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MEMORANDUM

Subject:	Registration Review – Preliminary Problem Formulation for the Ecological Risk Assessment of Dimethyl 2,3,5,6-Tetrachloroterephthalate (DCPA)
To:	Jill Bloom, Chemical Review Manager Risk Management and Implementation Branch II Pesticide Re-evaluation Division (7508P) Office of Pesticide Programs
From:	Christina Wendel, Biologist Christina Wendel Wm. J. Shaughnessy, PhD, Environmental Fate Scientist Environmental Risk Branch II Environmental Fate and Effects Division (7507P) Office of Pesticide Programs
Through:	Brian Anderson, Branch Chief Environmental Risk Branch II Environmental Fate and Effects Division (7507P) Office of Pesticide Programs

Attached is the preliminary problem formulation for the environmental fate, ecological risk, endangered species and drinking water assessments to be conducted as part of the Registration Review of the herbicide DCPA.

This problem formulation outlines the plan to be utilized in the risk assessment of the herbicide DCPA. The risk assessment of DCPA will include several chemicals:

1. Parent DCPA applied directly to the environment
2. Major degradate, TPA, which has up to a 100% conversion rate and forms as a major degradate in aerobic and anaerobic metabolism studies.
3. Manufacturing by-products of concern, including hexachlorobenzene (HCB) and congeners (structurally related chemicals) of polyhalogenated dibenzo-p-dioxins/dibenzofurans (dioxins/furans).

Given that there are several chemicals that will be included in the risk assessment, data on each are required for conduct of a risk assessment. Data gaps for DCPA and TPA are summarized below. Additional details are provided in the problem formulation.

DCPA: No aquatic chronic studies have been submitted for DCPA. DCPA is relatively persistent in the environment and has a tendency to bioaccumulate in aquatic organisms. Therefore, availability of chronic studies using DCPA is important to an ecological risk assessment. In addition, a number of the aquatic studies that were formerly considered to be acceptable have been downgraded to unacceptable because of evidence that the test substance was not fully dissolved and no measurements were made to confirm test concentrations. Additional acute aquatic studies were downgraded from acceptable to supplemental, due to the failure to centrifuge the measured concentrations. The chemical properties of DCPA indicate that although the test concentrations were measured, without centrifugation the dissolved soluble test concentrations could not be estimated.

TPA: No data have been submitted on the major degradate, TPA. TPA forms at high levels relative to parent chemical, it is expected to be more mobile than DCPA, and is expected to be somewhat persistent. Therefore, availability of a relatively comprehensive dataset on the toxicity and environmental fate of TPA is needed. However, a more limited testing strategy will be considered *in lieu* of a comprehensive data submission if one is proposed.

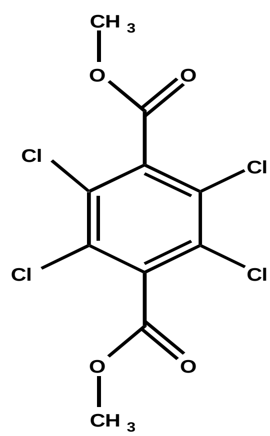
Manufacturing Contamination By-Products: No additional data are required on the contamination by-products because sufficient data are currently available to allow for a risk assessment on these by-products.

REGISTRATION REVIEW

Preliminary problem formulation for the environmental fate, ecological risk, endangered species and drinking water assessments for:

DCPA

[dimethyl 2,3,5,6-tetrachloroterephthalate]



PREPARED BY:

Christina Wendel, Biologist
Wm. J. Shaughnessy, PhD, Environmental Scientist
Environmental Risk Branch II
Environmental Fate and Effects Division
Office of Pesticide Programs

REVIEWED BY:

Nelson Thurman, Senior Fate Scientist
Kristina Garber, Senior Effects Scientist
Environmental Risk Branch 2
Environmental Fate and Effects Division
Office of Pesticide Programs

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Description of Regulatory Action

The Food Quality Protection Act of 1996 mandated the EPA to implement a new program for assessing the risks of pesticides, *i.e*., registration review[1]. All pesticides distributed or sold in the United States generally must be registered by EPA. The decision to register a pesticide is based on the consideration of scientific data and other factors showing that it will not cause unreasonable risks to human health, workers, or the environment when used as directed on product labeling. The registration review program is intended to ensure that, as the ability to assess risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects to human health and the environment. Changes in science, public policy, and pesticide use practices will occur over time. Through the new registration review program, the Agency periodically reevaluates pesticides to ensure that as change occurs, products in the marketplace can be used safely.

As part of the implementation of the new Registration Review program pursuant to Section 3(g) of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Agency is beginning its evaluation to determine whether dimethyl 2,3,5,6-tetrachloroterephthalate (DCPA) uses continue to meet the FIFRA standard for registration. This problem formulation for the environmental fate and ecological risk assessment chapter in support of the registration review is intended for the initial docket opening, which starts the public phase of the review process. This problem formulation considers all current and active registrations for DCPA.

Problem formulations provide a strategic framework for the risk assessment. By identifying the important components of the problem, it focuses the assessment on the most relevant life history stages, habitat components, chemical properties, exposure routes, and endpoints. The structure of this risk assessment is based on guidance contained in U.S. EPA's Guidance for Ecological Risk Assessment (U.S. EPA 1998a), the Services' Endangered Species Consultation Handbook (U.S. FWS/NMFS 1998) and is consistent with procedures and methodology outlined in the Overview Document (U.S. EPA, 2004) and reviewed by the U.S. Fish and Wildlife Service and National Marine Fisheries Service (U.S. FWS/NMFS 2004).

The purpose of this problem formulation is to provide the foundation for the environmental fate and ecological risk assessment being conducted for DCPA. It sets the objectives for the risk assessment, evaluates the nature of the problem, and provides a plan for analyzing the data and characterizing the risk.

Stressor Source and Distribution

DCPA (also called dacthal), a pre-emergence herbicide first registered under FIFRA in 1958, is used widely to control annual grass and certain broadleaf weeds. It is registered for a variety of food (vegetables, cole crops, herbs, melons, and others) and a variety of non-food uses (turf, residential lawns, ornamentals, nurseries, and sod farms). The formulations currently registered include granular, wettable powders, and flowable concentrates. DCPA may be applied via ground, chemigation, and aerial applications. Application methods include broadcast spray, soil

[1] (http://www.epa.gov/oppsrrd1/registration_review/)

incorporation, soil band treatments, layby treatments, spreader, sprinkler irrigation, and soil broadcast treatment and, in general, it is applied at seeding or transplanting or after cultivation to prevent germination of weeds. Depending on the crop, it may be applied to the crop pre-plant, preemergence, post emergence, or post transplant (OMAFRA, 2008).

Two major degradates were observed in laboratory studies, tetrachloroterephthalic acid (TPA) and monomethyl tetrachloroterephthalic acid (MTP). TPA reached maximums of 100% applied radioactivity and MTP maximums of 16% applied radioactivity in aerobic soil metabolism studies. TPA was also a major degradate in an anaerobic soil metabolism study, and is stable to aerobic and anaerobic soil metabolism. MTP is an intermediate between DCPA and TPA. MTP is short lived and degraded to TPA. Exposure to DCPA and TPA is expected to be much greater than to MTP. In addition, TPA is a known groundwater contaminant. Therefore, the risk assessment of degradates focuses on exposure to TPA.

The manufacturing processes of DCPA results in the formation of several known contaminants. Of toxicological concern are hexachlorobenzene (HCB), congeners (structurally related chemicals) of polyhalogenated dibenzo-p-dioxins/dibenzofurans (dioxins/furans), and other possible organochlorine contaminants. Dibenzofurans and dibenzodioxins other than 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD) are a possible manufacturing by-products and were reported as a contaminant in the RED. The risk assessment will examine potential exposures to HCB and the dioxin 2,3,7,8-TCDD.

The following uses are considered part of the federal action that will be evaluated in this assessment and reflect the current labeled uses of DCPA.

Terrestrial food crops

Terrestrial food crop uses include: arrowroot, dried-type succulent (snap) beans, *brassica* (head and stem vegetables), broccoli, broccoli raab, brussels sprouts, cabbage, chinese cabbage, canola/rape, cauliflower, chayote, collards, cucumber, eggplant, garlic, gherkin, medicinal ginseng, gourd, Chinese (wax) gourd, groundcherry (strawberry tomato/tomatillo), hanover salad, horseradish, kale, head and leaf lettuce (black seeded simpson, salad bowl, etc.), manioc (cassava), melons, watermelons, cantaloupe, honeydew, musk melons, momordica spp., mustard, onion (including green and scallions), onion, southern peas, pepino (melon pear), pepper, white/Irish potato, radish, shallot, all or unspecified squash, summer squash, winter squash, hubbard squash, sweet potato, strawberry, taro, tomatillo, tomato, tumeric, turnip, and yam.

Terrestrial non-food crops

Terrestrial non-food crop uses include: golf course turf, nursery stock, ornamental and/or shade trees, ornamental ground cover, ornamental herbaceous plants, ornamental lawns and turf ornamental sod farm (turf), ornamental lawns and turf, ornamental nonflowering plants, ornamental woody shrubs and vines, and residential lawns.

