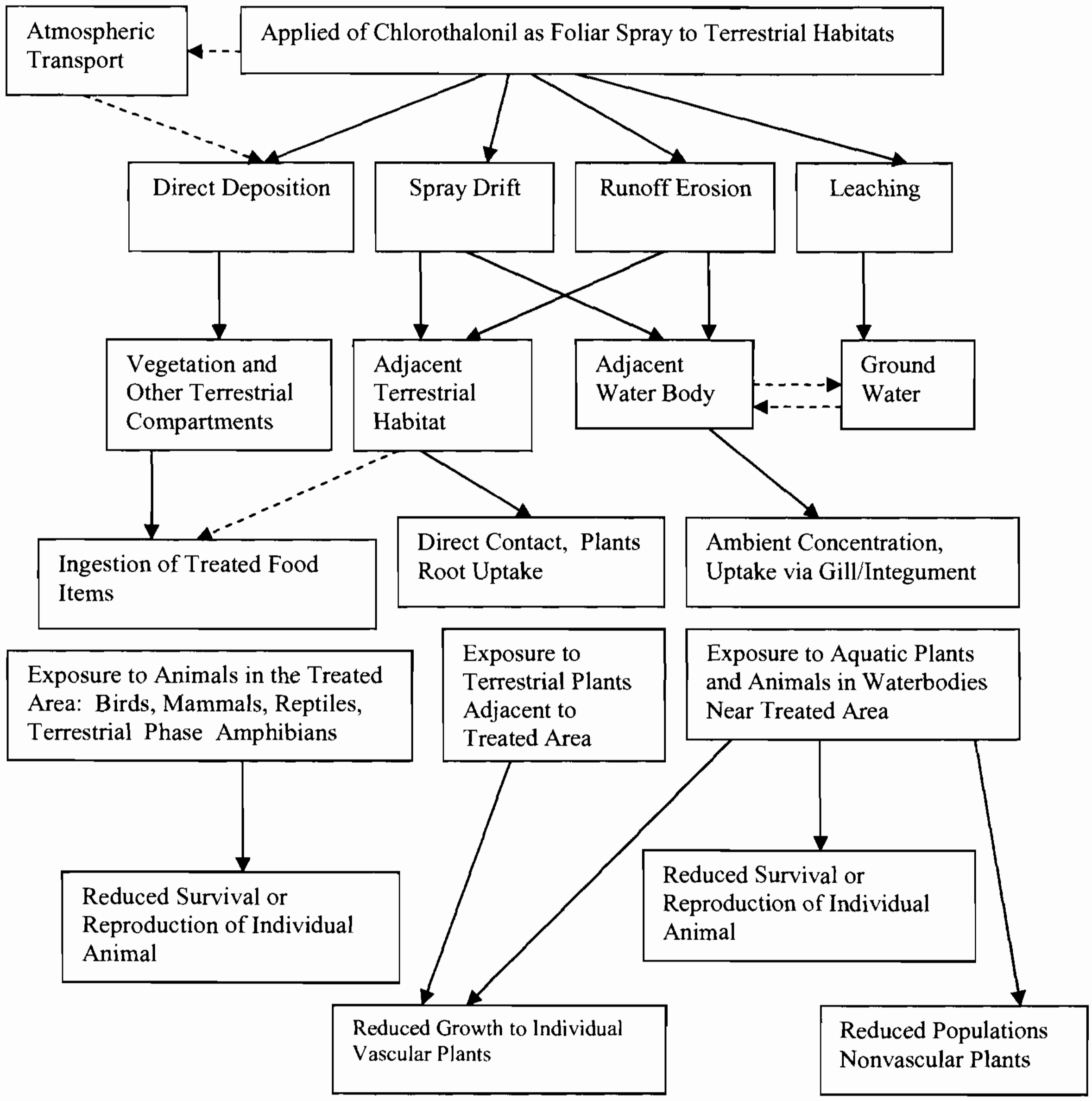


Figure 2. Conceptual Model: Potential Ecological Risks Based on Proposed Chlorothalonil Applications to Non-Food Uses

E. Analysis Plan

This document characterizes the environmental fate and effects of chlorothalonil to assess whether label uses of this compound results in potential risk to non-target organisms at levels above the Agency's Levels of Concern (LOCs). The Agency is particularly concerned with potential risk to non-target aquatic organisms based on chlorothalonil's high toxicity to fish and aquatic invertebrates. Residues in or on selected potential dietary sources for mammals and birds (e.g., vegetation, insects) that could be ingested by these organisms were estimated using the conceptual approach given in the Tier 1 model TREX (v 1.2.3, 2005). Risks to aquatic species were based on estimated environmental concentrations of chlorothalonil in surface water calculated using the linked PRZM/EXAMS models run through the PE4v01 shell. PRZM (Pesticide Root Zone Model) simulates runoff and erosion from an agricultural field on a daily time step. Integration of effects and potential exposure is done using the quotient method EEC/Toxicity to provide an estimate of adverse effects (risk) to non-target endangered/threatened and non-endangered animals and plants that could potentially impact the registration decision of chlorothalonil under the Federal Insecticide, Fungicide and Rodenticide Act, the Food Quality Protection Act, and the Endangered Species Act.

Some environmental fate, ecotoxicity, and physicochemical property data were taken from previous assessments conducted by EFED. These data were not re-evaluated. Some data were taken from studies submitted by Vischim. These data were evaluated for this Me-Too assessment.

1. Preliminary Identification of Data Gaps and Methods

Integration of effects and potential exposure provide an estimate of adverse effects (risk) to non-target endangered/threatened and non-endangered animals and plants that could potentially impact the registration decision of chlorothalonil under the Federal Insecticide, Fungicide and Rodenticide Act, the Food Quality Protection Act, and the Endangered Species Act. A risk quotient approach (ratio of exposure concentration to effects concentration) was used to determine whether risk of adverse effects to non-target terrestrial and aquatic animals are above the Agency's LOCs.

Preliminary Identification of Data Gaps

The data set for chlorothalonil is adequate to do a complete Tier I assessment. No data gaps were identified.

However, Vischim, the registrant requesting the Me-Too registration, did not cite/submit all guideline studies required to assess risk. Some data used were submitted by previous registrants, but not cited by Vischim. The following presents which data were cited/submitted by Vischim and which guidelines were not fulfilled by Vischim.

Summary of Data Requirements Not Fulfilled by Vischim Corp.

An OPPTS 870-1100 Mammal LD_{50} with parent and with degradate (SDS 3701) would be needed to assess risk to wild mammals. It was not clear if these were submitted/cited by Vischim.

A rat 2-generation reproduction study is needed with both parent and degradate (SDS 3701). It was not clear if these were submitted/cited by Vischim.

No 71-4 (OPPTS 850.2300) Mallard duck reproduction study with the TGAI was referenced or submitted. A Bobwhite quail study was submitted, and a previously Bobwhite quail study was also cited. A Mallard duck study should be submitted or cited. These are also needed to assess risk to birds and the organisms birds are surrogate for (reptiles and terrestrial phase amphibians.)

No 71-4 (OPPTS 850.2300) Mallard duck or Bobwhite quail reproduction studies were submitted or cited with the primary degradate, SDS3701. These studies should be submitted or cited.

The submitted 72-1 (OPPTS 850.1075) warmwater fish species, Carp, is not a preferred species. A study with a preferred species (eg Bluegill) should be submitted or cited.

A 72-5 (OPPTS 850.1500) fish full life cycle study needs to be cited or submitted. The studies cited for this guideline are not fish full life cycle studies. This is required.

A 72-1 (OPPTS 850.1075) acute test with the TEP and a coldwater species was not cited or submitted. This is required.

A 72-1 (OPPTS 850.1075) acute test with the degradate and a coldwater species was not cited or submitted. This is required.

A 72-2 (OPPTS 850.1010) study with the TEP was not submitted or cited. This is required to assess risk from drift.

A 72-2 (OPPTS 850.1010) study with the the degradate SDS 3701 was not submitted or cited. This is required.

A 72-4 mysid shrimp chronic study was not cited or submitted. This study is required.

A referenced 161-3, photodegradation on soil study (MRID # 00087349) is currently in review. The studies referenced under MRID # 00040542, 00040541, 00040543, and 00087348 are unacceptable, and are not useful for assessing the photodegradation of chlorothalonil on soil. Guideline is reserved pending review of existing studies.

Two referenced 162-1, aerobic soil metabolism studies (MRID # 00040547 and 00087285) are currently in review based upon current standards. The study referenced under MRID # 00087351 is classified as supplemental, and taken alone does not provide enough useful information to fully assess the aerobic metabolism of chlorothalonil in soil. Guideline is reserved pending review of existing studies.

A referenced 162-3, anaerobic aquatic soil metabolism study (MRID # 00147975) is classified as supplemental. Taken alone, it does not provide enough useful information to fully assess the anaerobic metabolism of chlorothalonil in soil/water systems. This study is required.

Three referenced 163-1, leaching/adsorption desorption studies (MRID # 00138144, 00137232 and 00029406) are currently in review based upon current standards. The study referenced under MRID # 00115105 is classified as supplemental, but taken alone does provide enough useful information to fully assess the leaching potential of unaged chlorothalonil in soil. Guideline is reserved pending review of existing studies.

A referenced set of 164-1, terrestrial field dissipation studies (MRID # 00071627, 00087369, 00087332, 00087301 are currently in review as if they were a single submission. Guideline is reserved pending review of existing studies.

2. Measures to Evaluate Risk Hypotheses and Conceptual Model

a. Measures of Exposure

Exposure concentrations for aquatic ecosystems were estimated based on the Tier 2 model, PRZM v.3.12 (Pesticide Root Zone Model, 2001), which simulates runoff and erosion from the agricultural field, and EXAMS v.2.98 (Exposure Analysis Modeling System, 2002), which simulates environmental fate and transport in surface water. For the terrestrial assessment, residues in or on potential dietary sources for mammals and birds (e.g., vegetation, insects, and seeds) were estimated using the conceptual approach given in the Tier 1 model TREX (v 1.2.3, 2005). The focus of terrestrial wildlife exposure estimates is for birds and mammals with an exposure route emphasis on uptake through the diet. In this Tier 1 assessment, it was assumed that organisms are exposed to one active ingredient in a given exposure scenario. In all screening-level assessments, the organisms are assumed to consume 100% of their diet as one food type.

b. Measures of Effect

Measures of ecological effects are obtained from a suite of registrant-submitted guideline studies conducted with a limited number of surrogate species. The test species are not intended to be representative of the most sensitive species but rather were selected based on their ability to thrive under laboratory conditions. Consistent with EPA test guidelines, a suite of ecological effects data on technical grade chlorothalonil that complies with good laboratory testing requirements has been submitted. These data are summarized in Section III.

A search of the open literature using EPA's Ecotoxicology database ECOTOX (http://www.epa.gov/ecotox) was not done for this Me-Too assessment. Therefore, no data from open literature studies are included in this report.

II. Analysis

A. Use Characterization

In the absence of new end-use labels, assessment for the Me-Too registration of chlorothalonil assumes the same uses, the same agronomic practices, and at the same application rates as used in the December 1, 2003 water assessment for use in endangered species risk assessments conducted by James Wolf, for Larry Turner from FEAD. Only the technical label has been provided to EFED.

Although chlorothalonil is currently registered for food uses, this Me-Too assessment is only considering terrestrial non-food and non-feed uses evaluated in the 2003 assessment, specifically: ornamental turf, sod, woody shrubs, herbaceous plants, vines and shade trees; Christmas trees; sod farms; golf courses and forest trees.

Table IIA-1 Proposed Non-Food Chlorothalonil Maximum Allowable Use Rates

Crop	Application Rate (lb. ai/acre)	Number of Applications (days)	Application Interval (days)
Oregon Christmas Tree	4.13	4	21
FL/Turf	12.7	7	14
PA/Turf	12.7	7	14

B. Exposure Characterization

1. Environmental Fate and Transport Characterization

Chlorothalonil degrades through both photolytic ($t_{1/2}$ = 10 hr) and microbial processes ($t_{1/2}$ = 5 – 68 days). Chlorothalonil degrades rapidly in clear, shallow water through aqueous photolysis. Chlorothalonil is not susceptible to hydrolysis in waters below pH 9, but does hydrolyze in waters at or above pH 9 ($t_{1/2}$ = 40-60 days). The main route of dissipation for chlorothalonil in the environment is expected to be through aqueous, biotic degradation ($t_{1/2}$ = 5-29 days). Chlorothalonil degrades under both aerobic aquatic conditions ($t_{1/2}$ = 7-16 days), and aerobic terrestrial conditions ($t_{1/2}$ = 22-68 days), and through anaerobic degradation ($t_{1/2}$ = 21-29 days). Biotic degradation rates for chlorothalonil are sensitive to the biogeochemical environment and ambient conditions, and may depart from first-order kinetics. Apparent initial aquatic half-lives for biotic degradation range from a few hours to around two weeks, while overall half-lives for the total system are much longer.

An identified major metabolite, 4-hydroxy-2,5,6-trichloro-1,3-dicyanobenzene, forms under differing test conditions, and appears to be persistent. Other metabolites also exhibit a degree of persistence sufficient to allow their appearance in ground water. Chlorothalonil and the chlorothalonil degradation product have simple chemical structures with simple substituents (including multiple chlorine atoms) attached to a single benzene ring.

Chlorothalonil is expected to range from slightly mobile to moderately mobile in the open environment (K_d = 3-30). Concentrations of chlorothalonil in benthic sediments could exceed concentrations found in runoff waters.

The vapor pressure and Henry's Law values for the chlorothalonil indicates a slight degree of volatility from both soil and water.

It has been demonstrated that chlorothalonil did not significantly bioconcentrate in oysters (BCF = 2660X) or bluegill sunfish (BCF = 3000X). Recalcitrant metabolites did concentrate somewhat in the biochemical (carbon) pool of the organisms, and were slow to be eliminated. Evolution of volatile compounds, including carbon dioxide, was not significant in laboratory testing. However, local ambient air monitoring data demonstrated that chlorothalonil was present in the air at locations up to a mile away from the application sites[4].

Table IIB-2 Summary of Environmental Fate Properties of Chlorothalonil Used in Assessment

Study Type	Value	Test System	Source / MRID Number
Hydrolysis	half-life = stable	pH 5 and 7; (half-life = 30-60 days @ pH9 -may be concentration dependant)	0040539, 00147975
Aquatic Photodegradation	half-life = 10 hours	pH 7	45710223
Photodegradation on Soil	half-life = stable		00040541, 00040542, 00040543, 00143751
Aerobic Soil Metabolism	half-life = 68 days; half-life = 24 days; half-life = 22 days; half-life = 24 days	silt loam soil loam soil TX sandy loam soil OH sandy loam soil	00087351
Aerobic Aquatic Metabolism	total system half-life = 21 days, total system half-life = 13 days	Running ditch water-clay sediment, UK Pond water-clay loam sediment, UK	45908001
Anaerobic Aquatic Metabolism	total system half-life = 21 days; total system half-life = 29 days	silt loam soil; sandy loam soil	00147975
Adsorption/Desorption	26 (K_d) 29 (K_d)	silty clay loam soil; silt soil;	00115105 00153730 for aged

[4] JOURNAL OF PESTICIDE REFORM/ WINTER 1997 • VOL.17, NO.
http://64.233.161.104/search?q=cache:0yXOLRyW_IUJ:www.pesticide.org/chlorothalonil.pdf+chlorothalonil+monitoring&hl=en&gl=us&ct=clnk&cd=5

	20 (K_d) 3 (K_d)	sandy loam soil; sand soil	column
Laboratory Volatility	5.72 x 10^{-7} torr	25 °C	00153732
Bioaccumulation in Fish	200 X 3000 X	edible tissue visceral tissue	45710224
Bioaccumulation in Bivalves	2660 X		42070601
Terrestrial Field Dissipation	half-life (total system) = 1-2 months	sandy loam soil	00087296; 42433813

2. Measures of Aquatic Exposure

a. Aquatic Exposure Modeling

Models, Scenarios, and Input Parameters

The estimated ecological effects concentrations (EECs) for surface water were calculated using Tier II PRZM (Pesticide Root Zone Model) and EXAMS (Exposure Analysis Modeling System). PRZM is used to simulate pesticide transport as a result of runoff and erosion from a standardized field planted in a single crop, and EXAMS estimates environmental fate and transport of pesticides in a standardized pond. The linkage program shell - PE4V01, which incorporates the standard scenarios developed by EFED, was used to run these models.

Linked crop-specific scenarios and meteorological data were used to estimate exposure as a result of specific uses for each modeling scenario. Simulations were done using the Ecological Effects Pond scenario in EXAMS. Weather and agricultural practices are simulated over 30 years so that the 1-in10 year exceedence probability at the site can be estimated (http://www.epa.gov/oppefed1/models/water/index.htm).

A total of three EFED standard scenarios were simulated for this aquatic ecological effects assessment. The PRZM/EXAMS modeled predictions are based on maximum labeled applications of chlorothalonil for the non-food uses. Among EFED's standard crop scenarios, there are 2 turf scenarios, and 1 surrogate ornamental scenario.

Input Parameters

Appropriate PRZM/EXAMS input parameters were selected from all available environmental fate data submitted to the Agency for chlorothalonil in accordance with US EPA-OPP EFED water model parameter selection *Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides, Version 2.3, February 28, 2002.* Dates for first pesticide application and application intervals were chosen to represent the actual window in which chlorothalonil will be applied.

Table IIB-3 Summary of Environmental Fate Data Used for the Aquatic Ecological Effects Assessment

Inputs		
Fate Property	**Input Value**	**MRID (or source)**
Molecular Weight	**265.9**	Chlorothalonil RED, EPA 738-R-99004, April, 1999
Henry's Law Constant	**2.6 x 10^{-7} atm - m^3/mole**	Chlorothalonil RED, EPA 738-R-99004, April, 1999
Vapor Pressure	**5.72 x 10^{-7} torr**	00153732
Aqueous Solubility	**0.8 mg/L at 25 °C**	Chlorothalonil RED, EPA 738-R-99004, April, 1999
Aqueous Photolysis	10 hours (**0.4 days**)	45710223, (40183418)
Aerobic Soil Metabolism Half- lives	**71 days** (90% upper bound on mean of 68, 24, 22 and 24 days; 35.4 + ((3.2 x 22.4)/sqrt 4)	00087351
Hydrolysis	**stable** @ pH =5 and 7	0040539
Aerobic Aquatic Metabolism (water column)	**35.2 days** (90% upper bound on mean of 13, 21 and 2.5 days; 12.2 + ((4.3 x 9.36)/sqrt 3)	45908001, (42226101)
Anaerobic Aquatic Metabolism (benthic)	**15 days** (range 5 to 15 days reported)	00147975
K_{ads}	**19.5** (average 26, 29, 20, and 3)	00115105
Application Efficiency	**95 percent**	EFED Guidance
Spray Drift	**5 percent**	EFED Guidance

Table IIB-4 Scenarios and Application Rates for Modeled Crops

Agricultural Commodity	Scenario Location	Application Rate (kg/ha)	Application Date	Number of Applications	Application Interval (days)
Christmas Trees – Oregon[1]	Benton County, OR	4.6	01-05	4	21
Turf - Florida	Osceola County, FL	12.7	01-06	7	14
Turf - Pennsylvania	York County, PA	12.7	15-09	7	14

[1]Used as a surrogate for all ornamental plants

Model Outputs for Chlorothalonil

PRZM/EXAMS estimated surface water concentrations was modeled for aerial applications of chlorothalonil to Oregon Christmas trees, which was used as surrogates for all ornamental uses, and to Florida and Pennsylvania turf (Table IIIB-5). The highest peak EEC values were estimated to be 331 µg/L (ppb) for chlorothalonil applied to Florida turf at the maximum labeled application rate. The highest 21 day concentration was estimated to be 254 µg/L (ppb) for chlorothalonil applied to Pennsylvania turf. The highest 60 day concentration was estimated to be 205 µg/L (ppb) for chlorothalonil applied to Pennsylvania turf.