USGS National Use Map

A national map showing the estimated poundage of DCPA applied in 2002 is presented in Figure 1. The map was downloaded from the U.S. Geological Survey (USGS), National Water Quality Assessment Program (NAWQA) website: http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m1872. It does not reflect any new registrations, label changes, changing use patterns, or mitigation measures that may have occurred between that time and the time of this problem formulation. The map is an illustration of the current extent of DCPA use for agricultural purposes and does not reflect non-agricultural uses. The risk assessment will be based on the labeled uses at the time the assessment is conducted.

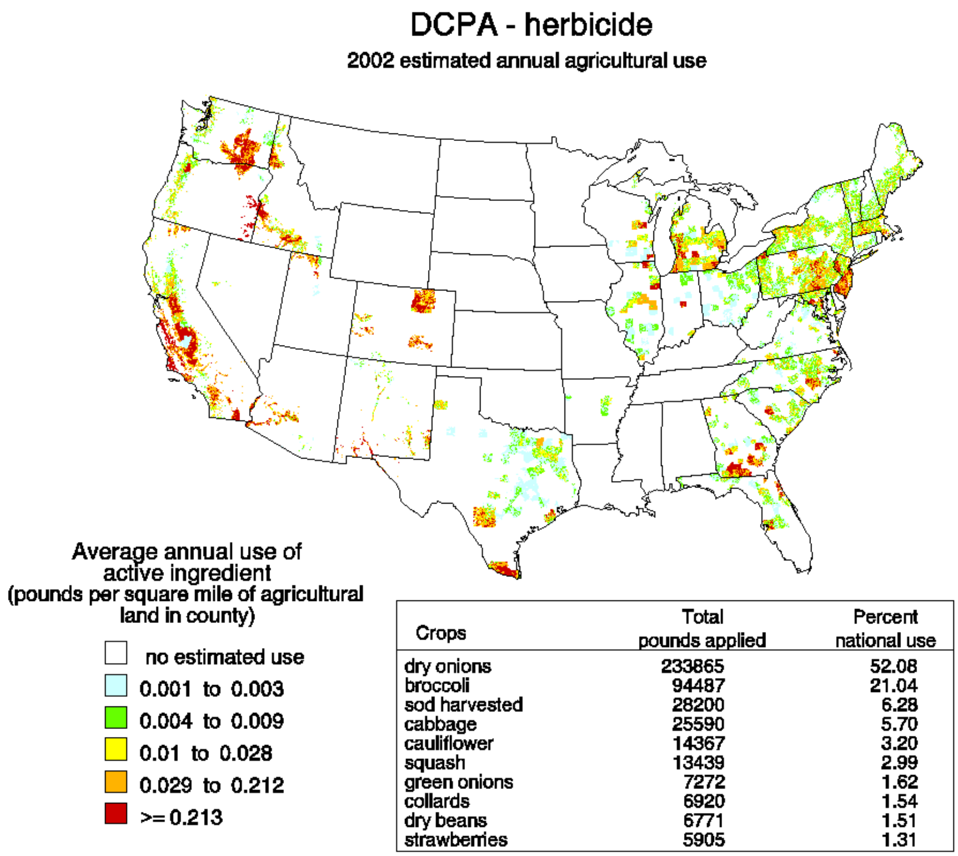

Figure 1. DCPA National Use Map

Label Application Rates and Intervals

DCPA labels may be categorized into two types: labels for manufacturing uses (including technical grade DCPA and its formulated products) and end-use products. While technical products are not used directly in the environment, they are used to make formulated products, which can be applied in specific areas to control annual grasses and broadleaf weeds. The formulated product labels legally limit DCPA's potential use to only those sites that are specified on the labels. A complete list of all uses that will be assessed is presented in Table 1. The maximum application rate on the labels will be used to estimate exposure. When some labels had a lower maximum application rate relative to other labels, both rates are included in Table 1.

Table 1. DCPA Uses and Application Information

Use Sites	Type of Application	Maximum Single Application Rate (lbs a.i./A) (Formulation)	Application Interval (days)	Crops Cycles per Year[1]
Brassica (head and stem vegetables), Broccoli, Broccoli raab, Cabbage, Chinese Cabbage, Canola\rape, Cauliflower, Collards, Horseradish, Kale, Mustard	Aerial (G only) Ground	10.5 (WP, FlC, G)	7, 30, NA	1 to 3
Canola/rape	Aerial (G only) Ground	10.5 (WP, FlC, G)	7	1 (assumed)
Garlic, Leek	Aerial (G only) Ground	10.4 (G)	7	1-2
Head and Leaf Lettuce, Brussels Sprouts, Hanover Salad	Aerial (G only) Ground	10.5 (WP, FlC, G)	183	1-2
	Ground	10.2 (WP)	183	1-2
Chayote, Cucumber, Gherkin, Gourd, Chinese Gourd, Bitter Melon, Cantaloupe, Honeydew, Watermelon, Musk Melon, *Mormordica* spp.[3], Pepino, Pear Melon, Summer Squash, Melon, Winter Squash, Hubbard Squash	Aerial (G only) Ground	10.5 (WP, FlC, G)	NA	1
	Aerial Ground	10.4 (G)	NA	1
Onion, Green Onion, Scallions, Radish, Shallot, Taro, Ginseng, Arrowroot, Manioc, Tumeric	Aerial (restrictions) Ground	10.5 (WP, FlC, G)	7	Often rotated with lettuce
Irish Potato, Sweet Potato, Turnip, Yam, Taro, Ginseng, Arrowroot, Manioc, Tumeric	Aerial (G only) Ground	10.5 (WP, FlC, G)	7	1
	Ground	10.4 (G)	7	1
Dried type beans, succulent beans, snap beans, southern peas, pepper	Ground	10.4 (G)	NA	1
Strawberry	Ground	10.5 (G)	NA	1
Eggplant, Groundcherry, strawberry tomato, Tomatillo, Tomato	Aerial (G only) Ground	10.5 (FlC) 9.1 (G)	1	1
Nursery Stock and ornamentals	Aerial Ground	11.4 (G) 12 (FlC, WP)	7	1 (assumed)

Use Sites	Type of Application	Maximum Single Application Rate (lbs a.i./A) (Formulation)	Application Interval (days)	Crops Cycles per Year[1]
		15.2 (G) 15 (FlC)		
Ornamentals lawns, residential lawns, turf, ornamental sod farm, shade trees, ground cover herbaceous plants, nonflowering plants, woody shrubs and vines, golf course turf, residential lawns	Aerial Ground	11.4 (G) 15 (FlC) 15.2 (G)	7, 30, 60	1 (assumed)

Abbreviations: App. = application; Form. = formulation; WP = wettable powder; FlC = flowable concentrate; G = granular; a.i./A = active ingredient/acre
1- Seasons per year were obtained from Memorandum from Monisha Kaul in BEAD to Melissa Panger in EFED dated 2/28/2007, unless stated otherwise.

DCPA may be applied at planting, transplant, post-emergence, or post-transplant and as a broadcast, foliar, layby, banded, or soil incorporated application. For example, it is recommended for use after cultivation to prevent germination of weeds.

The maximum amount of DCPA applied per season was not specified on the labels for most uses. Some labels specified one application of DCPA per crop cycle for lettuce but no other labels specified a maximum number of applications for any of the crops. In addition, minimum application intervals were not specified on any of the labels. In its absence, a varied application interval based on crop use scenarios used in the risk assessment will be assumed by EFED. Estimates of agricultural uses of DCPA as of June 17, 2008 are presented in Appendix A. Changes in label allowed uses that occur between now and the time the risk assessment is conducted will be reflected in the risk assessment.

Pesticidal Mechanism of Action

DCPA is a selective phthalic acid herbicide (Wood, 2007) and chlorinated benzoic acid herbicide (Cox, 1991). DCPA inhibits both root and shoot growth of emerging seedlings of annual grasses and certain annual broadleaf weeds (Holmesen and Hess, 1984). It is non-systemic and is absorbed by the roots but not foliage and does not translocate in the plant (OMAFRA, 2008). DCPA disrupts mitosis resulting in abnormal cell division in the root tip meristem areas. It causes significant disruption of cell wall formation and disrupts microtubule formation and function (Monaco *et al.*, 2002). The direction of cell wall formation during mitosis is random within the cell, rather than the usual straight walls formed between two daughter nuclei (Holmesen and Hess, 1984).

Conclusions from Previous Assessments

DCPA was first registered under FIFRA in 1958 for use on turf grasses as an herbicide for the selective preemergence control of crabgrass and other assorted weeds (U.S. EPA, 1998b).

Since that time more than 60 products were registered with the Agency. Given the long regulatory history with DCPA, a number of ecological risk assessments have been conducted. Results from two recent assessments are described in more detail below.

In 1998 an ecological risk assessment was completed in support of the RED (U.S. EPA, 1998b). In the RED assessment for DCPA (U.S. EPA, 1998b), the Agency was unable to make an eligibility decision for the use of DCPA on turf. The Agency identified several risks of regulatory concern, and planned to undertake a full benefits assessment before determining whether such use would be eligible for re-registration. The risks of concern included chronic risks to wild mammalian species and acute risks to freshwater and estuarine mollusks. The Agency determined that all remaining uses of DCPA did not pose an unreasonable risk to humans or the environment and were eligible for re-registration.

To mitigate potential risks, the RED required:

- The registrants to establish a certified upper limit for each impurity of toxicological significance (*e.g.*, 15 dioxin/furan congeners) associated with the active ingredient and found to be present in any sample of the product.
- The registrant to produce no more than an agreed upon limit every three calendar years, beginning in January, 1997.
- All fall turf uses to be dropped from the label and the maximum application rate to be reduced to 12 lbs a.i./A.
- All labels to contain surface water, ground water, and spray drift label advisories.

However, not all of these requirements are reflected on current labels. For instance, some fall uses on turf are still allowed on some labels, and some labels still allow for use at 15 lbs a.i./A.

The following ecological toxicity studies were required in the RED.

- Dietary study with mallard ducks
- Avian reproduction study using the mallard duck and bobwhite quail.
- Vegetative vigor and seedling emergence studies for sensitive terrestrial plants

These studies have been submitted and are described in this problem formulation, however, the vegetative vigor and seedling emergence studies do not fulfill guideline requirements, and are considered data gaps. Therefore, additional terrestrial plant studies are needed to meet this requirement.

In 2005, the Agency ordered that several uses be terminated, effective July 31, 2005, in response to concerns of contamination of ground water with TPA.[2] The uses that were to be terminated included: alfalfa, arracacha, artichokes (Chinese and Jerusalem), beans, bean yam (yam bean), beets, chestnuts (soil treatment and nursery stock), chufa, citron melon, cotton, crabapples (soil treatment and nursery stock), cucumber, edible canna, garlic, ginger, leren, peas, pepper, potatoes, residential uses (turf and ornamentals), squash (including pumpkin), tanier,

[2] U.S. EPA. 2005a. DCPA: Order to amend to terminate uses. Fed Reg 70 (143): 43408-43410. Available at http://www.epa.gov/EPA-PEST/2005/July/Day-27/p14737.htm

walnuts (non-bearing and nursery stock), and yam. Some labels still list uses on beans, nursery stock, garlic, peas, peppers, potatoes, residential uses on turf and ornamentals, squash, and yam.

In February 2009, the Agency completed an assessment of the potential direct and indirect effects to the California red-legged frog (CRLF) and potential modification to designated critical habitat from uses of DCPA.[3] Based on the information available at that time the Agency made a **May Affect and Likely to Adversely Affect** determination for the CRLF from the use of DCPA. Additionally, the Agency determined that there **is the potential for modification** of CRLF designated critical habitat from the use of the chemical. The effects determinations were based on the following predicted risks:

1) Risk of acute effects to freshwater fish exposed to TPA, for all uses;
2) Risk of acute effects to freshwater invertebrates exposed to TPA, for all uses;
3) Risk of chronic effects to freshwater fish and invertebrates exposed to DCPA and TPA, for all uses;
4) Risk of effects to freshwater plants exposed to DCPA and TPA, for all uses;
5) Risk of acute effects to small birds exposed to hexachlorobenzene (HCB) for uses with multiple applications;
6) Risk of chronic effects to small birds and small mammals exposed to DCPA and HCB, for all uses; and
7) Risk of effects to terrestrial plants exposed to DCPA, for all uses

Environmental Fate and Transport Characteristics

Physico-chemical Properties

DCPA has a vapor pressure of 12.5×10^{-6} and estimated Henry's law constants ranging from 1.0×10^{-3} to 2.2×10^{-6} atm-m^3/mole, indicating that it is somewhat volatile. It is slightly soluble in water with a solubility limit of 0.5 mg/L and has a log K_{OW} ranging from 4.3-4.4 (based on FAO classification system), indicating that it has a higher affinity for organics than for water and has the potential to accumulate in organisms. The air-water partition coefficient (K_{AW}) was reported to be 10^{-4} (Daly *et al*., 2007a).

Two major degradates were observed in laboratory studies, tetrachloroterephthalic acid (TPA) and monomethyl tetrachloroterephthalic acid (MTP). TPA reached maximums of 100% applied radioactivity and MTP maximums of 16% applied radioactivity in aerobic soil metabolism studies. TPA was also a major degradate in an anaerobic soil metabolism study. MTP is an intermediate between DCPA and TPA. TPA is much more soluble than DCPA with a water solubility of 5780 mg/L and is stable to aerobic and anaerobic soil metabolism (Table 4). MTP is short lived and degraded to TPA. Therefore, the risk assessment of degradates will focus on exposure to TPA. The chemical identity information for these compounds is shown in Table 2 and the structures are shown in Figure 2.

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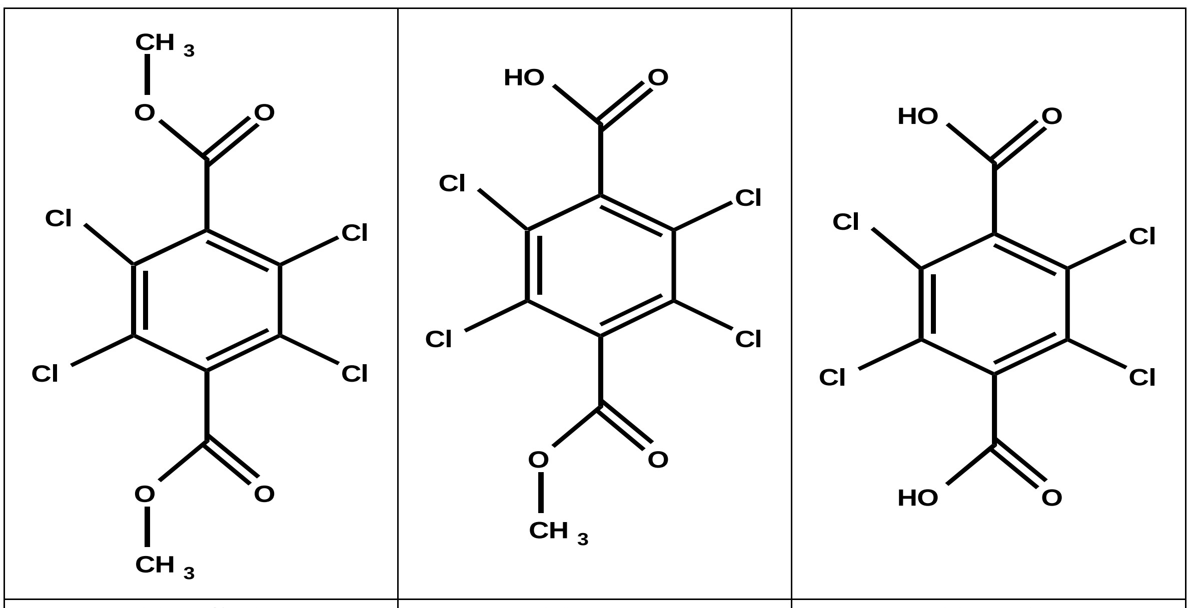
[3] Memorandum from Jean Holmes, ERB 2, Environmental Fate and Effects Division, to Arthur-Jean Williams, Associate Director, Environmental Fate and Effects Division, Subj: Effects Determinations for DCPA Relative to the California Red-Legged Frog and Designated Critical Habitat, dated 2/18/2009.

Table 2. Identification Information for DCPA and its Degradates, TPA, and MTP[1]

Parameter	DCPA	MTP	TPA
Common Name	Chlorthal dimethyl	Tetrachloroterephthalic acid, monomethyl; chlorthal monomethyl, monomethyl 2,3,5,6tetrachloroterephthalate	Tetrachloroterephthalic acid; chlorthal; perchloroterephthalic acid
Chemical Abstract Service (CAS) Number	1861-32-1	887-54-7	2136-79-0
International Union of Pure and Applied Chemistry (IUPAC) Name	Dimethyl 2,3,5,6-tetrachloroterephthalate		
CAS Name	Dimethyl 2,3,5,6-tetrachloro-1,4-benzenedicarboxylate		2,3,5,6-Tetrachloro-1,4-benzenedicarboxylic acid
Synonyms	Dacthal, Dacthalor, chlorothal, chlorothal dimethyl; Chlorothal dimethyl ester	Chlorthal monomethyl	Chlorthal
Empirical Formula	$C_{10}H_6Cl_4O_4$	$C_9H_4Cl_4O_4$	$C_8H_2Cl_4O_4$
SMILES Notation	c1(c(c(c(C(OC)=O)c(c1Cl)Cl)Cl)Cl)C(OC)=O	c1(c(c(c(C(O)=O)c(c1Cl)Cl)Cl)Cl)C(OC)=O	c1(c(c(c(C(O)=O)c(c1Cl)Cl)Cl)Cl)C(O)=O

1 Data from U.S. EPA, 1998b, U.S. EPA, 2008a, and the U.S. National Library of Medicine CHEMIDplus Lite Online Database available at http://toxnet.nlm.nih.gov/cgi-bin/sis/search.



(a) DCPA	(b) MTP	(c) TPA

Figure 2. Chemical structure of (a) chlorthal dimethyl (DCPA), (b) monomethyl tetrachloroterephthalic acid (MTP), and (c) tetrachloroterephthalic acid (TPA)(US EPA, 1998a)

The manufacturing process of DCPA produces several known contaminants. Of toxicological concern are hexachlorobenzene (HCB), congeners (structurally related chemicals) of polyhalogenated dibenzo-p-dioxins/dibenzofurans (dioxins/furans), and other possible organochlorine contaminants. Dibenzofurans and dibenzodioxins, other than 2,3,7,8-TCDD, are possible manufacturing by-products and were reported as a contaminant in the re-registration eligibility decision (RED) (U.S. EPA, 1998b). The risk assessment will consider all impurities of toxicological concern. The maximum level of HCB that is allowed in formulations of DCPA is 0.3 percent. Dioxin/furans do not have a maximum allowable level in formulations. The RED reported that dioxin/furans in submitted samples were below 0.1 parts per billion (U.S. EPA, 1998b).