Table IIB-6 Tier II, PRZM/EXAMS, Estimated Aquatic Ecological Effects Concentration (EECs) of Chlorothalonil in standard ecological pond for Non-Food Uses. Simulation Based Aerial Applications.

Concentrations are in µg/L (ppb)					
State/Crop	Application Rate-Individual/ Seasonal	Number of Applications/ Application Interval	1-in-10-year annual exceedence probability for		
			Peak EEC	21-day	60-day
	lb. ai/ac	month/day	µg/L (ppb)		
OR/X-masTre	4.13 / 16.5	4/21	25.7	19.9	17.7
FL/turf	11.3 / 79.1	7/14	331	237	197
PA/turf	11.3 / 79.1	7/14	288	254	205

b. Aquatic Exposure Monitoring and Field Data

Available NAWQA (USGS National Water Quality Assessment Data Warehouse) aquatic monitoring data (http://web1.er.usgs.gov/NAWQAMapTheme/index.jsp) indicates that chlorothalonil was not detected in either surface water or ground water at any of the site types monitored throughout the United States. Local monitoring data from southern Florida also indicate that chlorothalonil was not present in any samples tested. However, data for use patterns (application rate, spatial and temporal distributions) that are necessary to evaluate the monitoring data are not currently available. Additionally, groundwater monitoring data from Suffolk County, New York (MRID 44006001) confirmed that chlorothalonil metabolites were present in ground water, but these metabolite(s) were not identified to be of concern for this assessment.

While Evolution of volatile compounds was not significant in laboratory testing, local ambient air monitoring data from a site in North Dakota and three sites in California indicate that chlorothalonil was present in the air at the application sites, and at locations up to a mile away from the application sites[5].

Terrestrial and aquatic field dissipation studies referenced by Vischim are currently under review. Data from the one available terrestrial field dissipation study indicates that chlorothalonil dissipates from a terrestrial test plot with a total system half-life of one to two months. A cursive, preliminary inspection of the field dissipation data currently under review indicates that the results of these studies appear to be in concurrence with laboratory fate data.

C. Ecological Effects Characterization

[5] JOURNAL OF PESTICIDE REFORM/ WINTER 1997 • VOL.17, NO.
http://64.233.161.104/search?q=cache:0yXOLRyW_IUJ:www.pesticide.org/chlorothalonil.pdf+chlorothalonil+monitoring&hl=en&gl=us&ct=clnk&cd=5

The following presents the ecological effects data that will be used in assessing risk from chlorothalonil and its primary degradate SDS3701. The assessment also identifies, for each study whether that specific study was cited or submitted by Vischim Corp or not.

1. Aquatic Effects Characterization

a. Aquatic Animals Toxicity

FW Fish acute

Parent chlorothalonil

Fish 96-hr LC_{50}=18 ppb rainbow trout (MRID 45710219 submitted by Vischim)
This is lower than any of the other submitted or available acute toxicity test results for fish so it will be used for assessing acute risk to fish.

Estuarine fish 96-hr LC_{50}=32 ppb (MRID 00127863, cited by Vishcim)

TEP

The specific test endpoint used to assess risk from the TEP would depend on the TEP being applied and if it was being applied by air. If no aerial application, drift of the TEP would not be a significant route of exposure. The available data do not suggest the TEP is more toxic than the ai, or makes the ai more toxic.

Bravo 720 (54% ai) Rainbow trout LC_{50} 61 ppb (33.2 ppb ai)

Degradate SDS3701

Testing with the degradate, SDS3701 does not suggest that it represents a risk.

Fish 96-hr LC_{50}=15 ppm Bluegill (MRID 00030393 not cited by Vischim)

SW Fish acute

Sheepshead minnow 96-hr LC_{50}=32 ppb Sheepshead minnow (MRID 00127863 cited by Vischim)

Fish Chronic

Fathead minnow NOAEC 3 ppb (MRID 00030391 not cited by Vischim)

FW Invertebrate Acute

Parent Chlorothalonil

Daphnia EC_{50} 54 ppb (MRID 45710221 submitted by Vischim)

Vischim also cited MRID 00068754 which is an acute Daphnia test EC_{50}=68 ppb

TEP

Daphnia EC_{50} for Bravo 720=180 ppb (97 ppb for ai)

Degradate SDS3701

Daphnia EC_{50}=26 ppm (MRID 00030394 not cited by Vischim)

SW Invertebrate

Oyster shell deposition EC_{50}=3.6 ppb (MRID 00138143 cited by Vischim)

Shrimp EC_{50}=154 ppb (MRID 00127864 cited by Vischim)

FW Invertebrate Chronic

Daphnia NOAEC 6 ppb LOAEC 18 ppb (MRID 45710222 submitted by Vischim)

SW Invertebrate Chronic

Shrimp NOAEC 0.83 ppb LOAEC 1.2 ppb (MRID 42433807 not cited by Vischim)

b. Aquatic Plants

Selenastrum EC_{50}=190 ppb, NOAEC = 50 ppb

2. Terrestrial Effects Characterization

a. Mammal Toxicity:

Parent Chlorothalonil

These data show low potential for risk as environmental relevant exposure levels, see exposure assessment.

Rat LD_{50} >10,000 mg/kg (MRID 00094940) not cited by Vischim Corp. Vischim cited 45710203, but the data evaluation for this study was not available to EFED at the time of this assessment.

Rat development NOAEL = 2000 ppm (100 mg/kg bw) (MRID 00130733)

Rat 2-generation reproductive effects NOAEL = 3000 ppm (MRID 41706201C)

Table IIC-1 Original and Adjusted Toxicity Used to Assess Risk to Mammals
Chlorothalonil

Test Endpoint	Study Result	MRID	Test Species	Wt of tested mammal (TW)
LD_{50} mg/kg	>10000	00094940	rat	350
NOAEL mg/kg	100	00130733	rat	350
NOAEL mg/kg diet	2000	00130733		

Weight of Assessed Mammal (AW)	Adjusted LD_{50} (mg/kg bw	Adjusted NOAEL (mg/kg bw/day)	Equation for calculating adjusted toxicity (replace LD_{50} with NOAEL for adjusted NOAEL)
15	>21978	220	$Adj.LD_{50} = LD_{50}\left(\frac{TW}{AW}\right)^{(0.25)}$
35	>17783	178	
1000	>7692	77	

Degradate SDS3701

The following table was extracted from the Chlorothalonil RED. It was not evident that Vischim Corp. cited or submitted any mammal toxicity data with the degradate SDS 3701. EFED required both an acute oral LD_{50} and multiple-generation reproductive test with SDS 3701 to support a complete risk assessment.

Table IIC-2 Mammalian Toxicity Findings for Degradate SDS-3701

Test Species	LD_{50} mg/kg	NOEL PPM	LOEL PPM	Citation (MRID #)	Toxicity Category
Rat (small mammal surrogate)	332			001098	moderately toxic
Rabbit (developmental)		> 165 (develop) highest dose tested	82.5 maternal death and abortion	001096; 003925	n/a
Rat (3 generation reproduction)		> 125 (repro) highest dose tested	reduced pup body weight gain at 60 ppm	071524; 003725; 003925	n/a
Rat (1 generation reproduction)		> 120 (repro) highest dose tested	reduced pup body weight gain at 60 ppm	071525; 003725	n/a

Based on an LD_{50} of 332 mg/kg, and a reproductive no effect level of 125 ppm (6.25 mg/kg bw), the following toxicity values are used to assess risk to mammals from SDS 3701.

Table IIC-3 Original and Adjusted Toxicity Used to Assess Risk to Mammals
Degradate SDS 3701

Test Endpoint	Study Result	MRID	Test Species	Wt of tested mammal (TW)

LD_{50} mg/kg	332	0001098	rat	350
NOAEL mg/kg bw	6.25	00071524	rat	350
NOAEL mg/kg diet	125			

Weight of Assessed Mammal (AW)	Adjusted LD_{50} (mg/kg bw	Adjusted NOAEL (mg/kg bw/day)	Equation for calculating adjusted toxicity (replace LD_{50} with NOAEL for adjusted NOAEL)
15	730	14	$Adj.LD_{50} = LD_{50}\left(\frac{TW}{AW}\right)^{(0.25)}$
35	590	11	
1000	255	5	

Avian Toxicity:

These data show low potential for acute risk as environmental relevant exposure levels, however, chronic risk is possible. See exposure and risk characterization.

Acute risk from parent chlorothalonil to birds will be based on an avian LD_{50} of >4640 (MRID 00068753 cited by Vischim) and an LC_{50} of >10,000 ppm (MRIDs 00030388 cited by Vischim and 00039146 cited by Vischim). Another avian dietary study with mallard ducks resulated in an LC_{50} of >21500 (MRID 00039146).

Avian chronic NOAEL=153 ppm, LOAEL 625 ppm Bobwhite quail (MRID 45710218 submitted by Vischim)

Table IIC-4 Original and Adjusted Toxicity Used to Assess Dose Based Risk to Birds from Chlorothalonil

Test Endpoint	Study Result	MRID	Test Species	Wt of tested bird (TW)
LD_{50} mg/kg	4640	00068753	Mallard	1580

Weight of Assessed Birds (AW)	Adjusted LD_{50} (mg/kg bw	Equation for calculating adjusted toxicity
20	2409	$Adj.LD_{50} = LD_{50}\left(\frac{AW}{TW}\right)^{(1.15-1)}$
100	3067	
1000	4332	

The primary degradate of chlorothalonil, SDS 3701 is more toxic to birds than parent chlorothalonil.

Avian LD_{50}=158 mg/kg Mallard duck (MRID 00030395 cited by Vischim)

Avian LC_{50}=1746 ppm Bobwhite quail (MRID 00011509 cited by Vischim)

Avian reproductive NOAEC=50 ppm Mallard duck (MRID 40729402 not cited by Vischim)

Table IIC-5 Original and Adjusted Toxicity Used to Assess Dose Based Risk to Birds from Degradate SDS 3701

Test Endpoint	Study Result	MRID	Test Species	Wt of tested bird (TW)
LD_{50} mg/kg	158	00030395	Mallard	1580

Weight of Assessed Birds (AW)	Adjusted LD_{50} (mg/kg bw	Equation for calculating adjusted toxicity
20	82	$Adj.LD_{50} = LD_{50}\left(\frac{AW}{TW}\right)^{(1.15-1)}$
100	104	
1000	148	

a. **Terrestrial Plants**

Vegetative Vigor EC_{25}>16 lb ai/acre (MRID 42433809 cited by Vischim)

Seedling Emergence EC_{25}>16 lb ai/acre (MRID 42433808 cited by Vischim)

III. Risk Characterization

A. Risk Description

Risk characterization integrates EEC's and toxicity estimates and evaluates whether the proposed chlorothalonil uses pose risk to non-target species at levels of concern to the Agency. In a deterministic approach, a single point estimate of toxicity is divided by an exposure estimate to calculate a risk quotient (RQ). The RQ is then compared to Agency LOC's that serve as criteria for categorizing potential risk to non-target organisms. LOC's currently address the following risk presumption categories:

Table III-1 Risk Presumptions for Terrestrial Animals

Risk Presumption	Risk Quotient (RQ)	Level of Concern (LOC)
	Birds	

Table III-1 Risk Presumptions for Terrestrial Animals

Risk Presumption	Risk Quotient (RQ)	Level of Concern (LOC)
Acute Risk	EEC^1/LC_{50}	0.5
Acute Restricted Use	EEC/LC_{50} or $LD_{50} < 50$ mg/kg	0.2
Acute Endangered Species	EEC/LC_{50}	0.1
Chronic Risk	EEC/NOAEC	1
Wild Mammals		
Acute Risk	EEC/LC_{50}	0.5
Acute Restricted Use	EEC/LC_{50} or $LD_{50} < 50$ mg/kg	0.2
Acute Endangered Species	EEC/LC_{50}	0.1
Chronic Risk	EEC/NOAEC	1

[1] abbreviation for Estimated Environmental Concentration (ppm) on avian/mammalian food items

Table IIIC-2 Risk Presumptions for Aquatic Animals

Risk Presumption	RQ	LOC
Acute Risk	EEC^1/LC_{50} or EC_{50}	0.5
Acute Restricted Use	EEC/LC_{50} or EC_{50}	0.1
Acute Endangered Species	EEC/LC_{50} or EC_{50}	0.05
Chronic Risk	EEC/NOAEC	1

[1] EEC = (ppm or ppb) in water

Table IIIC-3 Risk Presumptions for Plants

Risk Presumption	RQ	LOC
Plant Inhabiting Terrestrial and Semi-Aquatic Areas		
Acute Risk	EEC^1/EC_{25}	1
Acute Endangered Species	EEC/ NOAEC	1
Aquatic Plants		
Acute Risk	EEC^2/EC_{50}	1
Acute Endangered Species	EEC/ NOAEC	1

[1] EEC = lbs a.i./A
[2] EEC = (ppb or ppm) in water

1. Risk Estimation - Integration of Exposure and Effects Data

The risk estimation presents risk quotients calculated for chlorothalonil and the LOCs (if any) that are exceeded.

a. Non-target Aquatic Animals and Plants

Acute and chronic risk quotients and LOC exceedances are presented in Tables IV-1 to IV-3 below. The following LOCs were exceeded:

Discussion of these exceedances is presented in the risk description (Section IV.B. of this document).

Table IIIC-4 Risk Quotients for Aquatic Organisms for Turf Use at 11.3 lb ai/acre, 7 Applications at 14 Day Intervals. EECs Were Based on PRZM EXAMS, Pennsylvania Turf Scenario

Taxonomic Group and Endpoint	Surrogate Species	Toxicity [MRID]	EEC Duration	EEC	RQ
FW Fish Acute	Rainbow trout (surrogate for amphibian)	18 ppb [45710219]	peak	288	**16**
FW Invert Acute	Daphnia	54 ppb [45710221]	peak	288	**5.3**
SW Fish Acute	Sheepshead minnow (surrogate for amphibian)	32 ppb [00127863]	peak	288	**96**
SW Invert Acute	Shrimp	154 ppb [00127864]	peak	288	**1.9**
SW Mussel Acute	Oyster	3.6 ppb [00138143]	peak	288	**80**
FW Fish Chronic	Fathead minnow	NOAEC 3 ppb [00030391]	60-day	205	**68**
FW Invert Chronic	Daphnia	NOAEC 6 ppb [45710222]	21-day	254	**42**
SW Invert Chronic	Shrimp	NOAEC 0.83 ppb [42433807]	21-day	254	**306**
Aquatic Plants	Selenastrum	EC_{50} 190 ppb NOAEC 50 ppb [42432801]	peak	288	**1.5**

RQs that are bolded exceed the animal species LOCs; endangered (0.05), restricted use (0.01) and nonendangered (0.5) and the endangered plant LOC (1).

Table IIIC-5 Risk Quotients for Aquatic Organisms for Turf Use at 11.3 lb ai/acre, 7 Applications at 14 Day Intervals. EECs Were Based on PRZM EXAMS, Florida Turf Scenario					
Taxonomic Group and Endpoint	**Surrogate Species**	**Toxicity [MRID]**	**EEC Duration**	**EEC**	**RQ**
FW Fish Acute	Rainbow trout (surrogate for amphibian)	18 ppb [45710219]	peak	331	**18.4**
FW Invert Acute	Daphnia	54 ppb [45710221]	peak	331	**66.2**
SW Fish Acute	Sheepshead minnow (surrogate for amphibian)	32 ppb [00127863]	peak	331	**10.3**
SW Invert Acute	Shrimp	154 ppb [00127864]	peak	331	**2**
SW Mussel Acute	Oyster	3.6 ppb [00138143]	peak	331	**91.9**
FW Fish Chronic	Fathead minnow	NOAEC 3 ppb [00030391]	60-day	197	**65.7**
FW Invert Chronic	Daphnia	NOAEC 6 ppb [45710222]	21-day	237	**39.5**
SW Invert Chronic	Shrimp	NOAEC 0.83 ppb [42433807]	21-day	237	**285.5**
Aquatic Plants	Selenastrum	EC_{50} 190 ppb NOAEC 50 ppb [42432801]	peak	331	**1.7**
RQs that are bolded exceed the animal species LOCs; endangered (0.05), restricted use (0.01) and nonendangered (0.5) and the endangered plant LOC (1).					

Table IIIC-6 Risk Quotients for Aquatic Organisms for Ornamental Use at 4.13 lb ai/acre, 4 Applications at 21 Day Intervals. EECs Were Based on PRZM EXAMS, Oregon Christmas Tree Scenario					
Taxonomic Group and Endpoint	**Surrogate Species**	**Toxicity [MRID]**	**EEC Duration**	**EEC**	**RQ**
FW Fish Acute	Rainbow trout (surrogate for amphibian)	18 ppb [45710219]	peak	25.7	**1.4**
FW Invert Acute	Daphnia	54 ppb [45710221]	peak	25.7	*0.48*
SW Fish Acute	Sheepshead minnow (surrogate for amphibian)	32 ppb [00127863]	peak	25.7	**0.8**
SW Invert Acute	Shrimp	154 ppb	peak	25.7	*0.17*

		[00127864]			
SW Mussel Acute	Oyster	3.6 ppb [00138143]	peak	25.7	**7.1**
FW Fish Chronic	Fathead minnow	NOAEC 3 ppb [00030391]	60-day	17.7	**5.9**
FW Invert Chronic	Daphnia	NOAEC 6 ppb [45710222]	21-day	19.9	**3.3**
SW Invert Chronic	Shrimp	NOAEC 0.83 ppb [42433807]	21-day	19.9	**23.9**
Aquatic Plants	Selenastrum	EC_{50} 190 ppb NOAEC 50 ppb [42432801]	peak	25.7	0.14
RQs that are bolded exceed the animal species LOCs; endangered (0.05), restricted use (0.01) and nonendangered (0.5) and the endangered plant LOC (1). *RQs in italics exceed the endangered species LOC (0.05)*					

The risk quotients in the above tables indicate that based on a tier II assessment (using PRZM EXAMS) there is potential risk to all aquatic organisms including aquatic plants for the turf use.

Testing was submitted on the toxicity of the degradate SDS 3701 to aquatic organisms. The following test results suggest SDS 3701 is much less toxic than parent chlorothalonil.

Bluegill LC_{50}=15 ppm [00030393]

Daphnia EC_{50}=26 ppm [00030394]

No quantitative risk assessment was done for SDS-3701 because visual comparisons of peak exposures from parent chlorothalonil suggest minimal risk because there would not be more of the degradate than of the parent; the degradate would not likely form more than 100% of the parent.

Testing with Typical End-use Products do not suggest the TEP is more toxic than parent chlorothalonil. No separate risk assessment was done for TEP formulations.

b. Non-target Aquatic Terrestrial Organisms

(1) Mammals

Acute Mammals

Acute risk quotients were not calculated because no effects were observed at the highest dose tested in the available acute toxicity studies. The dose based EECs are compared to the adjusted LD_{50} ">" values derived from the >10,000 mg/kg. None of the dose based EECs for the various weight classes comes close to the adjusted > LD_{50} suggesting low probability of acute effects to mammals. Where low risk is concluded with the maximum rates of 11.3 lb ai/acre, the lower rate of 4.13 lb ai/acre are not modeled.

Table IIIC-7 Upper 95th Percentile Chlorothalonil Dose Based EECs (mg/kg-bw) on Selected Food Items for Small to Medium Sized Mammals Following 7 Applications of 11.3 lb ai/acre at 14 Day Intervals Assuming a 35-Day Foliar Dissipation Rate. Exposure Values Calculated Using TREX Version 1.2.3

	Herbivores (mass fraction of water in food=0.8)			Granivores(mass fraction of water in food=0.1)		
	15 g	35 g	1000 g	15 g	35 g	1000 g
Short Grass	9145.1	6320.5	1465.4			
Tall Grass	4191.5	2896.9	671.7			
Fruits/pods/lg insects	5144.1	3555.3	824.3			
Fruits/seed pods/lg insects	571.6	395.0	91.6	127.0	87.8	20.45

Table IIIC-8 Original and Adjusted Toxicity Used to Assess Dose Based Risk to Mammals from Chlorothalonil

Test Endpoint	Study Result	MRID	Test Species	Wt of tested mammal (TW)
LD_{50} mg/kg	10000	00094940	rat	350
NOAEL mg/kg	100	00130733	rat	350
NOAEL mg/kg diet	2000	00130733		

Weight of Assessed Mammal (AW)	Adjusted LD_{50} (mg/kg bw	Adjusted NOAEL (mg/kg bw/day)	Equation for calculating adjusted toxicity (replace LD_{50} with NOAEL for adjusted NOAEL)
15	21978	220	$Adj.LD_{50} = LD_{50}\left(\frac{TW}{AW}\right)^{(0.25)}$
35	17783	178	
1000	7692	77	

Chronic Mammals

Chronic risk quotients for parent chlorothalonil are in Table IV-9 below. The mammalian chronic LOC of 1 was exceeded for herbivores of all sizes feeding on grass, broadleaf plants, small fruits and insectivores feeding on insects. The risk quotients are not exceeded for seed eating mammals.

Table IIIC-9 Dose-Based Chronic Risk Quotients Based on the Upper 95th Percentile Chlorothalonil EECs (mg/kg-bw) on Selected Food Items for Small to Medium Sized Mammals				
Food Item		**Mammal Classes and Body Weights**		
		15-gram NOAEL$_{Adj}$: 220 mg/kg-bw	35-gram NOAEL$_{Adj}$: 178 mg/kg-bw	1000-gram NOAEL$_{Adj}$: 77 mg/kg-bw
Short Grass	Use on Turf at 11.3 lb ai/acre applied 7 times at 14 day intervals	**41.6**	**35.5**	**19.1**
Tall Grass		**19.1**	**16.3**	**8.7**
Broadleaf plants/sm insects		**23.4**	**20.0**	**10.7**
Fruits/pods/lg insects		**2.6**	**2.2**	**1.2**
Seeds (granivores)		1.0	0.5	0.3

Table IIIC-10 Dose-Based Chronic Risk Quotients Based on the Upper 95th Percentile Chlorothalonil EECs (mg/kg-bw) on Selected Food Items for Small to Medium Sized Mammals				
Food Item		**Mammal Classes and Body Weights**		
		15-gram NOAEL$_{Adj}$: 220 mg/kg-bw	35-gram NOAEL$_{Adj}$: 178 mg/kg-bw	1000-gram NOAEL$_{Adj}$: 77 mg/kg-bw
Short Grass	Use on Turf at 4.13 lb ai/acre applied 4 times at 21 day intervals	**10.3**	**8.8**	**4.7**
Tall Grass		**4.7**	**4.0**	**2.2**
Broadleaf plants/sm insects		**5.8**	**4.9**	**2.6**
Fruits/pods/lg insects		0.6	0.6	0.3
Seeds (granivores)		0.1	0.1	0.1

Lower application rates result in lower risk, but the LOC is still exceeded for all mammal sizes for many food items.

Risk to Mammals from Degradate SDS 3701

The following table shows the adjusted toxicity values used to assess risk to mammals from degradate SDS 3701 for various weight mammals. The equation to calculate the adjusted toxicity values is presented in the Ecological Effects Section.

Table IIIC-11 Original and Adjusted Toxicity Used to Assess Dose Based Risk to Mammals from Degradate SDS 3701

Test Endpoint	Study Result	MRID	Test Species	Wt of tested mammal (TW)
LD_{50} mg/kg	332	0001098	rat	350
NOAEL mg/kg bw	6.3	00071524	rat	350

NOAEL mg/kg diet	125	00071524	
Weight of Assessed Mammal (AW)	**Adjusted LD_{50} (mg/kg bw**	**Adjusted NOAEL (mg/kg bw/day)**	**Equation for calculating adjusted toxicity (replace LD_{50} with NOAEL for adjusted NOAEL)**
15	730	14	$Adj.LD_{50} = LD_{50}\left(\frac{TW}{AW}\right)^{(0.25)}$
35	590	11	
1000	255	5	

Acute and Chronic risk from degradate SDS 3701

Table IIIC-12 Acute and Chronic Dose-Based Risk Quotients for Small to Medium Sized Mammals from Degradate SDS 3701 Occurring at the Equivalent of 10% of Parent Chlorothalonil or 1.1 lb ai/acre, 7 Applications at 14-Day Interval Assuming a Foliar Half-life of 35 Days

	15 gram mammals		35 gram mammals		1000 gram mammals	
	acute	chronic	acute	chronic	acute	chronic
Short Grass	**1.2**	**135.0**	**1.04**	**115.3**	**0.6**	**61.8**
Tall Grass	**0.6**	**61.9**	*0.5*	**52.9**	*0.3*	**28.3**
Broadleaf plants/sm insects	**0.7**	**76.0**	**0.6**	**64.9**	*0.3*	**34.8**
Fruits/pods/lg insects	0.1	**8.4**	0.07	**7.2**	0.03	**3.9**
Seeds (granivore)	0.02	**1.88**	0.01	**1.6**	0.01	0.9

RQ in bold exceed endangered species and non-endangered species (0.5) LOCs. RQs in italics exceed the endangered species LOC (0.1)

Table IIIC-13 Acute and Chronic Dose-Based Risk Quotients for Small to Medium Sized Mammals from Degradate SDS 3701 Occurring at the Equivalent of 10% of Parent Chlorothalonil or 0.4 lb ai/acre, 7 Applications at 21-Day Interval Assuming a Foliar Half-life of 35 Days

	15 gram mammals		35 gram mammals		1000 gram mammals	
	acute	chronic	acute	chronic	acute	chronic
Short Grass	*0.0*	**33.1**	*0.3*	**28.3**	*0.1*	**15.1**
Tall Grass	*0.14*	**15.2**	*0.1*	**13.0**	0.06	**6.9**
Broadleaf plants/sm insects	*0.2*	**18.6**	*0.1*	**15.9**	0.08	**8.5**
Fruits/pods/lg insects	0.02	**2.1**	0.02	**1.8**	0.01	1.0
Seeds (granivore)	0.00	0.5	0.00	0.4	0.00	0.2

RQ in bold exceed endangered species and non-endangered species (0.5) LOCs. RQs in italics exceed the endangered species LOC (0.1)

Acute

At the higher application rate, the acute risk quotients for some food items and feeding regimes exceed the LOC for risk to mammals. Smaller animals because of their higher food consumption compared to body weight tend to have higher risk quotients. At the lower application rate, acute risk LOC is not exceeded for nonendangered species. The endangered species LOC is exceeded for most food items and all mammal sizes.

Chronic

The LOC for chronic risk to mammals is exceeded for herbivores for all food items. This assumes approximately 10% of parent chlorothalonil becomes SDS 3701 with each application and remains on foliage and other food items with a dissipation half-life of 35 days. However, given the magnitude of the risk quotients, even if substantially less of the parent converts to SDS 3701 the risk would still exceed the LOC.

Dietary Based RQs for Mammal chronic risk from degradate SDS 3701

Table IIIC-13 Dietary-based RQs (Dietary-based EEC/ LC_{50} or NOAEC) for Mammals from Degradate SDS 3701 Assuming Equivalent of 1.1 lb ai/acre Applied 7 Times at 14 Day Intervals	
Short Grass	Chronic
Tall Grass	**7.1**
Broadleaf plants/sm insects	**7.1**
Fruits/pods/seeds/lg insects	1.0
RQs that are bolded exceed the LOC for chronic risk	

Table IIIC-14 Dietary-based RQs (Dietary-based EEC/ LC_{50} or NOAEC) for Mammals from Degradate SDS 3701 Assuming Equivalent of 0.4 lb ai/acre Applied 4 Times at 21-Day Intervals	
Short Grass	Chronic
Short Grass	**3.8**
Tall Grass	**1.8**
Broadleaf plants/sm insects	**2.1**
Fruits/pods/seeds/lg insects	0.2
RQs that are bolded exceed the LOC for chronic risk	

(2) Birds

Acute

Acute risk quotients were not calculated because no effects were observed in the available acute and subacute toxicity studies.

The following adjusted values (based on an LD_{50}>4640) at which no mortality occurred are compared to the dose based exposure.

Table IIIC-15 Original and Adjusted Toxicity Used to Assess Dose Based Risk to Birds from Chlorothalonil

Test Endpoint	Study Result	MRID	Test Species	Wt of tested bird (TW)
LD_{50} mg/kg	4640	00068753	Mallard	1580
Weight of Assessed Birds (AW)	**Adjusted LD_{50} (mg/kg bw**		**Equation for calculating adjusted toxicity**	
20	2409		$Adj. LD_{50} = LD_{50}\left(\frac{AW}{TW}\right)^{(1.15-1)}$	
100	3067			
1000	4332			

The following table reiterates the dose based exposure for birds from use of chlorothalonil on turf.

Table IIIC-16 Upper 95th Percentile Chlorothalonil EECs (mg/kg-bw) on Selected Food Items for Small, Medium, and Large Birds Following 7 Applications of 11.3 lb ai/acre at 14 Day Intervals Assuming a 35-Day Foliar Dissipation Rate

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	20 g	100 g	1000 g
Short Grass	10924.2	6229.4	2789.0
Tall Grass	5006.9	2855.2	1278.3
Broadleaf plants/sm Insects	6144.9	3504.1	1568.8
Fruits/pods/seeds/lg insects	682.8	389.3	174.3

Since the dose based EECs exceed the dose at which no mortality occurred it creates uncertainty in drawing conclusion on potential acute risk from dose based exposure. Another approach is to compare the subacute dietary test level at which no mortality occurred, 10,000 ppm with diet based EECs, reiterated below.

Table IIIC-17 Maximum Dietary EECs Chlorothalonil Based on 7 Applications at 11.3 lbs ai/acre at 14-Day Intervals with 35-Day Foliar Half-life	
Dietary-based EECs (ppm)	Kenaga Values
Short Grass	9591.87
Tall Grass	4396.27
Broadleaf plants/sm Insects	5395.43
Fruits/pods/seeds/lg insects	599.49

Since the dietary levels do not exceed the dietary level at which no mortality occurred, it suggests low potential for mortality from parent chlorothalonil, including no direct effects to endangered birds from acute risk.

Chronic

Chronic risk to birds from chlorothalonil is based on comparing the avian chronic NOAEL=153 ppm, for Bobwhite quail (MRID 45710218 submitted by Vischim) with dietary exposure levels estimated by TREX ver 1.2.3. The following table presents the EECs and risk quotients.

Table IIIC-18 Maximum Dietary EECs Chlorothalonil based on 7 applications at 11.3 lbs ai/acre at 14-Day Intervals With 35-Day Foliar Half-life and Bird Chronic RQs	
Dietary-based EECs (ppm)	Kenaga Value RQ
Short Grass	**9591.9** 62.9
Tall Grass	**4396.3** 28.7
Broadleaf plants/sm Insects	**5395.4** 35.3
Fruits/pods/seeds/lg insects	**599.5** 3.9

Table IIIC-19 Maximum Dietary EECs Chlorothalonil based on 4 applications at 4.13 lbs ai/acre at 21- day intervals with 35-day foliar halflife and bird chronic RQs	
Dietary-based EECs (ppm)	Kenaga Value RQ
Short Grass	**2361.2** 15.4
Tall Grass	**1082.2**

	7
	1328.2
Broadleaf plants/sm Insects	**8.6**
	147.6
Fruits/pods/seeds/lg insects	1.0

All risk quotients at the higher application rate and most at the lower application rate exceed the LOC for chronic risk to endangered and nonendangered species.

Acute Effects from Primary Degradate SDS 3701

The following table reiterates the adjusted LD_{50}s for the primary degradate SDS 3701 based on the Mallard LD_{50} of 158 mg/kg (00030395).

Table IIIC-20 Adjusted LD_{50}s for Primary degradate SDS 3701, Based on the Mallard LD_{50}

Avian Body Weight (g)	Adjusted LD_{50} (mg/kg-bw)
20	82.0
100	104.4
1000	147.5

The following table presents the dose based EECs and RQs for acute risk to birds from the primary degradate SDS 3701.

Table IIIC-21 Upper 95th Percentile Degradate SDS 3701 EECs (mg/kg-bw) on Selected Food Items for Small, Medium, and Large Birds Following 7 Applications of 1.1 lb ai/acre at 14-Day Intervals Assuming a 35-Day Foliar Dissipation Rate. The 1.1 lb Value Assumes 10% of the Parent Applied Becomes the Primary Degradate Shortly After Each Treatment

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights EEC Acute RQ		
	20 g	100 g	1000 g
Short Grass	1063.42	606.40	271.50
	12.96	**5.81**	**1.84**
Tall Grass	487.40	277.94	124.44
	5.94	**2.66**	**0.84**
Broadleaf plants/sm Insects	598.2	341.1	152.7
	7.3	**3.3**	**1.0**
Fruits/pods/seeds/lg insaects	66.5	37.9	17.0
	0.8	*0.4*	*0.1*

RQ in bold exceed endangered species and non-endangered species (0.5) LOCs. RQs in italics exceed the endangered species LOC (0.1)

Table IIIC-22 Upper 95th Percentile degradate SDS 3701 EECs (mg/kg-bw) on Selected Food Items for Small, Medium, and Large Birds Following 4 Aapplications of 0.4 lb ai/acre at 21 Day Intervals Assuming a 35-Day Foliar Dissipation Rate. The 1.1 lb Value Assumes 10% of the Parent Applied Becomes the Primary Degradate Shortly After Each Treatment			
Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights EEC Acute RQ		
	20 g	100 g	1000 g
Short Grass	260.5	148.5	66.5
	3.2	**1.4**	*0.5*
Tall Grass	119.4	68.1	30.5
	1.5	**0.7**	*0.2*
Broadleaf plants/sm Insects	146.5	83.5	37.4
	1.8	**0.8**	*0.3*
Fruits/pods/seeds/lg insaects	16.3	9.3	4.2
	0.20	0.1	0.03

RQ in bold exceed endangered species and non-endangered species (0.5) LOCs. RQs in italics exceed the endangered species LOC (0.1)

All dose based avian acute Risk Quotients for the degradate SDS-3701 meet or exceed the endangered species LOC (0.1). Most exceed the LOC (0.5) for acute risk to species in general and the restricted use LOC (0.2).

The following diet based RQs use an avian LC_{50} of 1746 ppm (Bobwhite) and an avian NOAEL of 50 mg/kg diet (Mallard, 40729402) and the following dietary exposure levels.

Table IIIC-23 Dietary EECs and Acute and Chronic RQs for the Primary Degradate SDS 3701 Applied at an Equivalent Rate of 10% of Parent Chlorothalonil, 1.1 lb ai/acre, 7 Times at 14-Day Intervals Assuming 35-Day Foliar Dissipation Rate			
Dietary-based EECs (ppm)	Kenaga Values ppm diet	Acute RQs	Chronic RQs
Short Grass	933.7	**0.5**	**18.7**
Tall Grass	428.0	**0.3**	**8.6**
Broadleaf plants/sm Insects	525.2	**0.3**	**10.5**
Fruits/pods/seeds/lg insects	58.4	0.04	**1.2**

Table __ Dietary EECs and acute and chronic RQs for the primary degradate SDS 3701 applied at an equivalent rate of 10% of parent chlorothalonil, 1.1 lb ai/acre, 7 times at 14-day intervals assuming 35-day foliar dissipation rate.			
Dietary-based EECs (ppm)	Kenaga Values ppm diet	Acute RQs	Chronic RQs
Short Grass	228.7	*0.1*	**4.6**
Tall Grass	104.8	0.06	**2.1**

Broadleaf plants/sm Insects	128.6	0.07	**2.6**
Fruits/pods/seeds/lg insects	14.3	0.01	0.3

Based on dose based risk and to some extent on dietary exposure (grass, broad leaf plants and small insects) there is potential for acute risk. The chronic RQs exceed the LOC for most food items.

(3) Insects

Insect risk quotients were not calculated. Chlorothalonil is not toxic to bees therefore potential for direct risk to insects is considered low including endangered terrestrial invertebrates.

(4) Terrestrial Plants

The exposure to off-site plants does not result in risk exceeding the LOC for endangered or nonendangered plants. Therefore risk is considered minimal and endangered plants are not affected. This assumes a single application of 11.3 lb ai/acre. Multiple applications might increase the off-site exposure, but there is uncertainty in modeling multiple applications.