The structure of hexachlorobenzene, 2,3,7,8-TCDD, and base structures of dibenzodioxins are shown in Figure 3. Polychlorinated dioxins have a triple ring structure that consists of two benzene rings connected by a ring with two oxygens. One to four chlorine atoms may be present on each benzene ring.

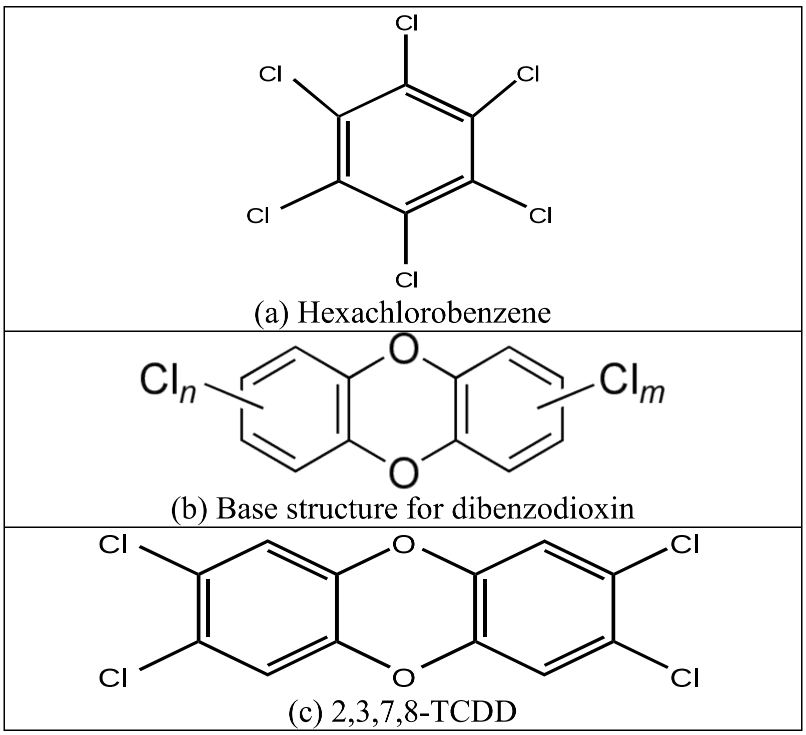


Figure 3. Structure of (a) Hexachlorobenzene, (b) Dibenzodioxins, and (c) 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD)

Table 3 provides a summary of the physico-chemical properties of DCPA, the degradates MTP and TPA, and the impurities, HCB and 2,3,7,8-TCDD.

Table 3. Summary of Physico-Chemical Properties of DCPA, Its Degradates, and Impurities

Property	DCPA	MTP	TPA	HCB	2,3,7.8-TCDD
Molecular Weight	331.97 g/mol (2)	317.94 g/mol (2)	303.91 g/mol (2)	284.79 (14)	321.9709 g/mol
Melting Point	155°C (1,2)	158.62°C (5)	178.10°C (5)	230 °C (14)	305-306 °C (13)
Boiling Point	Not determinable	393.09 °C (5)	426.15 °C (5)	322 °C (14)	NA
Bulk Density	0.75 g/cm^3 (1)	NA	NA	NA	NA
Vapor Pressure at 25°C	0.33 mPa or 2.5 x 10^{-6} torr (1,2) 0.21 mPa or 1.6x 10^{-7} torr (4)	5.23 x 10^{-7} mm Hg (5)	4.89 x 10^{-8} mm Hg (5)	1089 x 10^{-5} mm Hg at 20 °C (14)	1.5 x 10^{-9} mm Hg (12)
Henry's Law Constant	2.2 x 10^{-6} atm-m^3/mol, measured (1, 7) 0.001042 atm-m^3/mol (4)	2.11 x 10-10 atm-m^3/mole (5)	6.58 x 10^{-13} atm-m^3/mole (5)	6.84 x 10-4 atm-m3/mol (14) 1.30 x 10-3 atm-m3/mol (14)	1.62 x 10^{-5} at-m^3/mol (13)
Water Solubility	0.5 mg/L (1,2)	18.26 mg/L (5)	175.4 mg/L (5) 5780 mg/L (6)	3.5-20 µg/L (14)	19.3 ng/L (12)
Log Octanol – water partition coefficient (K_{OW})	4.28 (1, 4) 4.40 (2)	3.19 (5)	2.13 (5)	6.18 (14)	6.80 (12)
pKa	No dissociation constant at pH 2-12 (11)	NA	NA	NA	NA
Air-water partition coefficient (K_{AW})	10^{-4} at 25°C (8)	NA	NA	NA	NA
Log Octanol-air Partition Coefficient (K_{OA})	8.28 at 25°C (9) 8.45 at 25°C (10) 8.51 at 20°C (10)	NA	NA	NA	NA
Log Particle-gas Partitioning Coefficient (Kp)	-4.1 (10)	NA	NA	NA	NA

Abbreviations: NA = not available

(1) Data from U.S. EPA, 1998b; (2) Data from U.S. EPA, 2008a; (3) Data from ChemBioFinder.com; (4) Data from Health Canada, 2008; (5) Data estimated from EPI Suite version 3.20 using the SMILES string from Table 2 as input; (6) Data from Wettasinghe and Tinsley, 1993 as reported by U.S. EPA, 1994; (7) Data from U.S. EPA, 1994 (8) Data from Muir *et al*., 2004 as reported by Daly *et al.,* 2007a; (9) Data from Muir *et al*., 2004 (10) Data from Yao *et al*., 2007; (11) Data from U.S. EPA, 2001; (12) Data from U.S. EPA, 2003; The most reliable or definitive value reported by the review is reported; (13) Data from U.S. EPA, 2006b; (14) Data from U.S. EPA, 1998c

Environmental Fate

The primary route of degradation for the parent is aerobic metabolism. It is stable to hydrolysis and photolysis and biotic half-lives range from 27 - 66 days. Organic-carbon water partition coefficients (K_{OC}s) ranging from 1863-3503 L/kg, indicate it is slightly mobile. Potential transport mechanisms include spray drift, runoff, volatilization, and atmospheric transport. The moderate K_{OC}, indicates that DCPA may be present in runoff as a solute and/or bound to organic carbon in soil or sediment. Table 4 presents a summary of the environmental fate properties of DCPA. EFED will access existing data to obtain environmental fate data for HCB and dioxins.

Table 4. Summary of DCPA Environmental Fate Properties

<table>
<tr><th>Study</th><th colspan="3">Value (units)</th><th>Major Deg. (maximum %)
Minor Deg.[1]</th><th>MRID #</th><th>Study Status or Comments</th></tr>
<tr><td>Hydrolysis</td><td colspan="3">Stable at pH 5, 7, and 9</td><td>None</td><td>00114648</td><td>Acceptable</td></tr>
<tr><td>Direct Aqueous Photolysis</td><td colspan="3">No data available</td><td></td><td>00143063
41508607</td><td>Unacceptable</td></tr>
<tr><td>Soil Photolysis</td><td colspan="3">Stable
TPA was Stable</td><td>*MTP (5.2%)*</td><td>41508608</td><td>Acceptable</td></tr>
<tr><td rowspan="6">Aerobic Soil Metabolism</td><td colspan="3">Single First Order (LN/Linear Fit) Half-life (days)</td><td rowspan="6">TPA (100%)[2]
MTP (6.9%)</td><td rowspan="6">00114649

Supplemented by 41648801</td><td rowspan="6">Supplemental due to insufficient mass balance (70-114% on day 0), moisture 95% of 1/3 bar, and temperatures were 30°C. Half-lives may be longer than predicted at 75% 1/3 bar and at 25°C. Additionally, soils were not completely characterized. See DER Addendum (02/10/2009)</td></tr>
<tr><td>Soil</td><td>With Unextract.</td><td>Without Unextract.</td></tr>
<tr><td>Sand Loam</td><td>55</td><td>29</td></tr>
<tr><td>Sandy Clay Loam</td><td>66</td><td>48</td></tr>
<tr><td>Clay</td><td>57</td><td>31</td></tr>
<tr><td colspan="3">TPA stable in all soils</td></tr>
<tr><td rowspan="6"></td><td colspan="3">Single First Order (LN/Linear Fit) Half-life (days)</td><td rowspan="6">TPA (100%)[3]
MTP (16%)</td><td rowspan="6">00114652</td><td rowspan="6">Supplemental due to insufficient mass balance (70-84% on day 0), moisture 95% of 1/3 bar, and temperatures were 30°C
Half-lives may be longer than predicted at 75% 1/3 bar and at 25°C. Additionally, soils were not completely characterized. See DER Addendum (02/10/2009)</td></tr>
<tr><td>Soil</td><td>With Unextract</td><td>Without Unextract</td></tr>
<tr><td>Sandy Loam</td><td>38</td><td>27</td></tr>
<tr><td>Sandy Clay Loam</td><td>61</td><td>47</td></tr>
<tr><td>Clay</td><td>41</td><td>29</td></tr>
<tr><td colspan="3">TPA stable in all soils</td></tr>
<tr><td></td><td colspan="3">Half life (days) =
92 days at 10°C
18 days at 25°C and 30°C</td><td></td><td>Choi *et al.*, 1988</td><td>Not applicable</td></tr>
</table>