A single treatment at 11.3 lb ai/acre would not result in offsite exposure that exceeds the NOAEC of 16 lb ai/acre in any habitat. But 3 applications at 11.3 might result in exposure that exceeds the NOAEC of 16 lb ai/acre in areas receiving channelized runoff and drift. This exposure estimate does not take into account degradation/dissipation between treatments, so it represents the maximum exposure possible. The level of risk is substantially below the LOCs for a single application, therefore, even with multiple applications, risk should be minimal.

B. Risk Description

1. Risk to Aquatic Organisms

Levels of concern were exceeded for all aquatic animals and for aquatic plants at the higher application rate (11.3 lb ai/acre), and for most aquatic animals at the lower application rate (4.13 lb ai/acre). That risk assumed maximum label rates and multiple applications. Risk from degradate SDS 3701 was assumed to be minimal, since it is much less toxic to aquatic organisms than parent chlorothalonil.

2. Risk to Terrestrial Organisms

a. Risk to Terrestrial Animals

The following risk discussion is based on estimated exposure assuming multiple (7) applications at 11.3 lb ai/acre at 14 day intervals and 4 applications of 4.13 lb ai/acre at 21-day intervals. It assumes a default dissipation rate from foliage for parent chlorothalonil of 35 days. These assumptions result in substantial buildup of estimated residues over the entire season, so the peak levels approach 10000 ppm on short grass. To assess risk from the degradate, it was assumed up to 10% of the applied parent transforms to SDS 3701 on the terrestrial food items.

Mammals

Acute risk to mammals is concluded to be low from parent chlorothalonil. Chronic risk quotients based on peak estimated residues exceed the LOC by a substantial margin. The primary factors in this risk conclusion are the EECs resulting from high and repeated application rates compared with the dose based NOAELs ranging from 77 to 220 mg/kg bw/day for various sized mammals.

The degrdate is more toxic to mammals than the parent and is a potential acute risk. Chronic risk quotients from SDs 3701 are substantially higher than for parent chlorothalonil.

Birds

Chlorothalonil is practically non-toxic to birds on an acute and subacute oral basis. No mortality or signs of toxicity were observed at the limit dose for acute studies in birds and mammals. LD_{50}s were >4640 mg/kg-bw in birds and >10000 mg/kg-bw in mammals. The subacute LC_{50} in birds was >10000 ppm [00030388 and 00039146] and >21500 ppm [00039146]. Therefore, risk quotients were not calculated, risk is concluded to be lower than the Agency's concern level for acute effects to birds.

However, it is possible that risk could be above the Agency's concern level for birds exposed to the **degradate SDS 3701**, LD_{50} 158 mg/kg Mallard. Because the adjusted LD_{50} in birds was 82, 104, 147 mg/kg-bw for a 20, 100 and 1000-gram bird respectively. The dose-based EEC from the highest application rate for the degradate for a 20 gram bird was from 66 to 1063 mg/kg-bw.. Risk quotients for birds exposed to SDS 4701 were as high as 12.9 and exceed the acute LOCs for endangered and nonendangered species.

Avian chronic risk quotients for SDS 3701 exceed the LOC for endangered and nonendangered bird species for all types of food. Exposure to SDS 3701 assumes approximately 10% of the applied parent on foliage. There is uncertainty in how much degradate might form and persist between applications. In the 1988 EEB reregistration review several residue studies were evaluated to determine potential residues on SDS 3701 on vegetation. Data were insufficient to determine with certainty the likely or potential residues on avian and mammal food items. The analysis determined that a reasonable conservative estimate of SDS-3701 residues on vegetation would be 10% of parent. However, this is not based on foliar breakdown to SDS 3701 so is uncertain. The analysis from the 1988 reregistration review is included as an appendix.

Since birds are surrogate for reptiles and terrestrial phase amphibians, the risk assumed for birds may also be representative of potential risk to reptiles and terrestrial amphibians on sites treated by chlorothalonil at the rates assessed.

b. Risk to Non-target Terrestrial Plants

Risk to terrestrial plants is uncertain because the available tests only tested up to 16 lb ai/acre, at which no effects occurred. Exposure in habitats receiving channelized runoff and drift from multiple chlorothalonil treatment at 11.3 lb ai/acre 7 times might exceed that maximum treatment level. A single application would not exceed the LOC.

b. Non-target Insects

Risk to nontarget insects is expected to be low from chlorothalonil.

B. Assumptions, Limitations, Uncertainties, Strengths and Data Gaps Related to Effects Assessment

The foliar dissipation rate is uncertain. The default value of 35 days was used because adequate foliar dissipation rate data were not located. A more refined assessment would be possible of foliar dissipation data that tracked the dissipation of residues available to terrestrial animals were presented and summarized.

The formation of the degradate, SDS 3701 is uncertain for the compartments (terrestrial food items) on which exposure was estimated.

Bird data are used as surrogate for reptiles and terrestrial phase amphibians and fish data are used as surrogate for aquatic phase amphibians. It was assumed that the use of surrogate effects data is sufficiently conservative. If other species are more or less sensitive to chlorothalonil than the surrogates, risks may be under- or overestimated, respectively.

Although the screening risk assessment relies on a selected toxicity endpoint from the most sensitive species tested, it does not necessarily mean that the selected toxicity endpoints reflect sensitivity of the most sensitive species existing in a given environment. The relative position of the most sensitive species tested in the distribution of all possible species is a function of the overall variability among species to a particular chemical. The relationship between the sensitivity of the most sensitive tested species versus wild species (including listed species) is unknown and a source of significant uncertainty. In addition, in the case of listed species, there is uncertainty regarding the relationship of the listed species' sensitivity and the most sensitive species tested.

The use of laboratory species has historically been driven by availability and ease of maintenance. A widespread comparison of species is lacking, however, even variation within a species can be quite high.

IV. Risk to Endangered and Threatened Species

A. Potential Direct Effects Surrogate Organisms Assessed

Endangered species LOCs were exceeded for all aquatic organisms at the highest and lower (4.13 lb ai/acre) application rate. Endangered species LOCs were also exceeded for mammals and birds. Both mammals and birds (and reptiles and terrestrial phase amphibians) may be at chronic risk from parent chlorothalonil. Endangered species LOCs were also exceeded for the primary degradate SDS 3701 for acute and chronic risk to terrestrial animals.

Although EFED identified potential risks to listed species, an effects determination has not yet been made for listed species to determine if labeled use of this pesticide will have (1) "no effect" on listed species or critical habitat; (2) "may affect but is not likely to adversely affect the species or critical habitat"; or (3) "may adversely affect the species or critical habitat."

B. Indirect Effects Analyses

The Agency acknowledges that pesticides have the potential to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering the extent of nesting habitat, etc. In conducting a screen for indirect effects, direct effect LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms in these taxonomic groups as resources critical to their life cycle. Risk of direct effects to aquatic animals and plants, and mammals, birds and other terrestrial animals was identified in this assessment. Therefore, there may be a potential concern for indirect effects to animals that depend on these species for survival, habitat, or reproduction.

Table IVB-1 Listed Species Risks Associated With Direct or Indirect Effects Due to Applications of Chlorothalonil for Use on Turf and Ornamentals.

Listed Taxon	Direct Effects	Indirect Effects	

Terrestrial and semi-aquatic plants - monocots	No	Yes	Potential indirect effects from direct effects to terrestrial animals
Terrestrial and semi-àquatic plants - dicots	No	Yes	Potential indirect effects from direct effects to terrestrial animals
Insects	No	No	
Birds	Yes	No	
Terrestrial phase amphibians	Yes	No	
Reptiles	Yes	No	
Mammals	Yes	No	
Aquatic vascular plants	No	No	Algae are affected, but terrestrial plants not affected, so effects to vascular plants not expected
Freshwater fish	Yes	No	
Aquatic phase amphibians	Yes	No	
Freshwater crustaceans	Yes	No	
Mollusks	Yes	No	
Marine/estuarine fish	Yes	No	
Marine/estuarine crustaceans	Yes	No	

C. Probability of Mortality

The Agency uses the dose-response relationship from the toxicity studies used for calculating the RQ to estimate the probability of acute effects associated with an exposure equivalent to the endangered species LOC. This information serves as a guide to establish the need for and extent of additional analysis that may be performed using Services-provided "species profiles" as well as evaluations of the geographical and temporal nature of the exposure to ascertain if a "not likely to adversely affect" determination can be made. The degree to which additional analyses are performed is commensurate with the predicted probability of adverse effects from the comparison of the dose-response information with the EECs. The greater the probability that exposures will produce effects on a taxon, the greater the concern for potential indirect effects for listed species dependant upon that taxon, and therefore, the more intensive the analysis on the potential listed species of concern, their locations relative to the use site, and information regarding the use scenario (e.g., timing, frequency, and geographical extent of pesticide application).

Table IVC-1. Probability of Individual Mortality at the Endangered Species LOC (0.05) for Aquatic Organisms[a]				
Taxa	**Probit Slope**	**95% Confidence Interval**	**Probability of Individual Mortality, probability is 1 in:**	**Source**
Fish (rainbow trout, LC_{50} = 18 ppb)	5.583414	2.794664 AND 8.372164	5.16E+12 95% conf int between 7.05E+03 and 1.60E+27	45710219
FW Aquatic Invertebrates (Daphnia magna EC_{50} 54 ppb)	4.572242	3.118588 AND 6.025895	7.27E+08 95% conf int between 4.06E+04 and 4.17E+14	45710221
SW Invertebrate (Oyster, EC_{50} 3.6 ppb)	Default slope of 4.5	NA	4.18E+08	00138143

a Calculations were performed using IEC V1.1 - Individual Effect Chance Model Version 1.1 (June 22, 2004). The lower reporting limit of the model is 1 in 1E16.

D. Critical Habitat

In the evaluation of pesticide effects on designated critical habitat, consideration is given to the physical and biological features (constituent elements) of a critical habitat identified by the U.S Fish and Wildlife and National Marine Fisheries Services as essential to the conservation of a listed species and which may require special management considerations or protection. The evaluation of impacts for a screening level pesticide risk assessment focuses on the biological features that are constituent elements and is accomplished using the screening-level taxonomic analysis (risk quotients, RQs) and listed species levels of concern (LOCs) that are used to evaluate direct and indirect effects to listed organisms.

The screening-level risk assessment has identified potential concerns for indirect effects on listed species for those organisms dependant on terrestrial and aquatic animals and aquatic plants.

This screening-level risk assessment for critical habitat provides a listing of potential biological features that, if they are constituent elements of one or more critical habitats, would be of potential concern. These correspond to the taxa identified above as being of potential concern for indirect effects. This should serve as an initial step in problem formulation for further assessment of critical habitat impacts outlined above, should additional work be necessary.

E. Co-occurrence Analysis

The goal of the analysis for co-location is to determine whether sites of pesticide use are geographically associated with known locations of listed species. At the screening level, this analysis is accomplished using the LOCATES database. The database uses location information for listed species at the county level and compares it to agricultural census data for crop production at the same county level of resolution. The product is a listing of federally listed species that are located within counties known to produce the crop upon which the pesticide will be used. Because the Level I screening assessment considers both direct and indirect effects across generic taxonomic groupings, it is not possible to exclude any taxonomic group from a LOCATES database run for a screening risk assessment. Given the geographical extent of the chlorothalonil me-too uses across the U.S. and the expected large number of listed species that are likely to occur in the associated counties where chlorothalonil might be used, a list of endangered/threatened species at the county level for the taxonomic groups and crops of concern is not included in this phase of the risk assessment process. A summary list is included in Appendix E. A full list by state is provided electronically.

V. Description of Assumptions, Limitations, Uncertainties, Strengths and Data Gaps

Assumptions, limitations, uncertainties, strengths, and data gaps have been described throughout this assessment and are summarized below.

A. Assumptions, Limitations, Uncertainties, Strengths and Data Gaps Related to Exposure of All Taxa

1. Maximum Use Scenario

The screening-level risk assessment of the Me-Too assessment focuses on characterizing potential ecological risks resulting from a maximum use scenario, which had been determined from the 2000 RED for chlorothalonil. The 2000 RED relied on labeled statements of maximum chlorothalonil application rate and number of applications with the shortest time interval between applications. The frequency at which actual uses approach this maximum use scenario may be dependant on fungicide resistance, timing of applications, cultural practices, and market forces.

2. Additive and/or Synergistic Effects

It was assumed that aquatic and terrestrial organisms were exposed only to chlorothalonil fungicide. Ecological risks associated with exposure to a mixture of chlorothalonil, other pesticides, adjuvants, heavy metals, industrial chemicals, pharmaceuticals, etc. were not considered in this risk assessment.

B. Assumptions, Limitations, Uncertainties, Strengths and Data Gaps Related to Exposure To Aquatic Species

1. Data Gaps

Environmental Fate

Combined data from the original registration and the Me-Too registration are sufficient to access the environmental fate of chlorothalonil. However, data gaps may exist within the data set referenced and/or submitted for the Me-Too registration. Some of the older data are still in review, but can be considered conditionally acceptable at the present time.

2. Aquatic Exposure Model

PRZM/EXAMS Uncertainties

Modeling relies on estimated fate parameters and assumed agricultural practices to predict concentrations of chlorothalonil present in surface water. The fate database is essentially complete even though several older studies are still under review. In order to insure that an EEC is predicted which is protective of all populations, many of the model inputs used in this assessment were estimated at the upper 90^{th} percentile in accordance with EFED guidance (see EFED "*Guidance for Chemistry and Management Practice Input Parameters for Use in Modeling the Environmental Fate and Transport of Pesticides*" dated February 28, 2002).

PRZM/EXAMS requires information on agricultural practices as inputs. In the case of PRZM/EXAMS, the model requires a specific application date and rate to be applied for a number of scenarios. In reality, application dates and rates applied across the United States will vary depending on geography, pest pressure, climatic factors, and changes in agricultural cropping patterns. EFED attempts to capture some of this variability by modeling as many representative scenarios as possible and by using meteorological data which covers a time span sufficient to capture climatic variations which are likely to occur. However, the model is limited in its ability to capture all of the natural variation which occurs for any pesticide application. This limitation adds uncertainty to the assessment.

Some general uncertainties are associated with the use of PRZM/EXAMS standard runoff scenario (a 10 hectare field draining into a 1 hectare small static water body) with regional specific crop and pesticide management practices, weather, and soil types. Although there are uncertainties with the use of a standard runoff scenario for a regional aquatic exposure assessment, it is designed to represent pesticide exposure from an agricultural field impacting a vulnerable aquatic environment. Extrapolating the risk conclusions from this standard water body scenario may either underestimate or overestimate the potential risks.

Major uncertainties with the standard runoff scenario are associated with the physical construct of the agricultural field with respect to the standard pond, and representation of vulnerable aquatic environments for different geographic regions. The physicochemical properties (pH, redox conditions, etc.) of the small static water body are based on a Georgia farm pond. These properties are likely to be regionally specific because of the local hydrogeological conditions. Any alteration in water quality parameters may impact the environmental behavior of the pesticide. The farm pond represents a well mixed, static water body. Because it is a static water body, it does not account for pesticide removal through flow through or accidental water releases. However, the lack of water flow in the farm pond provides an environmental condition for accumulation of persistent pesticides. The assumption of uniform mixing does not account for stratification due to thermoclines (e.g., seasonal stratification in deep water bodies). Additionally, the physical construct of the standard runoff scenario assumes a watershed:water body area ratio of 10. This ratio is recommended to maintain a sustainable pond in the Southeastern United States. The use of higher watershed: water body ratios (as recommended for sustainable ponds in drier regions of the United States) may lead to higher pesticide concentrations when compared to the standard watershed:water body ratio.

The standard water body scenario also assumes uniform environmental and management conditions exist over the standard 10 hectare watershed. Soils can vary substantially across even small areas, and thus, this variation is not reflected in the model simulations. Additionally, the impact of unique soil characteristics (e.g., fragipan) and soil management practices (e.g., tile drainage) are not considered in the standard runoff scenario. The assumption of uniform site and management conditions is not expected to represent some site-specific conditions. Extrapolating the risk conclusions from the standard water body scenario to other aquatic habitats (e.g., marshes, streams, creeks, and shallow rivers, intermittent aquatic areas) may either underestimate or overestimate the potential risks in those habitats.

The runoff and leaching vulnerability schemes used in this assessment were adapted from a vulnerability scheme developed by the USDA (Kellogg et al, 1998). USDA identified several caveats to be considered when using this vulnerability scheme which could contribute to the uncertainty associated with this assessment. Among these are that estimates of runoff and leaching vulnerability are estimated through the use of algorithms (i.e. they represent estimates of vulnerability and not actual field measurements), fate and transport processes (i.e. dilution and recharge) are not included, farm management practices are not considered, and some watershed estimates are based on major crops only. The effect of these factors on the vulnerability assessment is unknown.

Additionally, standardized are not available for every possible agricultural crop or non-agricultural use pattern. In the absence of a standardized scenario, surrogate scenarios are chosen to represent those uses. In the case of this Me-Too registration of chlorothalonil, only non-food uses are proposed. Turf scenarios in Florida and Pennsylvania were used to represent all turf uses, and an Oregon Christmas tree scenario was used as a surrogate for all ornamental uses. The Oregon scenario represents an area of the state that receives less rainfall than many parts of the United States, and may underestimate the ecological effects concentrations in surface water resulting from ornamental uses.

Me-Too Appendix A – Chlorothalonil Environmental Fate Evaluation

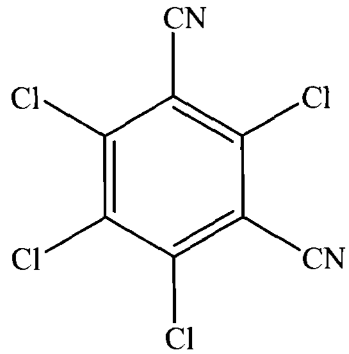


Figure A-1 Chlorothalonil

Chlorothalonil degrades through both photolytic (half-life of 10 hours) and microbial processes (half-life of 5 to 68 days). Chlorothalonil degrades rapidly in clear, shallow water through aqueous photolysis. However, only limited areas of the open environment are subject to those conditions. Chlorothalonil is not susceptible to hydrolysis in waters below pH 9, but does hydrolyze in waters at or above pH 9, with a calculated half-life between 40 and 60 days.

The main route of dissipation for chlorothalonil in the environment is expected to be through biotic, aqueous degradation (half-life of 5 to 29 days). Chlorothalonil degrades under both aerobic aquatic conditions (half-life of 7 to 6 days), and aerobic terrestrial conditions (half-life of 22 to 68 days), and through anaerobic degradation (half-life of 21 to 29 days). Biotic degradation rates for chlorothalonil are sensitive to the biogeochemical environment and ambient conditions, and may depart from first-order kinetics. Apparent initial aquatic half-lives for biotic degradation range from a few hours to around two weeks, while overall half-lives for the total system are much longer.

An identified major metabolite, 4-hydroxy-2,5,6-trichloro-1,3-dicyanobenzene, forms under differing test conditions, and appears to be persistent. Other metabolites also exhibit a degree of persistence sufficient to allow their possible appearance in ground water. Chlorothalonil and the chlorothalonil degradation product have simple chemical structures with simple substituents (including multiple chlorine atoms) attached to a single benzene ring.

Chlorothalonil is expected to range from slightly mobile to moderately mobile in the open environment, with laboratory K_d values ranging from 3 to 30. Depending upon soil/sediment composition, concentrations of chlorothalonil in benthic sediments could exceed concentrations found in runoff waters. The vapor pressure and Henry's Law values for the chlorothalonil indicates a slight degree of volatility from both soil and water.

Submitted laboratory studies demonstrate that chlorothalonil did not significantly bioconcentrate in oysters, with a reported bioconcentration factor of 2660X, or in bluegill sunfish, with a reported bioconcentration factor of 3000X. Recalcitrant metabolites did concentrate somewhat in the biochemical (carbon) pool of the organisms, and were slow to be eliminated. Evolution of volatile compounds, including carbon dioxide, was not significant in laboratory testing.

Table A-1 Summary of Environmental Fate Properties of Chlorothalonil Used in Assessment.

Study Type	Value	Test System	Source / MRID Number
Hydrolysis	half-life = stable	pH 5 and 7; (half-life 30-60 days @ pH9 -may be concentration dependant)	0040539, 00147975
Photodegradation in Water	half-life = 10 hours	pH 7	45710223
Photodegradation on Soil	half-life = stable		00040541, 00040542, 00040543, 00143751
Aerobic Soil Metabolism	half-life = 68 days; half-life = 24 days; half-life = 22 days; half-life = 24 days	silt loam soil loam soil TX sandy loam soil OH sandy loam soil	00087351
Aerobic Aquatic Metabolism	total system half-life = 21 days, total system half-life = 13 days	Running ditch water-clay sediment, UK Pond water-clay loam sediment, UK	45908001
Anaerobic Aquatic Metabolism	total system half-life = 21 days; total system half-life = 29 days	silt loam soil; sandy loam soil	00147975
Adsorption/Desorption	26 (K_d) 29 (K_d) 20 (K_d) 3 (K_d)	silty clay loam soil; silt soil; sandy loam soil; sand soil	00115105 00153730 for aged column
Laboratory Volatility	5.72×10^{-7} torr	25 °C	00153732
Bioaccumulation in Fish	200 X 3000 X	edible tissue visceral tissue	45710224
Bioaccumulation in Bivalves	2660 X		42070601
Terrestrial Field Dissipation	total system half-life = 1-2 months	sandy loam soil	00087296; 42433813

Me-Too Appendix B – Chlorothalonil Terrestrial Ecological Effects Concentrations (EEC's)

Upper Bound Kenaga Residues For RQ Calculation

Chemical Name:	Chlorothalonil	
Use	Turf, ornamental	
Formulation	0	
Application Rate	11.3	lbs a.i./acre
Half-life	35	days
Application Interval	14	days
Maximum # Apps./Year	7	
Length of Simulation	1	year

Endpoints

Avian	Bobwhite quail	LD50 (mg/kg-bw)	4640.00
	Bobwhite quail	LC50 (mg/kg-diet)	10000.00
	0	NOAEL(mg/kg-bw)	0.00
	Bobwhite quail	NOAEC (mg/kg-diet)	153.00
Mammals		LD50 (mg/kg-bw)	10000.00
		LC50 (mg/kg-diet)	0.00
		NOAEL (mg/kg-bw)	100.00
		NOAEC (mg/kg-diet)	2000.00

Dietary-based EECs (ppm)	Kenaga Values
Short Grass	9591.87
Tall Grass	4396.27
Broadleaf plants/sm Insects	5395.43
Fruits/pods/seeds/lg insects	599.49

Avian Results

Avian Class	Body Weight (g)	Ingestion (Fdry) (g bw/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Small	20	5	23	114	2.28E-02
Mid	100	13	65	65	6.49E-02
Large	1000	58	291	29	2.91E-01

Avian Body Weight (g)	Adjusted LD50 (mg/kg-bw)
20	3342.79
100	4255.54
1000	6011.11

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small 20 g	mid 100g	large 1000 g
Short Grass	10924.18	6229.43	2789.00
Tall Grass	5006.91	2855.15	1278.29
Broadleaf plants/sm Insects	6144.85	3504.05	1568.81
Fruits/pods/seeds/lg insects	682.76	389.34	174.31

Dose-based RQs (Dose-based EEC/adjusted LD50)	Avian Acute RQs		
	20 g	100 g	1000 g
Short Grass	3.27	1.46	0.46
Tall Grass	1.50	0.67	0.21
Broadleaf plants/sm Insects	1.84	0.82	0.26
Fruits/pods/seeds/lg insects	0.20	0.09	0.03

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	RQs	
	Acute	Chronic
Short Grass	0.96	62.69
Tall Grass	0.44	28.73
Broadleaf plants/sm Insects	0.54	35.26
Fruits/pods/seeds/lg insects	0.06	3.92

Mammalian Results

Mammalian Class	Body Weight	Ingestion (Fdry) (g bwt/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Herbivores/ Insectivores	15	3	14	95	1.43E-02
	35	5	23	66	2.31E-02
	1000	31	153	15	1.53E-01
Granivores	15	3	[illegible]	21	3.18E-03
	35	5	[illegible]	15	5.13E-03
	1000	31	34	3	3.40E-02

Mammalian Class	Body Weight	Adjusted LD50	Adjusted NOAEL
Herbivores/ Insectivores	15	21978.31	219.78
	35	17782.79	177.83
	1000	7691.61	76.92
Granivores	15	21978.31	219.78
	35	17782.79	177.83
	1000	7691.61	76.92

Dose Based EECs (mg/kg-bw)	Mammalian Classes and Body weight					
	Herbivores/ insectivores			Granivores		
	15 g	35 g	1000 g	15 g	35 g	1000 g
Short Grass	9145.11	6320.50	1465.43			
Tall Grass	4191.51	2896.89	671.65			
Broadleaf plants/sm Insects	5144.12	3555.28	824.30			
Fruits/pods/seeds/lg insects	571.57	395.03	91.59	127.02	87.78	20.35

Dose-based RQs (Dose-based EEC/LD50 or NOAEL)	15 g mammal		35 g mammal		1000 g mammal	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Short Grass	0.42	41.61	0.36	35.54	0.19	19.05
Tall Grass	0.19	19.07	0.16	16.29	0.09	8.73
Broadleaf plants/sm Insects	0.23	23.41	0.20	19.99	0.11	10.72
Fruits/pods/lg Insects	0.03	2.60	0.02	2.22	0.01	1.19
Seeds (granivore)	0.01	0.58	0.00	0.49	0.00	0.26

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	Mammal RQs	
	Acute	Chronic
Short Grass	#DIV/0!	4.80
Tall Grass	#DIV/0!	2.20
Broadleaf plants/sm Insects	#DIV/0!	2.70
Fruits/pods/seeds/lg Insects	#DIV/0!	0.30

Upper Bound Kenaga Residues For RQ Calculation

Chemical Name:	Chlorothalonil	
Use	Turf, ornamental	
Formulation	0	
Application Rate	4.13	lbs a.i./acre
Half-life	35	days
Application Interval	21	days
Maximum # Apps./Year	4	
Length of Simulation	1	year

Endpoints

Avian	Bobwhite quail	LD50 (mg/kg-bw)	4640.00
	Bobwhite quail	LC50 (mg/kg-diet)	10000.00
	0	NOAEL (mg/kg-bw)	0.00
	Bobwhite quail	NOAEC (mg/kg-diet)	153.00
Mammals		LD50 (mg/kg-bw)	10000.00
		LC50 (mg/kg-diet)	0.00
		NOAEL (mg/kg-bw)	100.00
		NOAEC (mg/kg-diet)	2000.00

Dietary-based EECs (ppm)	Kenaga Values

Short Grass	2361.24
Tall Grass	1082.24
Broadleaf plants/sm Insects	1328.20
Fruits/pods/seeds/lg Insects	147.58

Avian Results

Avian Class	Body Weight (g)	Ingestion (Fdry) (g bw/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Small	20	5	23	114	2.28E-02
Mid	100	13	65	65	8.49E-02
Large	1000	58	291	29	2.91E-01

Avian Body Weight (g)	Adjusted LD50 (mg/kg-bw)
20	3342.79
100	4285.64
1000	6011.11

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small 20 g	mid 100 g	large 1000 g
Short Grass	2689.22	1533.51	686.57
Tall Grass	1232.56	702.86	314.68
Broadleaf plants/sm Insects	1512.68	862.60	386.20
Fruits/pods/seeds/lg insects	168.08	95.84	42.91

Dose-based RQs (Dose-based EEC/adjusted LD50)	Avian Acute RQs		
	20 g	100 g	1000 g
Short Grass	0.80	0.36	0.11
Tall Grass	0.37	0.17	0.05
Broadleaf plants/sm Insects	0.45	0.20	0.06
Fruits/pods/seeds/lg insects	0.05	0.02	0.01

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	RQs	
	Acute	Chronic
Short Grass	0.24	15.43
Tall Grass	0.11	7.07
Broadleaf plants/sm Insects	0.13	8.68
Fruits/pods/seeds/lg insects	0.01	0.96

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

Chlorothalonil	Turf, ornamental	Upper bound Kenaga Residues
Mammalian Results		

Mammalian Class	Body Weight	Ingestion (Fdry) (g bwt/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Herbivores/ Insectivores	15	3	14	95	1.43E-02
	35	5	23	66	2.31E-02
	1000	31	153	15	1.53E-01
Grainvores	15	3	3	21	3.18E-03
	35	5	5	15	5.13E-03
	1000	31	34	3	3.40E-02

Mammalian Class	Body Weight	Adjusted LD50	Adjusted NOAEL
Herbivores/ insectivores	15	21976.31	219.76
	35	17782.79	177.83
	1000	7691.61	76.92
Grainvores	15	21976.31	219.76
	35	17782.79	177.83
	1000	7691.61	76.92

Dose-Based EECs (mg/kg-bw)	Mammalian Classes and Body weight					
	Herbivores/ insectivores			Granivores		
	15 g	35 g	1000 g	15 g	35 g	1000 g
Short Grass	2251.26	1555.92	360.75			
Tall Grass	1031.83	713.13	165.34			
Broadleaf plants/sm Insects	1266.33	875.21	202.92			
Fruits/pods/seeds/lg insects	140.70	97.25	22.55	31.27	21.61	5.01

Dose-based RQs (Dose-based EEC/LD50 or NOAEL)	15 g mammal		35 g mammal		1000 g mammal	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Short Grass	0.10	10.24	0.09	8.75	0.05	4.69
Tall Grass	0.05	4.69	0.04	4.01	0.02	2.15
Broadleaf plants/sm Insects	0.06	5.76	0.05	4.92	0.03	2.64
Fruits/pods/lg insects	0.01	0.64	0.01	0.55	0.00	0.29
Seeds (granivore)	0.00	0.14	0.00	0.12	0.00	0.07

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	Mammal RQs	
	Acute	Chronic
Short Grass	#DIV/0!	1.18
Tall Grass	#DIV/0!	0.54
Broadleaf plants/sm Insects	#DIV/0!	0.66
Fruits/pods/seeds/lg insects	#DIV/0!	0.07

Upper Bound Kenaga Residues For RQ Calculation

Chemical Name:	Chlorothalonil degradate SDS 3701
Use	Turf, ornamental
Formulation	G
Application Rate	13 lbs a.i./acre
Half-life	35 days
Application Interval	14 days
Maximum # Apps./Year	7
Length of Simulation	1 year

Endpoints

Avian	Mallard duck	LD50 (mg/kg-bw)	158.00
	Bobwhite quail	LC50 (mg/kg-diet)	1746.00
	0	NOAEL (mg/kg-bw)	0.00
	Bobwhite quail	NOAEC (mg/kg-diet)	50.00
Mammals		LD50 (mg/kg-bw)	332.00
		LC50 (mg/kg-diet)	0.00
		NOAEL (mg/kg-bw)	2.00
		NOAEC (mg/kg-diet)	60.00

Dietary-based EECs (ppm)	Kenaga Values
Short Grass	933.72
Tall Grass	427.96
Broadleaf plants/sm insects	525.22
Fruits/pods/seeds/lg insects	58.36

Avian Results

Avian Class	Body Weight (g)	Ingestion (Fdry) (g bw/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Small	20	5	23	114	2.28E-02
Mid	100	13	65	65	6.49E-02
Large	1000	58	291	29	2.91E-01

Avian Body Weight (g)	Adjusted LD50 (mg/kg-bw)
20	82.04
100	104.44
1000	147.52

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small 20 g	mid 100 g	large 1000 g
Short Grass	1063.42	606.40	271.50
Tall Grass	487.40	277.94	124.44
Broadleaf plants/sm Insects	598.17	341.10	152.72
Fruits/pods/seeds/lg insects	66.46	37.90	16.97

Dose-based RQs (Dose-based EEC/adjusted LD50)	Avian Acute RQs		
	20 g	100 g	1000 g
Short Grass	12.96	5.81	1.84
Tall Grass	5.94	2.66	0.84
Broadleaf plants/sm Insects	7.29	3.27	1.04
Fruits/pods/seeds/lg insects	0.81	0.36	0.12

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	RQs	
	Acute	Chronic
Short Grass	0.53	18.67
Tall Grass	0.25	8.56
Broadleaf plants/sm Insects	0.30	10.50
Fruits/pods/seeds/lg insects	0.03	1.17

Mammalian Results

Mammalian Class	Body Weight	Ingestion (Fdry) (g bwt/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Herbivores/ Insectivores	15	3	14	95	1.43E-02
	35	5	23	66	2.31E-02
	1000	31	153	15	1.53E-01
Grainvores	15	3	3	21	3.18E-03
	35	5	5	15	5.13E-03
	1000	31	34	3	3.40E-02

Mammalian Class	Body Weight	Adjusted LD50	Adjusted NOAEL
Herbivores/ Insectivores	15	729.68	6.59
	35	590.39	6.33
	1000	255.36	2.31
Grainvores	15	729.68	6.59
	35	590.39	5.33
	1000	255.36	2.31

Dose-Based EECs (mg/kg-bw)	Mammalian Classes and Body weight					
	Herbivores/ Insectivores			Granivores		
	15 g	35 g	1000 g	15 g	35 g	1000 g
Short Grass	890.23	615.27	142.65			
Tall Grass	408.02	282.00	65.38			
Broadleaf plants/sm Insects	500.76	346.09	80.24			
Fruits/pods/seeds/lg insects	55.64	38.45	8.92	12.36	8.55	1.98

Dose-based RQs (Dose-based EEC/LD50 or NOAEL)	15 g mammal		35 g mammal		1000 g mammal	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Short Grass	1.22	135.02	1.04	115.33	0.56	61.82
Tall Grass	0.56	61.88	0.48	52.86	0.26	28.33
Broadleaf plants/sm insects	0.69	75.95	0.59	64.87	0.31	34.77
Fruits/pods/lg insects	0.08	8.44	0.07	7.21	0.03	3.86
Seeds (granivore)	0.02	1.88	0.01	1.60	0.01	0.86

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	Mammal RQs	
	Acute	Chronic
Short Grass	#DIV/0!	15.56
Tall Grass	#DIV/0!	7.13
Broadleaf plants/sm insects	#DIV/0!	8.75
Fruits/pods/seeds/lg insects	#DIV/0!	0.97

Upper Bound Kenaga Residues For RQ Calculation

Chemical Name:	Chlorothalonil
Use	Turf, ornamental
Formulation	0
Application Rate	20.4 lbs a.i./acre
Half-life	35 days
Application Interval	21 days
Maximum # Apps./Year	[illegible]
Length of Simulation	1 year

Endpoints

Avian	Mallard duck	LD50 (mg/kg-bw)	158.00
	Bobwhite quail	LC50 (mg/kg-diet)	1746.00
	0	NOAEL (mg/kg-bw)	0.00
	Bobwhite quail	NOAEC (mg/kg-diet)	50.00
Mammals		LD50 (mg/kg-bw)	338.00
		LC50 (mg/kg-diet)	0.00
		NOAEL (mg/kg-bw)	3.00
		NOAEC (mg/kg-diet)	60.00

Dietary-based EECs (ppm)	Kenaga Values
Short Grass	228.69
Tall Grass	104.82
Broadleaf plants/sm Insects	128.64
Fruits/pods/seeds/lg insects	14.29

Avian Results

Avian Class	Body Weight (g)	Ingestion (Fdry) (g bw/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Small	20	5	23	114	2.28E-[illegible]
Mid	100	[illegible]	65	65	6.49E-02
Large	1000	58	291	29	2.9[illegible]E-01

Avian Body Weight (g)	Adjusted LD50 (mg/kg-bw)
20	82.8[illegible]
100	104.44
1000	147.52

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small 20 g	mid 100 g	large 1000 g
Short Grass	260.46	148.52	66.50
Tall Grass	119.38	68.07	30.48
Broadleaf plants/sm Insects	146.51	83.54	37.40
Fruits/pods/seeds/lg insects	16.28	9.28	4.16

Dose-based RQs (Dose-based EEC/adjusted LD50)	Avian Acute RQs		
	20 g	100 g	1000 g
Short Grass	3.17	1.42	0.45
Tall Grass	1.46	0.65	0.21
Broadleaf plants/sm insects	1.79	0.80	0.25
Fruits/pods/seeds/lg insects	0.20	0.09	0.03

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	RQs	
	Acute	Chronic
Short Grass	0.13	4.57
Tall Grass	0.06	2.10
Broadleaf plants/sm Insects	0.07	2.57
Fruits/pods/seeds/lg insects	0.01	0.29

Chlorothalonil	Turf, ornamental	Upper bound Kenaga Residues
Mammalian Results		

Mammalian Class	Body Weight	Ingestion (Fdry) (g bwt/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Herbivores/ Insectivores	15	3	14	95	1.43E-02
	35	5	23	66	2.31E-02
	1000	31	153	15	1.53E-01
Grainvores	15	3	3	21	3.18E-03
	35	5	5	15	5.13E-03
	1000	31	34	3	3.40E-02

Mammalian Class	Body Weight	Adjusted LD50	Adjusted NOAEL
Herbivores/ Insectivores	15	729.68	6.59
	35	590.39	5.33
	1000	255.36	2.31
Grainvores	15	729.68	6.59
	35	590.39	5.33
	1000	255.36	2.31

Dose-Based EECs (mg/kg-bw)	Mammalian Classes and Body weight					
	Herbivores/ Insectivores			Granivores		
	15 g	35 g	1000 g	15 g	35 g	1000 g
Short Grass	218.04	150.69	34.94			
Tall Grass	99.93	69.07	16.01			
Broadleaf plants/sm Insects	122.65	84.77	19.65			
Fruits/pods/seeds/lg Insects	13.63	9.42	2.18	3.03	2.09	0.49

Dose-based RQs (Dose-based EEC/LD50 or NOAEL)	15 g mammal		35 g mammal		1000 g mammal	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Short Grass	0.30	33.07	0.26	28.25	0.14	15.14
Tall Grass	0.14	15.16	0.12	12.95	0.06	6.94
Broadleaf plants/sm Insects	0.17	18.60	0.14	15.89	0.08	8.52
Fruits/pods/lg Insects	0.02	2.07	0.02	1.77	0.01	0.95
Seeds (granivore)	0.00	0.46	0.00	0.39	0.00	0.21

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	Mammal RQs	
	Acute	Chronic
Short Grass	#DIV/0!	3.81
Tall Grass	#DIV/0!	1.75
Broadleaf plants/sm Insects	#DIV/0!	2.14
Fruits/pods/seeds/lg Insects	#DIV/0!	0.24

Me-Too Appendix C –Chlorothalonil Aquatic Ecological Effects Concentrations (EEC's) for Surface Water

Models, Scenarios, and Input Parameters

Estimated Environmental Concentrations (EEC's) for surface water were calculated using Tier II PRZM (Pesticide Root Zone Model) and EXAMS (Exposure Analysis Modeling System). PRZM is used to simulate pesticide transport as a result of runoff and erosion from a standardized field planted in a single crop, and EXAMS estimates environmental fate and transport of pesticides in a standardized pond. The linkage program shell - PE4V01, which incorporates the standard scenarios developed by EFED, was used to run these models.