Study	Value (units)	Major Deg. (maximum %) *Minor Deg.*[1]	MRID #	Study Status or Comments
	Half life (days)= 16.6 days at 25°C		Wettasinghe and Tinsley, 1993	Not applicable
Anaerobic Soil Metabolism	Half-life (days) at 30°C = 28 clay 38 sandy clay loam 23 sandy loam	TPA (26%)[4] *MTP (<10%)*	00114651 Supplemented by 41648802	Supplemental, only 3 points sampled, conducted at 30°C, and at moisture levels with 95% of 1/3 bar. Dissolved oxygen and redox potential were not reported. This study is not upgradeable. See DER update (1/17/1991)
Anaerobic Aquatic Metabolism	No data available	--	--	--
Aerobic Aquatic Metabolism	No data available	--	--	--
$K_{d\text{-}ads}$ / $K_{d\text{-}des}$ (mL/g) $K_{oc\text{-}ads}$ / $K_{oc\text{-}des}$ (mL/g)	DCPA, not used in modeling	--	41648803	Supplemental due to supernatant incompletely removed and finely sieved. See DER Addendum (02/10/2009)
	MTP and TPA see Table 6 and Table 7	--	41648804 41648805	Acceptable. Supernatant was incompletely removed but due to low values, it was assumed to have little influence on the data. Finely sieved.
	DCPA see Table 5	--	43661101	Acceptable
Terrestrial Field Dissipation	No half-life could be determined	Not determined	41508609	Supplemental due to variability in data and low recoveries of analytical method. See DER Addendum (02/10/2009)
	No half-life could be determined	Not determined	41508610	Supplemental due to data too erratic to allow assessment of dissipation. See DER Addendum (02/10/2009)
	Log-linear dissipation half-life = 54 days (silt loam soil)	TPA	Ross *et al.*, 1989	Circular plot planted with onion and then parsley.
Aquatic Field Dissipation	No data available	--	--	--
Bioconcentration Factor (BCF)	Bluegill Sunfish 1894 (whole fish) 777 (fillet) 2574 (viscera) Depuration complete in 14d	--	41155716 and 41197602	Acceptable, aquarium water DCPA concentration increased over time. Little metabolism or degradation of DCPA in fish tissues. A detectable amount of demethylation was present. Metabolite was a monomethyl analog (2,3,56-

Study	Value (units)	Major Deg. (maximum %) *Minor Deg.*[1]	MRID #	Study Status or Comments
				tetrachloroterephthalate). Study detected small trace quantities in organic extract concentratates of fish whole and viscera (0.62-1.06%).
	Clam, lipid and organic carbon normalized 126 (whole clam)	--	Pereira *et al*, *1996*	Based on concentrations measured in field.
Biota-Sediment-Accumulation-Factor (BSAF) – lipid normalized	Fish median = 0.1 Bivalve median = 4.5	--	Wong *et al*, *2001*	Based on concentrations measured in field

Abbreviations: Unextract.= unextractables; Deg.= degradate

1. A major degradate made up more than 10% of applied radioactivity equivalents or is toxicologically significant. The maximum reported percent of applied equivalents is reported in parenthesis.
2. Approximately 80% of applied radioactivity was detected at time zero and 77% as TPA at later time points. Based on this, TPA may be assumed to reach a maximum of 100% applied radioactivity (DER 5/27/1987).
3. Approximately, 83.6% of applied radioactivity was detected at time zero and 85.0% as TPA at 96 days. Based on this, TPA may be assumed to reach a maximum of 100% applied radioactivity (DER 5/27/1987).

Abiotic Degradation

DCPA is stable to hydrolysis and photolysis. No significant hydrolysis occurred at pH 5, 7, and 9 over 36 days (MRID 00114648). No acceptable studies examining photolysis in water have been submitted. When DCPA was exposed to a black light and fluorescent lamps with wavelengths of 255-360 nm on soil, little degradation occurred (MRID 41508608). Based on the soil photolysis data, it may be assumed that DCPA is also stable to aqueous photolysis.

Biotic Degradation

Aerobic soil metabolism. The primary mechanism of degradation of DCPA is via aerobic metabolism, with rates dependent on temperature and level of moisture. Aerobic soil metabolism half-lives measured at 30°C and at a moisture level of 95% of 1/3 bar ranged from 27-66 days (single first order, LN/linear fit; MRID 00114649, 00114652, 41648801). After 197 days, virtually all of the parent DCPA had been converted into TPA. Small amounts of monomethyl tetrachloroterephthalic acid (MTP) were also identified. DCPA did not degrade in steam-sterilized soil. Open literature degradation rates are slightly faster than those reported in submitted studies and ranged from 17-18 days for 25°C (Choi *et al*., 1988; Wettasinghe and Tinsley, 1993).[4] Walker (1978) reported that the DCPA half-life decreased by a factor of 17.9 with a soil temperature increase from 10°C to 30°C (as reported by Choi *et al*. 1988). Choi *et al*.'s (1988) research indicated that degradation rates for DCPA reached maximums between 25-30°C and then declined at higher temperatures and lower temperatures (*e.g*., an optimum temperature existed for maximum degradation rates). This suggests that for DCPA, the high

4 The average half-life in Choi *et al*.'s (1988) work was 18 days at both 25°C and 30°C, indicating that the difference in measured degradation rates between submitted and open literature studies is not due to the differences in temperature.

temperature of the submitted studies did not significantly change the rate of degradation from that expected at a temperature of 25^{o}C, the temperature of most degradation studies. Degradation rates of DCPA at low soil moisture levels were much lower than the medium and high moisture levels while medium and high moisture levels had similar degradation rates. This suggests that once a sufficient level of moisture is reached to support aerobic metabolism, more moisture would have little effect on the rate of degradation (Choi *et al*., 1988). TPA was stable to aerobic soil metabolism. The observed half-life for MTP was between 1 to 14 days in the sandy loam soil (MRID 00114649, 41648801). No data are available on aerobic aquatic metabolism for the parent and TPA. The aerobic soil metabolism data submitted by the registrant is considered supplemental and therefore is a data gap. Since aerobic metabolism is a primary degradation pathway the lack of aerobic aquatic metabolism data is also considered a data gap.

Anaerobic soil metabolism: The reported anaerobic soil conditions had little effect on degradation rates with estimated half-lives of 28-38 days at 30^{o}C and a moisture level of 95% of 1/3 bar. The high temperature and moisture level may have resulted in higher rates of degradation and reasonable anaerobic half-lives assuming 50% slower degradation rates at 25^{o}C were estimated to range from 37-59 days (DER 2, 1/17/1991). Additionally, redox potential and dissolved oxygen levels were not measured/reported in the study and it cannot be confirmed whether anaerobic conditions were obtained. The similarity of the anaerobic degradation rates to the aerobic degradation rates, suggest that anaerobic conditions were not achieved. TPA was the final degradate under the reported anaerobic conditions (MRID 00114651, 41648802). No data are available on anaerobic aquatic metabolism. While this technically constitutes a data gap EFED believes that anaerobic aquatic conditions will also have little effect on degradation rates of the parent compound.

Volatility

Based on a relatively low Henry's constant (2.2 x 10^{-6} atm-m^{3}/mol) and moderately to relatively high soil/water partitioning, DCPA does not appear to have a high volatilization potential from soil (Corbin *et al*., 2006). However, several published studies have shown that parent DCPA is volatile, especially from moist or wet soil (Glotfelty *et al*., 1984; Ross *et al.*, 1989; Majewski *et al*. 1991; Nash and Gish 1989). In the vapor phase, it may react slowly with hydroxyl radicals (Meylan and Howard, 1993). It may be deposited in nearby fields, areas with lower temperatures, or with wet and dry deposition. The measured log octanol-air partitioning coefficient (K_{OA}) is 8.51 at 20^{o}C and the estimated log particle-gas partitioning coefficient was -4.1, indicating that DCPA is likely to remain in the gas phase in air (Yao *et al*., 2007).

In a study by Ross et al. (1989), air samples showed that 10% of DCPA applied moved off site as a vapor and on particles for up to 21 days after application. The volatilization flux reached a maximum rate of 5.6 g/ha/hour (measured using the aerodynamic method). Based on flux data, 29% of DCPA was lost due to volatilization. Parsley planted on the plot 126 days after legal application of DCPA did not contain DCPA.

Majewski *et al*. (1991) measured air and soil concentrations of DCPA after it was applied at a rate of 7 kg/ha to a circular plot planted with white Lisbon onion. Fluxes were greatest after/during irrigation. A loss of between 1.27 and 1.59 kg per hectare out of 7 kg per hectare applied DCPA was reported. They also found that DCPA volatilization flux was very dependent upon the soil surface moisture content. High fluxes occurred immediately following irrigation. Approximately 36 to 52 percent of the total measured DCPA loss from soil was accounted for by volatilization and 26 percent by breakdown in soil during the 21 days of air sampling.