Linked crop-specific scenarios and meteorological data were used to estimate exposure as a result of specific uses for each modeling scenario. Simulations were done using the Ecological Effects Pond scenario in EXAMS. Weather and agricultural practices are simulated over 30 years so that the 1-in10 year exceedence probability at the site can be estimated (http://www.epa.gov/oppefed1/models/water/index.htm).

This assessment considers only non-food uses. Only three EFED standard scenarios were simulated for this aquatic ecological effects assessment. The PRZM/EXAMS modeled surface water predictions are based on maximum labeled applications of chlorothalonil for non-food uses. Among the standard EFED crop scenarios, there are 2 turf scenarios, and 1 surrogate ornamental scenario.

Input Parameters

Selection of modeling input parameters was *not limited* to data submitted and/or referenced for this Me-Too registration. Appropriate PRZM/EXAMS input parameters were selected from *all* available environmental fate data submitted to the Agency for chlorothalonil in accordance with US EPA-OPP EFED water model parameter selection *Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides, Version 2.3, February 28, 2002.* Dates for first pesticide application and application intervals were chosen to represent the actual window in which chlorothalonil will be applied.

Table C-1 Summary of Environmental Fate Data Used for the Aquatic Ecological Effects Assessment Inputs

Fate Property	Input Value	MRID (or source)
Molecular Weight	**265.9**	Chlorothalonil RED, EPA 738-R-99004, April, 1999
Henry's Law Constant	**2.6×10^{-7} atm - m^3/mole**	Chlorothalonil RED, EPA 738-R-99004, April, 1999
Vapor Pressure	**5.72×10^{-7} torr**	00153732
Aqueous Solubility	**0.8 mg/L at 25 °C**	Chlorothalonil RED, EPA 738-R-99004, April, 1999
Aqueous Photolysis	10 hours (**0.4 days**)	45710223, (40183418)
Aerobic Soil Metabolism Half- lives	**71 days** (90% upper bound on mean of 68, 24, 22 and 24 days; 35.4 + ((3.2 x 22.4)/sqrt 4)	00087351
Hydrolysis	**stable** @ pH =5 and 7	0040539
Aerobic Aquatic Metabolism	**35.2 days** (90% upper bound on mean of	45908001, (42226101)

(water column)	13, 21 and 2.5 days; 12.2 + ((4.3 x 9.36)/sqrt 3)	
Anaerobic Aquatic Metabolism (benthic)	**15 days** (range 5 to 15 days reported)	00147975
K_{ads}	**19.5** (average 26, 29, 20, and 3)	00115105
Application Efficiency	**95 percent**	EFED Guidance
Spray Drift	**5 percent**	EFED Guidance

Table C-2 Standard Scenarios and Application Rates for Chosen for Modeled Crops

Agricultural Commodity	Scenario Location	Application Rate (kg/ha)	Application Date	Number of Applications	Application Interval (days)
Christmas Trees – Oregon[1]	Benton County, OR	4.6	01-05	4	21
Turf - Florida	Osceola County, FL	12.7	01-06	7	14
Turf - Pennsylvania	York County, PA	12.7	15-09	7	14

[1]Used as a surrogate for all ornamental plants

Model Outputs for Chlorothalonil

PRZM/EXAMS estimated surface water concentrations was modeled for aerial applications of chlorothalonil to Oregon Christmas trees, which was used as surrogates for all ornamental uses, and to Florida and Pennsylvania turf. The highest peak EEC values were estimated at 331 µg/L (ppb) for chlorothalonil applied to Florida turf at the maximum labeled application rate. The highest 21 day concentration was estimated at 254 µg/L (ppb) for chlorothalonil applied to Pennsylvania turf. The highest 60 day concentration was estimated at 205 µg/L (ppb) for chlorothalonil applied to Pennsylvania turf.

The EFED standard PRZM/EXAMS scenarios are designed to estimate surface water concentrations that are only expected to be exceeded once every ten years. Model output files are appended below.

Table C-3 Tier II, PRZM/EXAMS, Estimated Aquatic Ecological Effects Concentration (EECs) of Chlorothalonil in standard ecological pond for Non-Food Uses. Simulation Based Aerial Applications. Concentrations are in µg/L (ppb).

State/Crop	Application Rate-Individual/ Seasonal	Number of Applications/ Application Interval	1-in-10-year annual exceedeence probability for		
			Peak EEC	**21-day**	**60-day**
	lb. ai/ac	**month/day**	**µg/L (ppb)**		
OR/X-masTre	4.13 / 16.5	4/21	25.7	19.9	17.7
FL/turf	11.3 / 79.1	7/14	331	237	197
PA/turf	11.3 / 79.1	7/14	288	254	205

Aquatic Exposure Monitoring and Field Data

Available NAWQA (USGS National Water Quality Assessment Data Warehouse) aquatic monitoring data (http://web1.er.usgs.gov/NAWQAMapTheme/index.jsp) indicates that chlorothalonil was not detected in either surface water or ground water at any of the site types monitored throughout the United States. Local monitoring data from southern Florida also indicate that chlorothalonil was not present above the limit of detection in any samples tested.

While Evolution of volatile compounds was not significant in laboratory testing, local ambient air monitoring data from a site in North Dakota and three sites in California indicate that chlorothalonil was present in the air at the application sites, and at locations up to a mile away from the application sites[1].

Terresterial and aquatic field dissipation studies referenced by Vischim are currently under review. Data from the one available terrestrial field dissipation study indicates that chlorothalonil dissipates from a terrestrial test plot with a total system half-life of one to two months. A cursive, preliminary inspection of the field dissipation data currently under review indicates that the results of these studies appear to be in concurrence with laboratory fate data.

[1] JOURNAL OF PESTICIDE REFORM/ WINTER 1997 • VOL.17, NO.
http://64.233.161.104/search?q=cache:0yXOLRyW_IUJ:www.pesticide.org/chlorothalonil.pdf+chlorothalonil+monitoring&hl=en&gl=us&ct=clnk&cd=5

PRZM/EXAMS OUTPUT FILES

stored as **FLturf**Pd.out
Chemical: **Chlorothalonil**
PRZM environment: FLturfC.txt   modified Monday, 16 June 2003 at 13:48:06
EXAMS environment: pond298.exv   modified Thuday, 29 August 2002 at 16:33:30
Metfile: w12834.dvf   modified Wedday, 3 July 2002 at 09:04:28
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	258	239	193	144	136	43.87
1962	204	189	157	139	122	38.08
1963	488	449	352	244	187	56.71
1964	333	307	228	171	151	47.73
1965	223	207	174	131	107	32.55
1966	518	479	361	276	227	65.54
1967	229	215	190	130	113	39.19
1968	306	284	231	200	166	53.31
1969	207	192	141	96.85	85.48	35.37
1970	72.54	66.85	57.59	53.8	50.01	16.34
1971	273	252	196	134	107	35.11
1972	255	236	172	120	126	44.45
1973	152	141	115	87.21	75.01	26.2
1974	197	182	145	122	111	37.48
1975	103	97.94	82.7	76.73	66.71	25.03
1976	182	169	143	110	95.06	34.47
1977	268	247	201	154	121	41.54
1978	183	168	128	99.2	102	33.59
1979	308	283	234	165	130	39.98
1980	126	119	96.64	82.29	70.46	22.5
1981	175	161	126	101	88.55	31.73
1982	221	204	169	145	122	38.39
1983	251	231	191	123	122	43.48
1984	155	144	125	105	100	33.53
1985	136	125	103	82.46	70.68	22.15
1986	263	242	203	152	119	36.58
1987	95.46	87.99	74.7	64.53	56.95	19.03
1988	82.97	76.58	65.18	60.78	57.66	20.42
1989	69.57	63.94	54.61	50.43	47.27	16.49
1990	121	111	89	71.53	64.12	21.98

Sorted results

Prob.	**Peak**	96 hr	**21 Day**	**60 Day**	90 Day	Yearly
0.032258064516129	518	479	361	276	227	65.54
0.0645161290322581	488	449	352	244	187	56.71
0.0967741935483871	333	307	234	200	166	53.31
0.129032258064516	308	284	231	171	151	47.73
0.161290322580645	306	283	228	165	136	44.45

0.193548387096774	273	252	203	154	130	43.87
0.225806451612903	268	247	201	152	126	43.48
0.258064516129032	263	242	196	145	122	41.54
0.290322580645161	258	239	193	144	122	39.98
0.32258064516129	255	236	191	139	122	39.19
0.354838709677419	251	231	190	134	121	38.39
0.387096774193548	229	215	174	131	119	38.08
0.419354838709677	223	207	172	130	113	37.48
0.451612903225806	221	204	169	123	111	36.58
0.483870967741936	207	192	157	122	107	35.37
0.516129032258065	204	189	145	120	107	35.11
0.548387096774194	197	182	143	110	102	34.47
0.580645161290323	183	169	141	105	100	33.59
0.612903225806452	182	168	128	101	95.06	33.53
0.645161290322581	175	161	126	99.2	88.55	32.55
0.67741935483871	155	144	125	96.85	85.48	31.73
0.709677419354839	152	141	115	87.21	75.01	26.2
0.741935483870968	136	125	103	82.46	70.68	25.03
0.774193548387097	126	119	96.64	82.29	70.46	22.5
0.806451612903226	121	111	89	76.73	66.71	22.15
0.838709677419355	103	97.94	82.7	71.53	64.12	21.98
0.870967741935484	95.46	87.99	74.7	64.53	57.66	20.42
0.903225806451613	82.97	76.58	65.18	60.78	56.95	19.03
0.935483870967742	72.54	66.85	57.59	53.8	50.01	16.49
0.967741935483871	69.57	63.94	54.61	50.43	47.27	16.34
0.1	**330.5**	304.7	**233.7**	**197.1**	164.5	52.752

Average of yearly averages: 35.094

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: FLturfPd
Metfile: w12834.dvf
PRZM scenario: FLturfC.txt
EXAMS environment file: pond298.exv
Chemical Name: Chlorothalonil

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	265.9	g/mol	
Henry's Law Const.	henry	2.60e-07	atm-m^3/mol	
Vapor Pressure	vapr	5.72e-7	torr	
Solubility	sol	8	mg/L	
Kd	Kd	19.5	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	0.4	days	Half-life
Aerobic Aquatic Metabolism	kbacw	35.2	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	15	days	Halfife
Aerobic Soil Metabolism	asm	71	days	Halfife
Hydrolysis:	pH 7	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	4	cm	
Application Rate:	TAPP	12.656	kg/ha	

Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 15-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
Interval 2 interval 14 days Set to 0 or delete line for single app.
Interval 3 interval 14 days Set to 0 or delete line for single app.
Interval 4 interval 14 days Set to 0 or delete line for single app.
Interval 5 interval 14 days Set to 0 or delete line for single app.
Interval 6 interval 14 days Set to 0 or delete line for single app.
Record 17: FILTRA
IPSCND
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

stored as **PAturf**Pd.out
Chemical: **Chlorothalonil**
PRZM environment: PAturfC.txt   modified Satday, 12 October 2002 at 16:27:02
EXAMS environment: pond298.exv   modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14737.dvf   modified Wedday, 3 July 2002 at 09:06:12
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	172	169	160	124	100	26.23
1962	183	176	158	149	119	68.04
1963	204	199	184	167	136	66.79
1964	191	184	172	155	137	71.08
1965	141	139	130	117	104	55.79
1966	147	144	134	116	109	52.43
1967	188	181	161	127	104	57.92
1968	153	150	140	121	99.05	56.49
1969	196	192	176	116	95.98	52.97
1970	204	196	180	168	143	73.99
1971	245	236	225	205	163	80.69
1972	425	407	364	294	218	92.57
1973	228	225	212	187	165	80.22
1974	268	258	225	140	117	64.48
1975	217	207	186	179	161	79.78
1976	204	199	184	142	129	66.54
1977	187	184	172	151	124	68.92
1978	169	166	155	137	120	60.24
1979	124	120	109	103	102	55.3
1980	186	178	167	138	113	48.15
1981	144	142	133	113	96.93	52.21
1982	120	118	110	98.07	86.7	48.49
1983	248	243	225	165	133	51.43
1984	210	207	192	159	133	68.92
1985	342	328	302	257	240	82.83
1986	245	242	227	203	178	78.1
1987	120	116	103	91.1	80.32	42.87
1988	290	277	257	193	148	56.47
1989	208	201	174	138	120	69.73
1990	263	250	216	176	139	57.07

Sorted results

Prob.	**Peak**	96 hr	**21 Day**	**60 Day**	90 Day	Yearly
0.032258064516129	425	407	364	294	240	92.57
0.0645161290322581	342	328	302	257	218	82.83
0.0967741935483871	290	277	257	205	178	80.69
0.129032258064516	268	258	227	203	165	80.22
0.161290322580645	263	250	225	193	163	79.78
0.193548387096774	248	243	225	187	161	78.1
0.225806451612903	245	242	225	179	148	73.99
0.258064516129032	245	236	216	176	143	71.08
0.290322580645161	228	225	212	168	139	69.73

0.32258064516129	217	207	192	167	137	68.92
0.354838709677419	210	207	186	165	136	68.92
0.387096774193548	208	201	184	159	133	68.04
0.419354838709677	204	199	184	155	133	66.79
0.451612903225806	204	199	180	151	129	66.54
0.483870967741936	204	196	176	149	124	64.48
0.516129032258065	196	192	174	142	120	60.24
0.548387096774194	191	184	172	140	120	57.92
0.580645161290323	188	184	172	138	119	57.07
0.612903225806452	187	181	167	138	117	56.49
0.645161290322581	186	178	161	137	113	56.47
0.67741935483871	183	176	160	127	109	55.79
0.709677419354839	172	169	158	124	104	55.3
0.741935483870968	169	166	155	121	104	52.97
0.774193548387097	153	150	140	117	102	52.43
0.806451612903226	147	144	134	116	100	52.21
0.838709677419355	144	142	133	116	99.05	51.43
0.870967741935484	141	139	130	113	96.93	48.49
0.903225806451613	124	120	110	103	95.98	48.15
0.935483870967742	120	118	109	98.07	86.7	42.87
0.967741935483871	120	116	103	91.1	80.32	26.23
0.1	**287.8**	275.1	**254**	**204.8**	176.7	80.643

Average of yearly averages: 62.8913333333333

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: PAturfPd
Metfile: w14737.dvf
PRZM scenario: PAturfC.txt
EXAMS environment file: pond298.exv
Chemical Name: Chlorothalonil
Description Variable Name Value Units Comments
Molecular weight mwt 265.9 g/mol
Henry's Law Const. henry 2.60e-07 atm-m^3/mol
Vapor Pressure vapr 5.27e-7 torr
Solubility sol 80 mg/L
Kd Kd 19.5 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0.4 days Half-life
Aerobic Aquatic Metabolism kbacw 35.2 days Halfife
Anaerobic Aquatic Metabolism kbacs 15 days Halfife
Aerobic Soil Metabolism asm 71 days Halfife
Hydrolysis: pH 7 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 4 cm
Application Rate: TAPP 12.656 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 15-09 dd/mm or dd/mmm or dd-mm or dd-mmm

```
Interval 1 interval   14    days  Set to 0 or delete line for single
app.
Interval 2 interval   14    days  Set to 0 or delete line for single
app.
Interval 3 interval   14    days  Set to 0 or delete line for single
app.
Interval 4 interval   14    days  Set to 0 or delete line for single
app.
Interval 5 interval   14    days  Set to 0 or delete line for single
app.
Interval 6 interval   14    days  Set to 0 or delete line for single
app.
Record 17: FILTRA
      IPSCND
      UPTKF
Record 18: PLVKRT
      PLDKRT
      FEXTRC     0.5
Flag for Index Res. Run     IR    Pond
Flag for runoff calc. RUNOFF     none  none, monthly or total(average
of entire run)
```

stored as **ORXtree**Pd.out
Chemical: **Chlorothalonil**
PRZM environment: ORXmasTreeC.txt modified Satday, 12 October 2002 at 16:23:10
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	23.86	22.42	17.56	16.42	14.26	4.758
1962	24.63	23.22	18.39	17.13	14.92	5.714
1963	26.46	25.1	20.36	19.28	17.47	6.679
1964	24.88	23.45	18.55	17.09	14.88	5.604
1965	24.54	23.05	18.03	16.88	14.71	5.781
1966	24.32	22.93	18.16	16.69	14.59	5.801
1967	23.85	22.36	17.37	16.38	14.3	5.407
1968	24.54	23.09	18.15	16.88	14.71	6.403
1969	26.71	25.16	20.12	17.43	15.18	6.21
1970	23.8	22.34	17.41	16.32	14.26	5.397
1971	25.32	23.82	18.76	17.3	15.03	6.131
1972	24.42	22.93	17.89	16.73	14.55	5.34
1973	24.51	23.02	17.99	16.69	14.53	5.864
1974	24.31	22.94	18.24	16.89	14.78	5.669
1975	24.67	23.24	18.36	16.86	14.68	5.476
1976	24.99	23.57	18.71	17.09	14.86	5.265
1977	24.22	22.87	18.2	16.81	14.65	5.268
1978	24.48	23.02	18.04	17.38	15.23	5.578
1979	23.81	22.35	17.42	16.21	14.13	5.777
1980	25.32	23.83	18.77	17.35	15.06	5.757
1981	25.68	24.21	19.2	17.81	15.49	6.983
1982	23.95	22.59	17.92	16.51	14.47	5.612
1983	24.69	23.34	18.7	16.87	14.73	5.701
1984	25.3	23.77	18.69	17.49	15.28	5.863
1985	25.4	23.75	18.9	17.72	15.23	5.671
1986	23.8	22.49	17.99	16.46	14.41	5.134
1987	24.1	22.8	19.99	17.47	15.97	6.126
1988	24.72	23.22	18.17	17.05	14.88	5.865
1989	24	22.68	18.14	16.57	14.5	5.684
1990	24.69	23.16	18.09	17	14.81	5.851