Nash and Gish (1989) measured pesticide decline in the atmosphere and the dissipation rate of DCPA from moist soil at different temperatures after application at 2.5 kg/ha. Volatilization increased 1.8 times for each 10°C increase in temperature and dissipation increased 1.4 times. At temperature of 35°C (95°F), volatility accounted for the loss of most of the DCPA applied.

Seiber *et al.* (1991) measured air residues of DCPA after it was applied at 11.2 kg/ha to a circular plot planted with white Lisbon onion in California. Downwind concentrations in air ranged from 910 ng/m^3 on day one to 22 ng/m^3 on day three based on XAD resin samples. Glass fiber filters contained 420 ng/m^3 on day one and were at a minimum of 5.8 ng/m^3 on day 11. Small amounts of DCPA were measured up-wind.

Mobility

Based on McCall's classification and FAO classifications of K_{OC} values, DCPA is slightly mobile (Corbin *et al*., 2006; FAO 2000). Sorption of DCPA was measured in one acceptable study in four different soils at 25°C (see Table 5). Freundlich sorption coefficients (K_F) ranged from 7-57 L/kg and the Freundlich exponent ranged from 0.94-0.99. Organic-carbon-water partition coefficients (K_{OC}s) ranged from 1863 - 3503 L/Kg. Solid-water distribution coefficients (K_d) calculated by the study author ranged from 8 – 60 L/kg and are near the K_F values as the Freundlich exponents were all near one and the isotherms were almost linear. The variability in K_{OC} values was much lower than K_F values and the linear relationship between K_F and organic matter had an r^2 value of 0.86.[5] This suggests that sorption of DCPA is strongly influenced by organic carbon.

Table 5. Summary of Sorption Coefficients measured for DCPA (MRID 43661101)

Soil	%OC	K_F (L/kg)	1/N	K_d (L/kg)	K_{OC} (L/kg)	Ce range (mg/L)[1]
Silt Loam	2.2	57	0.99	60	2577	0.001 – 0.01
Loamy Sand	0.86	30	0.94	38	3503	0.001 – 0.02
Sandy Loam	0.26	7	0.96	8	2563	0.005 – 0.05
Silt Clay Loam	1.77	33	0.96	39	1863	0.002 – 0.02
Average		32	0.96	36	2627	
Standard Deviation		20	0.02	21	673	
Coefficient of Variation		65%	2%	59%	26%	
Lowest Value		7	0.94	8	1863	

[1] Ce range is the range of DCPA concentrations in water at equilibrium. This is the range of DCPA concentrations in water that the sorption coefficients may be confidently used to predict sorption.

Pereira *et al.* (1996) measured log K_{OC}s in sediments of the San Joaquin River and Tributaries. Field K_{OC} values ranged from 316 L/kg in bed sediment ($10^{2.5}$ L/kg) to 851 L/kg in suspended sediment ($10^{2.93}$ L/kg). Sorption was measured for the parent and degradates, MTP

[5] The coefficient of variation (standard deviation/mean) for K_{OC} values was 26% versus 65% for K_F values.

and TPA, in one other study. The study was determined to be supplemental for DCPA (see Table 6) by EFED. However, these are the only data available for the degradates. The K_{OC} values measured for DCPA have a wider range than those measured in the acceptable study but the values are similar, indicating that the values are a good preliminary estimate of sorption coefficients for the degradates.[6] Based on the results of measured K_{OC} values in finely sieved soils ranging from 4 - 90 L/kg, TPA and MTP are both highly mobile and will leach into ground water (Table 77 and Table 8 8; FAO, 2000; U.S. EPA, 2001). Organic-carbon water partition coefficients (K_{OC}) values are the values that are used in the classification system. MTP and TPA K_d values ranged from 0.1 – 0.3 L/kg. Coefficients of variation (standard deviation/mean x 100) for MTP were approximately the same for K_d and K_{OC} values (49% versus 50%) and there was a linear relationship between the percent organic carbon and K_d values (r^2 = 0.9537). This indicates that organic carbon played a role in the sorption of MTP in these soils. Coefficients of variation for TPA were lower for K_d values than for K_{OC} values (41% versus 102%) and there was not a linear relationship between the percent organic carbon and K_d values. This indicates that sorption of TPA was not greatly influenced by the percent of organic carbon in these soils.

Table 6. Summary of Sorption Coefficients measured for DCPA in a finely sieved soil (MRID 41648803)

Soil	%OC	K_F (L/kg)	1/N	K_d (L/kg)	K_{OC} (L/kg)	Ce range (mg/L)[1]
Silt Clay	1.6	70.31	0.95	90.2	5640	0.002 - 0.02
Silt Loam	0.4	9.4	0.91	12.8	3200	0.01-0.095
Sandy Loam	1.8	32.14	0.94	41.6	2310	0.004-0.04
Sand	0.2	5.56	0.94	6.8	3400	not in DER
Average		29.35	0.93	37.9	29.35	
Standard Deviation		29.72	0.02	38.1	29.72	
Lowest Value		5.56	0.91	6.8	5.56	

[1] Ce range is the range of DCPA concentrations in water at equilibrium. This is the range of DCPA concentrations in water that the sorption coefficients may be confidently used to predict sorption.

Table 7. Summary of Sorption Coefficients measured for MTP in a finely sieved soil (MRID 41648804)

Soil	%OC	K_F (L/kg)	1/N	K_d (L/kg)	K_{OC} (L/kg)	Ce range (mg/L)
Silt Clay	1.6	0.29	1.103	0.289	18	0.09 - 2.9
Silt Loam	0.4	0.17	0.9552	0.162	41	0.09 - 3.0
Sandy Loam	1.8	0.23	0.8226	0.296	16	0.09 - 2.9
Sand	0.2	0.11	0.9907	0.087	44	0.09 - 3.0
Average		0.20	0.9679	0.209	30	
Standard Deviation		0.08	0.1155	0.102	15	
Lowest Value		0.11	0.8226	0.087	16	

1 Ce range is the range of MTP concentrations in water at equilibrium. This is the range of MTP concentrations in water that the sorption coefficients may be confidently used to predict sorption.

[6] These supplemental DCPA sorption values were not used in modeling.

Table 8. Summary of Sorption Coefficients measured for TPA in a finely sieved soil (MRID 41648805)

Soil	%OC	K_F (L/kg)	1/N	K_d (L/kg)	K_{OC} (L/kg)	Ce range (mg/L)
Silt Clay	1.6	0.08	0.6842	0.07	4	0.1 - 9.89
Silt Loam	0.4	0.16	0.5869	0.18	45	not in DER
Sandy Loam	1.8	0.19	0.8545	0.23	13	0.1 - 9.74
Sand	0.2	0.16	0.707	0.18	90	0.1 - 9.92
Average		0.15	0.7082	0.17	38	
Standard Deviation		0.05	0.1106	0.07	39	
Lowest Value		0.08	0.5869	0.07	4	

1 Ce range is the range of TPA concentrations in water at equilibrium. This is the range of TPA concentrations in water that the sorption coefficients may be confidently used to predict sorption.

Sorption of acidic compounds is influenced by pH and the dissociation state of the compound. Generally speaking, mobility is expected to decrease with pH for weak acids as more of the compound will be present in its neutral form at lower pH. Additionally, the pH-dependent anion exchange capacity increases as pH decreases. TPA has two COOH groups and MTP has one COOH group, indicating that TPA's sorption will be more influenced by pH than sorption of MTP. Several leaching studies performed for pesticide registration or re-registration of DCPA illustrated that TPA is very mobile and more mobile in higher pH soils (U.S. EPA, 1994, MRID 00114650). The pKa values of MTP and TPA are not known.

Accumulation

DCPA has been detected in fish at several locations in the United States (DeVault, 1985; DeVault *et al*., 1988; Jaffé *et al*., 1985; Leiker *et al*., 1991; Miller and Gomes, 1974; Pereira *et al*., 1994; Saiki and Schmitt, 1986; Schmitt *et al*., 1985, 1990). DCPA bioconcentration factors (BCFs) in bluegill sunfish were 1894, 777, and 2574 in whole fish, edible tissue, and viscera, respectively. Little metabolism or degradation of DCPA occurred in fish tissues, although there was a detectable amount of demethylation (MRID 41155716, 41197602).

Pereira *et al.* (1996) estimated organic-carbon and lipid normalized bioconcentration factors for clams based on concentrations measured in field samples. The observed bioconcentration factor was 125.9 and was lower than that predicted based on the K_{OW} (predicted BCF = $10^{3.02}$).

Wong *et al.* (2001) measured biota-sediment accumulation factors (BSAF) for DCPA in fish and bivalves based on samples collected in the NAWQA program. Median BSAF values were 0.1 in fish and 4.5 in bivalves.

Terrestrial Field Dissipation

Gilroy, CA: Bare ground plots of loam soil were treated up to three times with DCPA at 7.0-10.5 lbs. a.i. per acre (lbs a.i./A). DCPA was detected down to the maximum sampling depth of 18-inches in all of the plots, while the mono-acid was not detected below 6 inches in any plot. TPA was detected as deep as 60 inches 552 days after the first treatment and up to 96 inches 552 days after the second treatment. TPA was found at 0.03 ppm at the 72 inch depth 552 days after the third treatment (MRID 41508609). The study was considered supplemental.

Greenfield, CA: Bare ground plots of sandy loam soil were treated up to three times with DCPA at 7.0-10.5 lbs. a.i./A. DCPA was detected at the maximum sampling depth of 18-inches in all of the plots, while the mono-acid was not detected below six inches in any plot. TPA was detected at 48 inches. In the plot treated three times, parent DCPA was again detected in the 15-18 inch layer. The mono-acid was not found below 6 inches and TPA was found at 18 inches (the lowest layer sampled). The study was considered supplemental. The data requirement is not satisfied (MRID 41508610).

Carry Over of Residues: Studies show that residues of DCPA can carry over from year to year. DCPA and its two major degradates were detected on land that had five years of application (cumulative total of 94 lb/acre) and was then untreated for three years (Gershon and McClure, 1966; as reported by U.S. EPA, 2008a). This is also supported by the results observed in terrestrial field dissipation studies (MRID 41508609, 4158610).

Environmental Transport Assessment

Potential transport mechanisms include pesticide surface water runoff, spray drift, and secondary drift of volatilized or soil-bound residues leading to deposition onto nearby or more distant ecosystems. All of these transport mechanisms are important for DCPA.

Review of the environmental fate data and physico-chemical properties of DCPA indicate that spray drift, runoff, and volatilization are likely to be the dominant routes of exposure. Additionally, given the physico-chemical profile for DCPA and observed detections of DCPA in air, rainfall, and snow samples, the potential for offsite migration through the air exists in addition to runoff. DCPA and especially the degradate TPA have the potential to reach ground water. In addition, from the available data, bioaccumulation is also a potential route of concern, as observed in both fish and invertebrate samples.

The magnitude of transport via secondary drift depends on DCPA's ability to be mobilized into air and its eventual removal through wet and dry deposition of gases/particles and photochemical reactions in the atmosphere. Therefore, physicochemical properties of DCPA that describe its potential to enter the air from water or soil (*e.g.,* Henry's Law constant and vapor pressure), pesticide use data, modeled estimated concentrations in water and air, and available air monitoring data will be considered in evaluating the potential for atmospheric transport of DCPA.

Monitoring Data

There are a large number of studies and data available on DCPA and degradate residues in air, surface water, drinking water, ground water, tissue, rain, and snow. The most recent review of monitoring data was completed in May 2008, and reported in detail in the 2009 California Red-legged Frog risk assessment of DCPA. That assessment examined monitoring data relevant to drinking water, food, fish, shellfish, air, and soil. The major conclusions included:

- Monitoring data indicate widespread occurrence of DCPA in surface water, ground water, drinking water, and air. DCPA and TPA are one of the most commonly found pesticides/degradates found in water samples (U.S. EPA, 2008a). DCPA is typically detected at low concentrations in remote areas where it is not used and at higher concentrations near where it is used. DCPA concentrations in water are typically well below the lifetime Health Advisory of 4000 µg/L for DCPA (U.S. EPA, 2008a). Additionally, the solubility of DCPA (0.5 mg/L) is well below the advisory level.

- Non-agricultural uses of DCPA, *e.g.* use in urban areas, can be a significant source of DCPA in water. Higher frequencies of DCPA detections occurred in urban areas in the midwest and higher frequencies of detection were reported in some urban areas in NAWQA surface water samples (Kolpin *et al*., 1996; U.S. EPA, 2008a)
- DCPA's degradates, TPA and MTP are more commonly detected in ground water samples than DCPA. TPA is typically found at higher concentrations.
- TPA was the most commonly detected pesticide in the National Survey of Pesticides in Drinking Water Wells Survey (U.S. EPA, 1998b).
- Degradation rates are slower at lower temperatures and DCPA residues are commonly detected in cooler states. The re-registration eligibility decision for DCPA stated, "Seventeen states with DCPA residue detections could be classified as states with cooler temperatures (AK, CT, IA, IL, IN, MA, MI, MN, NH, NJ, NY, OH, OR, PA , RI, SD, and WI). States considered "warm" states with detections were California, Colorado, and New Mexico." (U.S. EPA, 1998b)
- Food was the major source of exposure to DCPA for humans (U.S. EPA, 2008a).

No prospective surface water monitoring studies which specifically targeted DCPA use (application period and/or sites) were available. Two prospective ground water monitoring studies were conducted in support of the reregistration of DCPA, including one in California. Generally, targeted monitoring data are collected with a sampling program designed to capture, both spatially and temporally, the maximum use of a particular pesticide. Typically, sampling frequencies employed in monitoring studies are insufficient to document peak exposure values. The lack of targeted data coupled with the fact that these data are not temporally or spatially correlated with pesticide application times and/or areas limit the utility of these data in estimating exposure concentrations for risk assessment purposes. Therefore, model-generated values will be used for estimating acute and chronic exposure values, and the non-targeted monitoring data are typically used for qualitative characterizations. All open literature and water quality monitoring databases will be searched for updates since the May 2008 data retrieval.

Clean Water Act

DCPA is identified as a cause of impairment for one water body listed as impaired under section 303(d) of the Clean Water Act, based on information provided at http://iaspub.epa.gov/tmdl_waters10/attains_nation_cy.cause_detail_303d?p_cause_group_id=885. The water body affected is Calleguas Creek Reach 5 (was Beardsley Channel On 1998 303d List). A waterbody report was completed in 2006. In addition, a Total Maximum Daily Loads (TMDL) has been developed for the herbicide, based on information provided at http://iaspub.epa.gov/tmdl_waters10/attains_nation.tmdl_pollutant_detail?p_pollutant_group_id=885&p_pollutant_group_name=PESTICIDES. More information on impaired water bodies and TMDLs can be found at http://www.epa.gov/owow/tmdl/.

The Agency invites submission of water quality data for this pesticide. To the extent possible, data should conform to the quality standards in Appendix A of the OPP Standard Operating Procedure: Inclusion of Impaired Water Body and Other Water Quality Data in OPP's Registration Review Risk Assessment and Management Process (see: http://www.epa.gov/oppfead1/cb/ppdc/2006/november06/session1-sop.pdf), in order to ensure they can be used quantitatively or qualitatively in pesticide risk assessments.

Ecological Effects

The Agency evaluates the potential for adverse affects as a result of DCPA usage. As described in the Agency's Overview Document (U.S. USEPA, 2004), the most sensitive endpoint for each taxon is evaluated. Assessment endpoints include direct toxic effects on the survival, reproduction, and growth of terrestrial and aquatic life, as well as indirect effects, such as reduction in prey base and/or modification of habitat. The evaluated taxa include freshwater fish, freshwater aquatic invertebrates, birds, small mammals, terrestrial invertebrates, algae, and terrestrial plants.

The major degradates of DCPA are tetrachloroterephthalic acid (TPA) and monomethyl tetrachloroterephthalic acid (MTP). The toxicity data for these chemicals are limited to mammals. The available data indicate that the adverse effects associated with TPA are much milder than those for the parent and tend to occur at doses that are lower by approximately an order of magnitude (U.S. EPA, 2008a). However, DCPA and TPA are among the most commonly found pesticides/degradates in water samples (U.S. EPA, 2008a), DCPA is slightly mobile and TPA is very mobile, respectively, and both are persistent. There is no aquatic toxicity data available for the degradate TPA. In past risk assessments for DCPA (i.e., the CRLF ESA, U.S. EPA 2009), EFED bridged the data gap using structurally similar benzoic acid herbicides (i.e., dicamba). However, for future assessments, in the absence of toxicity data for the degradate TPA, EFED will make highly conservative assumptions when evaluating the toxicity of TPA.

Another possible source of toxicity from the use of DCPA products is the presence of the known impurities that result from the manufacturing process. Hexachlorobenzene (HCB), dioxin/furan congeners (i.e., 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD)), and other possible organochlorine contaminants have been found in the DCPA herbicide formulation products.

The term "dioxins" is used to represent polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). There are 210 different congeners of dioxins (75 PCDDs and 135 PCDFs); however, only 17 congeners are considered to be of toxicological concern (listed in Table 9). For these 17 congeners, evidence is sufficient to conclude that a common mechanism of action, involving binding of the chemicals to the aryl hydrocarbon receptor (AHR) as the initial step, underlies 2,3,7,8-TCDD-like toxicity elicited by these PCDDs, PCDFs, and Polychlorinated biphenyls (PCBs) (Van den Berg et al., 1998, 2006; Hahn, 2002).

Table 9. Dioxin congeners that are of toxicological concern. Toxicity equivalency factors for mammals, birds and fish associated with each isomer are from U.S. EPA 2008b.