Sorted results

Prob.	**Peak**	96 hr	**21 Day**	**60 Day**	90 Day	Yearly
0.032258064516129	26.71	25.16	20.36	19.28	17.47	6.983
0.0645161290322581	26.46	25.1	20.12	17.81	15.97	6.679
0.0967741935483871	25.68	24.21	19.99	17.72	15.49	6.403
0.129032258064516	25.4	23.83	19.2	17.49	15.28	6.21
0.161290322580645	25.32	23.82	18.9	17.47	15.23	6.131
0.193548387096774	25.32	23.77	18.77	17.43	15.23	6.126
0.225806451612903	25.3	23.75	18.76	17.38	15.18	5.865
0.258064516129032	24.99	23.57	18.71	17.35	15.06	5.864
0.290322580645161	24.88	23.45	18.7	17.3	15.03	5.863

0.32258064516129	24.72	23.34	18.69	17.13	14.92	5.851
0.354838709677419	24.69	23.24	18.55	17.09	14.88	5.801
0.387096774193548	24.69	23.22	18.39	17.09	14.88	5.781
0.419354838709677	24.67	23.22	18.36	17.05	14.86	5.777
0.451612903225806	24.63	23.16	18.24	17	14.81	5.757
0.483870967741936	24.54	23.09	18.2	16.89	14.78	5.714
0.516129032258065	24.54	23.05	18.17	16.88	14.73	5.701
0.548387096774194	24.51	23.02	18.16	16.88	14.71	5.684
0.580645161290323	24.48	23.02	18.15	16.87	14.71	5.671
0.612903225806452	24.42	22.94	18.14	16.86	14.68	5.669
0.645161290322581	24.32	22.93	18.09	16.81	14.65	5.612
0.67741935483871	24.31	22.93	18.04	16.73	14.59	5.604
0.709677419354839	24.22	22.87	18.03	16.69	14.55	5.578
0.741935483870968	24.1	22.8	17.99	16.69	14.53	5.476
0.774193548387097	24	22.68	17.99	16.57	14.5	5.407
0.806451612903226	23.95	22.59	17.92	16.51	14.47	5.397
0.838709677419355	23.86	22.49	17.89	16.46	14.41	5.34
0.870967741935484	23.85	22.42	17.56	16.42	14.3	5.268
0.903225806451613	23.81	22.36	17.42	16.38	14.26	5.265
0.935483870967742	23.8	22.35	17.41	16.32	14.26	5.134
0.967741935483871	23.8	22.34	17.37	16.21	14.13	4.758

0.1 **25.652** 24.172 **19.911** **17.697** 15.469 6.3837
Average of yearly averages: 5.74563333333333

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: ORXtreePd
Metfile: w24232.dvf
PRZM scenario: ORXmasTreeC.txt
EXAMS environment file: pond298.exv
Chemical Name: Chlorothalonil

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	265.9	g/mol	
Henry's Law Const.	henry	2.60e-07	atm-m^3/mol	
Vapor Pressure	vapr	5.72e-7	torr	
Solubility	sol	0.8	mg/L	
Kd	Kd	19.5	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	0.4	days	Half-life
Aerobic Aquatic Metabolism	kbacw	35.2	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	15	days	Halfife
Aerobic Soil Metabolism	asm	71	days	Halfife
Hydrolysis:	pH 7	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	4	cm	
Application Rate:	TAPP	4.6406	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	
Application Date	Date	01-05	dd/mm or dd/mmm or dd-mm or dd-mmm	

```
Interval 1 interval   21    days  Set to 0 or delete line for single
app.
Interval 2 interval   21    days  Set to 0 or delete line for single
app.
Interval 3 interval   21    days  Set to 0 or delete line for single
app.
Record 17: FILTRA
      IPSCND
      UPTKF
Record 18: PLVKRT
      PLDKRT
      FEXTRC     0.5
Flag for Index Res. Run     IR    Pond
Flag for runoff calc. RUNOFF     none  none, monthly or total(average
of entire run)
```

Me-Too Appendix D - Chlorothalonil Degradate SDS-3701 Formation on Birds and Mammal Food Items

The following discussion is taken directly from the 1988 chlorothalonil RED.

A primary degradate of chlorothalonil, SDS-3701, is more toxic to mammals and birds than parent chlorothalonil.

Chemical	Acute Toxicity			Chronic NOELs	
	Birds (LD50) mg/kg	Birds (LC50) ppm	Mammals (LD50) mg/kgBirds (ppm)Mammals (ppm)		
Chlorothalonil	>4640	>10,000	>10,000	1,000	2,000
SDS-3701	158	1,746	332	50	33

Because SDS-3701 is more toxic than parent chlorothalonil, it is considered important to discuss its risk potential.

There is insufficient data to characterize with certainty how much SDS-3701 will form on avian and mammalian food items. Most of the available residue studies were designed to measure the amount of SDS-3701 that is taken up by crops and how much accumulates in vegetable items associated with human consumption such as beans and fruits. These studies typically show very small amounts of SDS-3701 occurring in crops; much less than 1 ppm. Residues of less than 1 ppm would be of minimal concern for acute or chronic effects to birds or mammals. Unfortunately, most of these studies do not provide a dependable basis for estimating how much SDS-3701 will form on avian and mammalian food items in the days immediately following treatment with chlorothalonil.

Several studies provide some indication as to how much SDS-3701 will be present on/in avian and mammalian food items (short grass, leaves, seeds and insects). These studies are on turf and peanut hay.

Peanut Hay Study

The residue study on peanut hay (MRID 43843601; reviewed by Chemistry Branch II, HED) suggests an inverse correlation between the residue levels of parent chlorothalonil and the percent of SDS-3701 that forms. The residues of SDS-3701 that formed ranged from 2.6% to 24% of parent chlorothalonil. When the actual residue level of parent chlorothalonil was about 45 ppm, SDS-3701 residues were about 1 ppm, or about 2.6% of the parent. When the actual chlorothalonil residues were about 1.7 ppm, SDS-3701 residues were 0.4 ppm or about 24%. Peanut hay could be a surrogate for foliage that small herbivores might consume.

It should be noted that 1) the peanut hay was sampled at six different sites at various times ranging from 2 to 6 weeks after the last application, and 2) that, in the process of making hay, the peanut plants (vines) were dried for several days to a week, then raked and baled. In this process much of foliage (leaf mass) is lost, with most of the mass of the bale composed of vine stem. Therefore, because of the time delay (with associated dissipation) and loss of exposed plant mass, it cannot be concluded that SDS-3701 would not occur at greater than 1 ppm on any treated vegetation.

Turf (Golf Green) Studies

At two study sites (related MRIDs 422220-01, -02, -03), residues of SDS-3701 were measured in turf clippings on each day for 14 days while chlorothalonil was being applied at approximately 7 day intervals. Application rates were from 5.6 to 10.6 lbs ai/acre. These studies showed that residues of SDS-3701 never exceeded 1 ppm in the turf clippings treated at 5.6 lbs ai/acre and never exceeded 7 ppm in turf clippings that had been treated at 10.6 lbs ai/acre. It is important to note two things about this study:

1) The grass that was treated and subsequently sampled was mowed daily so that a fraction of the parent and degradate that was on the grass was discarded daily as the grass was cut and removed. Subsequent samples in the form of clippings would include fresh growth that diluted the concentration of both parent and degradate. This would tend to reduce the residues more than if the grass was allowed to grow, and all the parent and degradate allowed to remain for sampling. However, these studies do suggest that at least on turf that is mowed frequently, the residues of SDS-3701 do not accumulate above 7 ppm.

2) Based on the rates at each application, i.e. 5.6 lb ai/acre and 10.6 lb ai/acre, and the fact that the vegetation treated and sampled was short grass on a putting green, this study represents a "high exposure" scenario relative to other chlorothalonil uses. This is also evidenced by the residues of chlorothalonil during the study, which were in the thousands of ppm. Even under these high use conditions, the actual residues of SDS-3701 did not exceed 7 ppm.

Grass grown for seed

Another study (MRID 42875926) measured the residues of chlorothalonil and SDS-3701 in grass seed, seed screenings and straw. Samples were collected 37 days after the last aerial application at 1.5 lb ai/acre. While parent residues on seed and straw ranged from 30 ppm to 54 ppm, residues of SDS-3701 never exceeded 1 ppm. The difficulty in interpreting this study stems from the fact that samples were collected more than a month after the last application. It is not known what the levels of parent and degradate would have been in the interim.

Acute and Chronic Risk Discussion:

Based on residues alone

While SDS-3701 is more acutely and chronically toxic to birds and mammals than parent chlorothalonil, residues less than 33 ppm SDS-3701 would not present either an acute or chronic risk. On the basis of measured residues alone, which never exceeded 7 ppm, it could be concluded that exposure from SDS-3701 represents little or no acute or chronic risk to birds or mammals. However, it is conceivable that under different conditions, and that SDS3701 was 24% of the total measured residues in peanut hay, residues of SDS-3701 could reach higher levels. Since there is high uncertainty as to what these levels may be, the degree of risk is unknown.

Based on percentage SDS-3701 formed

As indicated in the discussion above, there is no firm basis for estimating the residues of SDS-3701. If 10% is chosen as a relatively conservative upper limit of how much SDS-3701 forms relative to parent chlorothalonil, the approximate ranges for turf (and orchards) and other non orchard crops would be as follows:

Table D1: Estimates of SDS-3701 Residues on Terrestrial Food Items (ppm)*

	TURF/ORCHARD		NON-ORCHARD	
	Insects	Short Grass	Insects/Broad Leaf	Short Grass
Maximum (ppm)	86-572	152-1016	24-148	43-262
Average (ppm)	53-426	95-757	14-92	25-164

* Assuming 10% of parent chlorothalonil residues transform into SDS-3701. Lower number represents lowest application rate and shorter half-life (7 days); Higher number represents highest application rate and longer half-life (30 days).

Estimations of acute and chronic risk can be made by comparing maximum EECs to acute toxicity values and average EECs to chronic values. Birds would be considered at high acute risk (LC50 1,746 ppm) on turf and orchards and at chronic risk (NOEL 50 ppm) on all sites. Mammals would be at high acute (estimated LC50 342 ppm) and chronic risk (NOEL 33 ppm) for all sites."

Me-Too APPENDIX E – Environmental Fate Bibliography

Hydrolysis

Szalkowski, M.B. (1976) Hydrolysis of Daconil and Its Metabolite, 4-Hydroxy-2,5,6-trichloroisophthalonitrile, in the Absence of Light at pH Levels of 5, 7, and 9. Undated method. (Unpub- lished study received Feb 25, 1976 under 6F1749; submitted by Diamond Shamrock Agricultural Chemicals, Cleveland, Ohio; CDL: 096466-B) **MRID 0040539**

Aqueous Photolysis

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Soil Photolysis

Szalkowski, M.B. (19??) Photodegradation and Mobility of Daconil and Its Major Metabolite on Soil Thin Films. (Unpublished study received Feb 25, 1976 under 6F1749; submitted by Diamond Sham- rock Agricultural Chemicals, Cleveland, Ohio; CDL:096466-F) **MRID 00040543**

Szalkowski, M.B. (1975) Photodegradation and Mobility of Daconil and Its Major Metabolite on Soil Thin Films. (Unpublished study received Feb 25, 1976 under 6F1749; submitted by Diamond Sham- rock Agricultural Chemicals, Cleveland, Ohio; CDL:097394-E) **MRID 00087349**

Aerobic Soil Metabolism

Szalkowski, M.B. (1976) Effect of Microorganisms upon the Soil Metabolism of Daconil and 4-Hydroxy-2,5,6,trichloroisophthalo- nitrile. (Unpublished study received Feb 25, 1976 under 6F1749; prepared in cooperation with Ohio State Univ., Soil Testing Laboratory, submitted by Diamond Shamrock Agricultural Chemi- cals, Cleveland, Ohio; CDL:096466-J) **MRID 00040547**

Duane, W.C. (1970) Biodegradation of Daconil 2787. (Unpublished study received Aug 11, 1970 under 1F1024; submitted by Diamond Shamrock Chemical Co., Cleveland, Ohio; CDL:093333-E) **MRID 00087285**

Szalkowski, M.B. (1976) Effect of Microorganisms upon the Soil Metabolism of Daconil and 4-Hydroxy-2,5,6-trichloroisophthalo- nitrile. (Unpublished study received Feb 25, 1976 under 6F1749; submitted by Diamond Shamrock Agricultural Chemicals, Cleveland, Ohio; CDL:097394-I) **MRID 00087351**

Anaerobic Aquatic Metabolism

Nelsen, T. (1985) An Anaerobic Aquatic Soil Metabolism Study with [Radiolabeled Carbon]-chlorothalonil: Document No. 680-3EF-84- 0026-001. Unpublished study prepared by SDS Biotech Corp. 68 p. **MRID 00147975**

Anaerobic Soil Metabolism

Nelsen, T. (1985) An Anaerobic Aquatic Soil Metabolism Study with [Radiolabeled Carbon]-chlorothalonil: Document No. 680-3EF-84- 0026-001. Unpublished study prepared by SDS Biotech Corp. 68 p. **MRID 00147975**

Aerobic Aquatic Metabolism

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Hatzenbeler, C. (1991) An Aerobic Aquatic Soil Metabolism Study with ?carbon 14|-Chlorothalonil: Lab Project Number: 90-0240; 3163-90-0240-EF-001. Unpublished study prepared by Ricerca, Inc. 137 p. **MRID 42226101**

Adsorption/Desorption

Szalkowski, M.B.; Stallard, D.E. (1980) Adsorption of Chloro- thalonil (2,4,5,6-Tetrachloroisophthalonitrile) DS-2787. (Un- published study received Feb 19, 1980 under 677-313; submitted by Diamond Shamrock Agricultural Chemicals, Cleveland, Ohio; CDL:099248-D) **MRID 00029406**

Capps, T.; Marciniszyn, J.; Marks, A.; et al. (1982) Adsorption and Desorption of Chlorothalonil to Soils: Document No. 555-4EF-81- 0216-001. (Unpublished study received Sep 21, 1982 under 0F2405; submitted by Diamond Shamrock Corp., Cleveland, OH; CDL: 071096-B) **MRID 00115105**

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Laboratory Volatilty

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Bioconcentration in Fish

McEwen, A. (1997) Chlorothalonil Bioaccumulation in Rainbow Trout: Lab Project Number: VCM 67/963833: VCM/67. Unpublished study prepared by Huntingdon Life Sciences Ltd. 86 p. **MRID 45710224**

Bioconcentration in Aquatic Non-Target

Ernst, W.; Doe, K.; Jonah, P. et al. (1991) The toxicity of chlorothalonil to aquatic fauna and the impact of its operational use on a pond ecosystem. Archives of Environmental Contamination and Toxicology 21:1-9. **MRID 44286001**

Terrestrial Field Dissipation

Ciba-Geigy Corporation (1980) ?Tank Mix Soil Dissipation Studies with Various Chemicals|: AG-A 4801 I, II A. (Compilation; unpublished study, including AG-A 4801 I, II, III, 2nd Report A, 4802 I, II, III, 4802 I, II, III, Second Report B..., received Apr 15, 1981 under 100-607; CDL:070010-E)

Skinner, W.A.; Wolfe, A.L.; Stallard, D.E. (1965) Determinations of the Fate of 2,4,5,6-Tetrachloroisophthalonitrile (Daconil 2787) in Soil. (Unpublished study received Sep 30, 1965 under 677- 229; submitted by Diamond Shamrock Agricultural Chemicals, Cleveland, Ohio; CDL:120430-A)

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Aquatic Field Dissipation

Diamond Shamrock Agricultural Chemicals (1982) ?Bravo: Residues in Rice and Other Subjects|. (Compilation; unpublished study re- ceived Apr 21, 1983 under 677-313; CDL:071553-B) **MRID 00127861**

Ground Water – Small Prospective

Ricerca, Inc. (1996) Environmental Fate of Chlorothalonil and Metabolites in Soil, Plants, Surface Water and Ground Water--Additional New Information: Lab Project Number: EF-96-HF-020-001-001: WR 1201T: 762-3AS-86-0010-000. Unpublished study. 206 p. **MRID 44006001**

Cooper, S. (1996) July 1996 Interim Report: Chlorothalonil Small-Scale Prospective Ground-Water Monitoring Study: Lab Project Number: CHLORO-GW-93: EF-34-96-020-001. Unpublished study prepared by American Agricultural Services, Inc. 79 p. **MRID 44091501**

Cooper, S. (1997) Chlorothalonil: Small-Scale Prospective Ground-Water Monitoring Study: April 1997 Interim Report: Revised: Lab Project Number: EF-34-97-024-001: CHLORO-GW-93. Unpublished study prepared by ISK Biosciences, Inc. 95 p. **MRID 44291101**

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US Environmental Protection Agency, Office of Pesticide Programs; Chlorothalonil RED, EPA 738-R-99004, April, 1999

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APPENDIX F: Summary of Endangered Species

Species Counts by State for Indicated Crops

Minimum of 1 Acre.
Freshwater, Brackish, Saltwater

asparagus, beans - dry (PR), beans - snap, broccoli, brussels sprouts, cabbage - head, cantaloups, carrots, cauliflower, celery, cherries, sweet (see text), cherries, tart (see text), cranberries, cucumbers and pickles, onions - dry, papayas, peanuts for nuts, peanuts for nuts (irrigated), potatoes

AL, AK, AZ, AR, CA, CO, CT, DE, DC, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, OR, PA, PR, RI, SC, SD, TN, TX, UT, VT, VA, WA, WV, WI, WY

Alabama

The taxa Amphibian has 2 species co-occurring with indicated crops.

The taxa Bivalve has 30 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Dicot has 4 species co-occurring with indicated crops.

The taxa Fish has 15 species co-occurring with indicated crops.

The taxa Gastropod has 9 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

The taxa Reptile has 3 species co-occurring with indicated crops.

Arizona

The taxa Amphibian has 2 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 18 species co-occurring with indicated crops.

The taxa Gastropod has 1 species co-occurring with indicated crops.

Arkansas

The taxa Bivalve has 6 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 3 species co-occurring with indicated crops.

California

The taxa Amphibian has 5 species co-occurring with indicated crops.

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Crustacean has 3 species co-occurring with indicated crops.

The taxa Dicot has 10 species co-occurring with indicated crops.

The taxa Fish has 30 species co-occurring with indicated crops.

The taxa Mammal has 1 species co-occurring with indicated crops.

The taxa Monocot has 3 species co-occurring with indicated crops.

The taxa Reptile has 3 species co-occurring with indicated crops.

Colorado

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Fish has 6 species co-occurring with indicated crops.

Connecticut

The taxa Bivalve has 1 species co-occurring with indicated crops.

The taxa Fish has 1 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

Delaware

The taxa Fish has 1 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

Florida

The taxa Amphibian has 1 species co-occurring with indicated crops.

The taxa Bivalve has 7 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 4 species co-occurring with indicated crops.

The taxa Mammal has 1 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

The taxa Reptile has 7 species co-occurring with indicated crops.

Georgia

The taxa Amphibian has 1 species co-occurring with indicated crops.

The taxa Bivalve has 16 species co-occurring with indicated crops.

The taxa Dicot has 3 species co-occurring with indicated crops.

The taxa Fish has 11 species co-occurring with indicated crops.

The taxa Monocot has 2 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

Hawaii

The taxa Bird has 5 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Gastropod has 1 species co-occurring with indicated crops.

The taxa Reptile has 2 species co-occurring with indicated crops.

Idaho

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 8 species co-occurring with indicated crops.

The taxa Gastropod has 4 species co-occurring with indicated crops.

Illinois

The taxa Bivalve has 7 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Dicot has 2 species co-occurring with indicated crops.

The taxa Fish has 1 species co-occurring with indicated crops.

Indiana

The taxa Bivalve has 11 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

Iowa

The taxa Bivalve has 2 species co-occurring with indicated crops.

The taxa Fish has 2 species co-occurring with indicated crops.

Kansas

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Fish has 4 species co-occurring with indicated crops.

Kentucky

The taxa Bivalve has 22 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Fish has 4 species co-occurring with indicated crops.

Louisiana

The taxa Bivalve has 3 species co-occurring with indicated crops.

The taxa Fish has 2 species co-occurring with indicated crops.

The taxa Reptile has 6 species co-occurring with indicated crops.

Maine

The taxa Fish has 2 species co-occurring with indicated crops.

Maryland

The taxa Bivalve has 1 species co-occurring with indicated crops.

The taxa Dicot has 3 species co-occurring with indicated crops.

The taxa Fish has 2 species co-occurring with indicated crops.

The taxa Monocot has 2 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

Massachusetts

The taxa Fish has 1 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

The taxa Reptile has 2 species co-occurring with indicated crops.

Michigan

The taxa Bivalve has 2 species co-occurring with indicated crops.

The taxa Dicot has 2 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

Minnesota

The taxa Bivalve has 2 species co-occurring with indicated crops.

The taxa Fish has 1 species co-occurring with indicated crops.

Mississippi

The taxa Amphibian has 1 species co-occurring with indicated crops.

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Bivalve has 9 species co-occurring with indicated crops.

The taxa Fish has 3 species co-occurring with indicated crops.

The taxa Reptile has 5 species co-occurring with indicated crops.

Missouri

The taxa Bivalve has 6 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 7 species co-occurring with indicated crops.

The taxa Gastropod has 1 species co-occurring with indicated crops.

Montana

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 5 species co-occurring with indicated crops.

Nebraska

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Fish has 2 species co-occurring with indicated crops.

Nevada

The taxa Fish has 18 species co-occurring with indicated crops.

New Hampshire

The taxa Bivalve has 1 species co-occurring with indicated crops.

New Jersey

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 1 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

New Mexico

The taxa Amphibian has 1 species co-occurring with indicated crops.

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Crustacean has 2 species co-occurring with indicated crops.

The taxa Fish has 13 species co-occurring with indicated crops.

The taxa Gastropod has 4 species co-occurring with indicated crops.

New York

The taxa Bivalve has 1 species co-occurring with indicated crops.

The taxa Fish has 1 species co-occurring with indicated crops.

The taxa Gastropod has 1 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

North Carolina

The taxa Bivalve has 8 species co-occurring with indicated crops.

The taxa Dicot has 5 species co-occurring with indicated crops.

The taxa Fish has 4 species co-occurring with indicated crops.

The taxa Monocot has 2 species co-occurring with indicated crops.

The taxa Reptile has 5 species co-occurring with indicated crops.

North Dakota

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Fish has 1 species co-occurring with indicated crops.

Ohio

The taxa Bivalve has 6 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 1 species co-occurring with indicated crops.

The taxa Reptile has 2 species co-occurring with indicated crops.

Oklahoma

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Bivalve has 2 species co-occurring with indicated crops.

The taxa Fish has 4 species co-occurring with indicated crops.

Oregon

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 22 species co-occurring with indicated crops.

Pennsylvania

The taxa Bivalve has 2 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

Puerto Rico

The taxa Amphibian has 2 species co-occurring with indicated crops.

The taxa Reptile has 3 species co-occurring with indicated crops.

Rhode Island

The taxa Fish has 1 species co-occurring with indicated crops.

South Carolina

The taxa Amphibian has 1 species co-occurring with indicated crops.

The taxa Bivalve has 1 species co-occurring with indicated crops.

The taxa Dicot has 4 species co-occurring with indicated crops.

The taxa Fish has 1 species co-occurring with indicated crops.

The taxa Monocot has 2 species co-occurring with indicated crops.

The taxa Reptile has 4 species co-occurring with indicated crops.

South Dakota

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Fish has 2 species co-occurring with indicated crops.

Tennessee

The taxa Bivalve has 37 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 16 species co-occurring with indicated crops.

The taxa Gastropod has 1 species co-occurring with indicated crops.

Texas

The taxa Amphibian has 4 species co-occurring with indicated crops.

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Crustacean has 1 species co-occurring with indicated crops.

The taxa Fish has 8 species co-occurring with indicated crops.

The taxa Gastropod has 1 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

The taxa Reptile has 6 species co-occurring with indicated crops.

Utah

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 8 species co-occurring with indicated crops.

Vermont

The taxa Bivalve has 1 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

Virginia

The taxa Amphibian has 1 species co-occurring with indicated crops.

The taxa Bivalve has 21 species co-occurring with indicated crops.

The taxa Crustacean has 2 species co-occurring with indicated crops.

The taxa Dicot has 2 species co-occurring with indicated crops.

The taxa Fish has 7 species co-occurring with indicated crops.

The taxa Monocot has 2 species co-occurring with indicated crops.

The taxa Reptile has 1 species co-occurring with indicated crops.

Washington

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Fish has 18 species co-occurring with indicated crops.

West Virginia

The taxa Amphibian has 1 species co-occurring with indicated crops.

The taxa Bivalve has 5 species co-occurring with indicated crops.

The taxa Dicot has 1 species co-occurring with indicated crops.

The taxa Monocot has 1 species co-occurring with indicated crops.

Wisconsin

The taxa Bird has 1 species co-occurring with indicated crops.

The taxa Bivalve has 2 species co-occurring with indicated crops.

Wyoming

The taxa Fish has 1 species co-occurring with indicated crops.

No species were excluded.

APPENDIX G Status of Guidelines

Ecological Effects Data References for the Me-Too Assessment

Taxa	Required Guideline	Requirement fulfilled?	Reference	Comment
Birds	Acute oral, TGAI (71-1) OPPTS 850.2100	Yes	cited MRID 00068753 (**LD_{50}>4640 mg/kg**)	Japanese quail study (40964105) has a lower value (>2000 mg/kg), but it only tested up to 2000 mg/kg, so while >2000 mg/kg is lower numerically than > 4640, the cited study is considered useful for acute risk assessment for birds.
	Acute oral, degradate SDS-3701 (71-1) OPPTS 850.2100	Yes	cited MRID 00030395 (LD_{50}=158 mg/kg)	
	Subacute dietary, TGAI (71-2) OPPTS 850.2200	Yes	Cited 00030388 (Bobwhite quail LC_{50}>10000 ppm) Cited 00030389 (MD LC_{50}>10000 ppm) Cited 00039146 (MD LC_{50}<21500 ppm)	
	Subacute dietary, degradate SDS-3701 (71-2) OPPTS 850.2200	Yes	Cited 00115109 (Bobwhite quail LC_{50}=1746 ppm) Cited 00115108 (MD LC_{50}=2000 ppm)	
	Reproduction Bobwhite- TGAI (71-4) OPPTS 850.2300	Yes	New Data 45710218 (Bobwhite quail NOAEL 153 ppm LOAEL 624 pmm) and Cited 00041440 (Bobwhite quail NOAEL 50 ppm with no LOAEL)	Cited a valid study and submitted a valid study. The new study provides the best information with which to assess chronic risk to birds because it did provide a LOAEL.

Ecological Effects Data References for the Me-Too Assessment

Taxa	Required Guideline	Requirement fulfilled?	Reference	Comment
	Reproduction - MallardTGAI (71-4) OPPTS 850.2300	No	None submitted or cited	New submitted study is a Bobwhite quail study, Cited study is also a Bobwhite quail study, therefore no Mallard duck study was submitted or cited. The new study yields the most sensitive endpoint and will be used in risk assessment. A mallard study would need to be submitted or cited to fulfill the guideline requirement.
	Reproduction - degradate SDS-3701 (71-4) OPPTS 850.2300	No	None cited or submitted	Reproduction studies using SDS-3701 were presented in the RED. Two avian reproduction studies with 3701 degradate are required.
Fish	TGAI, Acute 72-1 OPPTS 850.1075	Yes (coldwater)	Submitted 45710219 (Rainbow trout LC_{50} 18 ppb)	
	TGAI, Acute 72-1 OPPTS 850.1075	Yes (warmwater)	Submitted 45710220 (Carp LC_{50} 55 ppb) Cited 00030390 (catfish LC_{50}=48 ppb)	MRID 00030390 is a previously submitted acute test with, but was cited by the Vischim Corp as a fish early life stage study The carp is not accepted as a warmwater species but the catfish is, so 00030390 would fulfill the requirement if cited as an acute study.

Ecological Effects Data References for the Me-Too Assessment				
Taxa	**Required Guideline**	**Requirement fulfilled?**	**Reference**	**Comment**
	TEP, Acute (72-1) OPPTS 850.1075	Yes	New and old data Cited 00087304 (48hr Rainbow trout LC_{50} 152 ppb [75% TEP]) Cited 00087303 (Rainbow trout LC_{50} =103 ppb[75% TEP]) Cited 00087258 (Bluegill LC_{50} 167 ppb[W-75 TEP]) Submitted 43302101 (Rainbow trout LC_{50} 61 ppb Bravo 720) Cited 30390 (Channel catfish, LC50 48 ppb)	The most sensitive study (MRID 00030391) was not cited by the "Vischim Corp". with an LC_{50} of 23 ppb. The MRID 30391 also reports a chronic study. 43302101, reported in Vischim Corp data table as their OWN, was also reported in the RED.
	Chronic 72-4 (fish early life stage study) OPPTS 850.1400	No	No applicable studies cited. Either the Fathead minnow study (00030391) would need to be cited, or a new fish full life cycle study submitted. * 30391 also has an acute test component	Cited studies 00029410 which is an acute Bluegill TEP test LC_{50} 84 ppb) 00029415 which is an acute Bluegill degradate test LC50 45 ppm) 00030390 which is an acute Catfish test TGAI test LC50 48 ppb). This guideline can be waived if the registrant cites or submits a fish full life cycle.
	72-5 fish full life cycle OPPTS 850.1500	No	No applicable study submitted or cited	Submitted 45710222 and listed it for this guideline but it is actually an invertebrate life cycle study. Study listed in RED as fulfilling this requirement was MRID 00030391, fathead minnow full life cycle with a NOAEC of 3 ppb and LOAEC of 6.5 ppb
	*Normally, a fish early life stage study is submitted first, but EFED does not have record of previous registrant submitted an early life stage study; only a full life cycle study. Based on results from all tests, including reproductive effects to birds, a fish full life cycle study would be required. The Vischim Corp could submit a new early life-stage study but would have to cite or submit a new life cycle study anyways. A fish early life stage is not required; just the fish full life cycle test.			

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Taxa	Required Guideline	Requirement fulfilled?	Reference	Comment
	Degradate SDS 3701, acute (72-1) OPPTS 850.1075	Yes Warmwater species	Cited 29415 which is an acute test with SDS 3701 Bluegill LC_{50} 45 ppm) However it was cited as a chronic study	The lowest toxicity study (MRID 00030393 BG LC_{50}=15 ppm) was not cited by the Vischim Corp.
	Degradate SDS 3701, acute (72-1) OPPTS 850.1075	No Coldwater species	None cited	
	TEP acute (72-1) OPPTS 850.1075	Yes Bluegill	Cited 00029410 which is an acute TEP test with Bluegill, (LC_{50} 84 ppb) However it was cited as a chronic study	Other Existing studies: 43302101 Rainbow trout LC_{50} 61 ppb w 33.2% formulation 42433804 Bluegill LC_{50} 49 ppb w 33.2% formulation
	TEP acute (72-1) OPPTS 850.1075	No Rainbow trout	None cited or submitted	This test would be required to assess risk from drift or direct application to water.
	TGAI saltwater fish (72-3) OPPTS 850.1025	Yes	Cited 00127863 (Sheepshead minnow 32 ppb)	
	BCF OPPTS 850.1710	Yes	Cited 43070601	Unclear in RED if this was the most sensitive study for this endpoint. There were several other BCF studies. (MRIDs 00086620, 00029411, 00086630, 43070601).
FW Aquatic invertebrate	FW Acute, TGAI (72-2) OPPTS 850.1010	Yes	The new study the Vischim Corp listed for this category 45710222 is actually a chronic invertebrate study Vischim did submit but did not list with this category (45710221) which is an acute FW invertebrate EC_{50} test (Daphnia EC_{50} 54 ppb)	Vischim did submit a valid acute aquatic invertebrate study (45710221). Vischim also cited a valid aquatic invertebrate Daphnia acute study (MRID 00068754, but Vischim did not list it as a 72-2 OPPTS 850.1010 study)

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Taxa	**Required Guideline**	**Requirement fulfilled?**	**Reference**	**Comment**
	FW Acute, TEP (72-2) OPPTS 850.1010	No	Cited 00068754	MRID 00068754 (Daphnia EC_{50}=68 ppb) is for **TGAI** not the TEP according to RED. MRID 42433806 (Daphnia EC_{50} 180 ppb [97 ppb ai]) was not cited by the Vischim Corp. Guideline is not fulfilled by cited data.
	FW Acute, degradate (72-2) OPPTS OPPTS 850.1010	No	None cited or submitted	MRID 00030394 (Daphnia EC_{50} 26 ppm) was used to assess this endpoint in the RED but was not cited.
	Chronic invertebrate, TGAI (72-4) OPPTS 850.1300	Yes	Submitted 45710222 (Daphnia NOAEC 6 ppb, LOAEC 18 ppb)	Old data not cited by Vischim Corp (MRID 00115107) Daphnia NOAEL 39 LOAEL 79. New study will be used to assess chronic risk to invertebrates.
	Acute, oyster 72-3 OPPTS 850.1025	Yes	Cited 00138143 (Eastern oyster shell deposition EC50 3.6 ppb)	
	Acute Mysid 72-3 OPPTS 850.1025	Yes	Cited 00127864 Shrimp EC50= 154 ppb	
	Chronic estuarine invertebrate 72-4 OPPTS 850.1300	No	None cited or submitted	MRID 42433807 (mysid shrimp NOAEC 0.83 ppb LOAEC 1.2 ppb) was used in the RED to assess potential chronic risks to mysid but was not cited. This guiadeline is required.
Plant Testing	Terrestrial Plant Testing 122-1 Seedling Emer OPPTS 850.4100 Veg Vigor OPPTS 850.4150	Yes	Cited 42433808 Seedling Emergence EC_{25}>16 lb ai/acre Cited 42433809 Vegetative Vigor EC_{25}>16 lb ai/acre	

Ecological Effects Data References for the Me-Too Assessment				
Taxa	**Required Guideline**	**Requirement fulfilled?**	**Reference**	**Comment**
	Aquatic Plant Testing 121-1 OPPTS 850.4400	Yes	Cited 42432801 Selenastrum EC_{50} 190 ppb NOAEC $_{50}$ ppb	

Environmental Fate Data References for the Me-Too Assessment

Study Type	Study Classification	Data Requirements Fulfilled	Comments	MRID
Hydrolysis (161-1)	**acceptable**	yes		0040539
Aqueous Photolysis (161-2)	**acceptable**	yes		45710223
Soil Photolysis (161-3)	**conditionally acceptable**	conditionally	under review[1]	00087349
	unacceptable		cited in previous action as study conducted on silica gel plates	00087348
	supplemental		cited in previous action as light source not identified	00040543
	unacceptable		cited in previous action as study conducted on glass beads	00040541
	unacceptable		cited in previous action as study conducted on silica gel plates	00040542
Aerobic Soil (162-1) Metabolism	**conditionally acceptable**	conditionally	under review[1]	00040547
	conditionally acceptable		under review[1]	00087285
	supplemental			00087351
Anaerobic Soil / Aquatic Metabolism (162-2, 162-3)	supplemental	**no**	accession no. 258779 - does not provide enough useful information to fully assess anaerobic metabolism	00147975
Aerobic Aquatic Metabolism (162-4)	supplemental	**no**	does not provide enough useful information to fully assess aerobic aquatic metabolism	45908001
Adsorption / Desorption (163-1)	**acceptable**	yes		00115105
	conditionally acceptable		under review [2]	00029406
	conditionally acceptable		under review [2]	00137232

[1] older study currently under review (June 2006) based upon current EFED standards
[2] older study currently under review (June 2006) based upon current EFED standards

Environmental Fate Data References for the Me-Too Assessment

Study Type	Study Classification	Data Requirements Fulfilled	Comments	MRID
	unacceptable			00040546
	unacceptable		older study, cited in previous action, unable to locate DER	00138144
Laboratory Volatilty (163-2)	**acceptable**	yes	also hydrolysis study	0040539
Bioaccumulation in Fish (165-4)	**acceptable**	yes		45710224
Bioaccumulation in Aquatic Non-Target (165-5)	supplemental	**not required**	literature reference, no DER requested	44286001
	supplemental		older study, cited in previous action, unable to locate DER	00029411
	supplemental		older study, cited in previous action, unable to locate DER	00086630
	not applicable		MRID number non-existent	00866200
Terrestrial Field Dissipation (164-1)	**conditionally acceptable**	conditionally	previously classified as unacceptable, combined packet under review[3] as if a single submission	00071627, 00087369, 00087332, 00087301
	conditionally acceptable	conditionally	under review [3]	00071625
Aquatic Field Dissipation (164-2)	**conditionally acceptable**	conditionally	under review [3]	00127861
Small Retrospective Groundwater (166-1)	**acceptable**	yes		44006001, 44091501, 44291101, 44483401
Small Prospective Groundwater (166-2)	waived	**not required**	waived	43959401, 43959402, 44254801

[3] older study currently under review (June 2006) based upon current EFED standards