Congener*	Mammal TEF	Bird TEF	Fish TEF
2378-TCDF	0.1	1	0.05
12378-PeCDF	0.03	0.1	0.05
23478-PeCDF	0.3	1	0.5
123478-HxCDF	0.1	0.1	0.1
123678-HxCDF	0.1	0.1	0.1
234678-HxCDF	0.1	0.1	0.1
123789-HxCDF	0.1	0.1	0.1
1234678-HpCDF	0.01	0.01	0.01
1234789-HpCDF	0.01	0.01	0.01
OCDF	0.0003	0.0001	<0.0001
2378-TCDD	1	1	1
12378-PeCDD	1	1	1
123478-HxCDD	0.1	0.05	0.5
123678-HxCDD	0.1	0.01	0.01
123789-HxCDD	0.1	0.1	0.01
1234678-HpCDD	0.01	<0.001	0.001
OCDD	0.0003	0.001	<0.001

*Abbreviations are as follows: TCDD = tetrachlorodibenzodioxin; PeCDD = pentachlorodibenzodioxin; HxCDD = hexachlorodibenzodioxin; HpCDD = Heptachlorodibenzodioxin; OCDD = Octachlorodibenzodioxin; TCDF = Tetrachlorodibenzofuran; PeCDF = Pentachlorodibenzofuran; HxCDF = Hexachlorodibenzofuran; HpCDF = Heptachlorodibenzofuran; OCDF = octachlorodibenzofuran

Research has been conducted to characterize the toxicities of PCDDs and PCDFs especially relative to each other, since these compounds are often present together in the environment. Demonstrated toxic effects of 2,3,7,8-TCDD and other similar-acting PCDD, PCDF and PCB congeners in fish, birds, and mammals include adverse effects on reproduction, development, and endocrine functions; wasting syndrome; immunotoxicity; and mortality in both laboratory and field settings (U.S. EPA 2008b). The EPA (U.S. EPA 2008b) and the World Health Organization (Van Den Berg *et al.* 1998 and 2006) have established toxicity equivalency factors (TEFs) for dioxins as they relate to mammals, to birds and to fish (Table 9). In the TEF approach, the toxicities of individual congeners are related to 2,3,7,8-TCDD, which is the most toxic congener of dioxins to animals (U.S. EPA 2008b; Table 9). For each PCDD and PCDF, the concentration (or mass) of the chemical is multiplied by its TEF. The sum of the product for each PCDD and PCDF represents the toxicity equivalent (TEQ) concentration relative to 2,3,7,8-TCDD (Equation 1; U.S. EPA 2008b).

Equation 1. $TEQ = \sum_n Concentraton_n * TEF_n$

Dioxins, and HCB are both listed under the Stockholm Convention as Persistent Organic Pollutants (POPs). These chemicals are persistent, bioaccumulative and subject to long range transport. In general, chronic toxicity endpoints for mammals and birds exposed to pesticides are expressed in terms of mg pesticide/kg-bw. The toxicity of 2,3,7,8-TCDD is expressed in units of ng/kg-bw, which indicates that this chemical is orders of magnitude more toxic than pesticides which are typically assessed by OPP. To characterize the risk associated with HCB, the toxicity of HCB will be summarized from the scientific literature. The Agency for Toxic Substances and Disease Registry (ATSDR), associated with the Center for Disease Control (CDC), Toxicological Profile for HCB (ATSDR, 2002) will be used as one source of information in the characterization of the toxicity of HCB.

Acute (short-term) and chronic (long-term) toxicity information is characterized based on registrant-submitted studies and a comprehensive review of the open literature on DCPA. Other sources of information, including use of the acute probit dose response relationship to establish the probability of an individual effect and reviews of the Ecological Incident Information System (EIIS), are conducted to further refine the characterization of potential ecological effects associated with exposure to DCPA. A summary of the available ecotoxicity information and the incident information for DCPA are provided below.

Table 10 and Table 911 summarize the most sensitive ecological toxicity endpoints based on currently available data. A preliminary evaluation of open literature, suggests that there may be more sensitive toxicity endpoints for both aquatic and terrestrial organisms. These will be reviewed and evaluated to determine potential use in the ecological risk assessment. A brief summary of submitted data considered relevant to this ecological risk assessment is presented below.

Table 10. Applicable DCPA endpoints for terrestrial organisms

Assessment Endpoint	Measures of Effect	Species	Toxicity Value	Study classification (Selection basis)	Reference (MRID)
Abundance (i.e., survival, reproduction, and growth) of individuals and populations of birds	Avian (single dose) acute oral 21-day LD_{50}	Northern bobwhite quail (*Colinus virginianus*)	LD_{50} >2,250 mg a.i./kg-bw (1)	Acceptable	41155705
	Avian subacute 5-day dietary LC_{50}	Northern bobwhite quail (*Colinus virginianus*) and Mallard duck (*Anas platyrhynchos*)	LC_{50} >5620 mg a.i./kg-diet (ppm) (1)	Acceptable & Acceptable	41155706 & 41155707
	Avian reproduction NOAEC	Northern bobwhite quail (*Colinus virginianus*) and Mallard duck (*Anas platyrhynchos*)	NOAEC = 1280 mg a.i./kg-diet (2) LOAEC = 3170 mg a.i./kg-diet	Supplemental & Supplemental	47550001 & 47550002
Abundance (i.e., survival, reproduction, and growth) of individuals and populations of mammals	Mammalian acute oral (single dose) LD_{50}	Rat (*Rattus norvegicus*)	Acute oral LD_{50} >5000 mg a.i./kg-bw (3)	Acceptable	41054808
	Mammalian 2-generation rat reproduction NOAEL	Rat (*Rattus norvegicus*)	NOAEL=50 mg/kg/day (1000 ppm) LOAEL= 250 mg/kg/day (5000 ppm) (4)	Acceptable	41750103
Survival of beneficial insect populations	Honey bee acute contact LD_{50}	Honey bee (*Apis mellifera*)	Acute contact LD_{50}>230 μg/bee (5)	Supplemental	00018842
Survival and growth of terrestrial plants	Seedling Emergence	Tomato (*Solanum lycopersicum*)	EC_{25} = 5.36 lbs a.i./A (6)	Supplemental	41564901
	Vegetative Vigor	Soybean (*Glycine max*)	EC_{25} > 7.5 lbs a.i./A (7)	Supplemental	41440101

1 Product tested contains 100% active ingredient (Technical Grade).
2 Based on mortality, signs of toxicity, and effects on reproduction and offspring (reduction in eggs laid, eggs set, live 3-week embryos, number hatched, the ratios of number hatched to eggs laid and to eggs set, and hatchling survival); Product tested contains 98.0% active ingredient (Technical Grade).
3 Product tested contains 98.0% active ingredient (Technical Grade).
4 Based on pup weight decrements. Product tested contained 96-98% active ingredient (Technical Grade).
5 Formulation was not identified although was described as technical; however only 3.2% mortality at 229.63 μg/bee was observed.
6 Most sensitive parameter is fresh weight. Product tested contained 97.8% active ingredient (Technical Grade) dissolved in 90% acetone, 10% deionized water, and 0.05% Triton X-100 (as a surfactant) solution. NOAEC for tomato was 0.47 lb ai/A based on fresh weight. EC_{25}'s could not be determined for all other species tested and tolerant plant species were used.
7 EC_{25}'s could not be determined for nearly all species and tolerant plant species were used. Product tested contained 97.8% active ingredient (Technical Grade) dissolved in 90% acetone, 10% deionized water, and 0.05% Triton X-100 (as a surfactant). NOAEC was 7.5 lb ai/A based on fresh weight (only one parameter was measured and recorded).

Table 9. Applicable DCPA endpoints for aquatic organisms

Assessment Endpoint	Measures of Effect	Species	Toxicity Value	Study classification (Selection basis)	Reference (MRID)
Survival and reproduction of individuals and communities of freshwater fish	Freshwater fish acute 96-hr LC_{50}	Bluegill sunfish (*Lepomis macrochirus*) & Rainbow trout (*Oncorhynchus mykiss*)	BG LC_{50}> 6.7 mg/L (TWA) (> 5.4 mg/L; mean-measured) & RT LC_{50}> 6.6 mg/L (TWA) (> 4.7 mg/L; mean-measured) (1)	Supplemental & Supplemental	41054827 & 40154826
	Freshwater fish early life-stage NOAEC	**No Data – submission of studies are needed**			
Survival and reproduction of individuals and communities of freshwater invertebrates	Freshwater invertebrate acute 48-hr LC_{50}	Water flea (*Daphnia magna*)	EC_{50} >100 mg/L nominal (2a)	Supplemental	40098001
			EC_{50} =18.02 mg/L nominal (2b)	Supplemental	40098001
	Freshwater invertebrate reproductive NOAEC	**No Data – submission of studies are needed**			
Survival and reproduction of individuals and communities of estuarine and marine fish	Estuarine and marine acute fish 96-h LC_{50}	Sheepshead minnow (*Cyprinodon variegatus*)	LC_{50} >1.0 mg/L (3)	Supplemental	40228401
	Estuarine and marine fish reproductive NOAEC	**No Data – submission of studies are needed**			
Survival and reproduction of individuals and communities of estuarine and marine invertebrates	Estuarine and marine invertebrate acute 96-hr LC_{50}	Eastern oyster (*Crassostrea virginica*)	EC_{50} = 0.62 mg/L (4)	Supplemental	40228401
		Brown shrimp (*Penaeus aztecus*)	EC_{50} >1.0 mg/L (5)	Supplemental	40228401
	Estuarine and marine invertebrate reproductive NOAEC	**No Data – submission of studies are needed**			
Standing crop or biomass and growth of aquatic plants	Freshwater green algae, cyanobacteria or diatom 96-h IC_{50} for biomass.	Freshwater diatom (*Navicula pelliculosa*) and/or Green algae (*Selenastrum capricornutum*)	**No Acceptable Data Available (6)**		42882401 & 42836103
	Vascular aquatic plants	Duckweed (*Lemna gibba*)	**No Acceptable Data Available (6)**		42836101

1 Product tested contains 96.7% active ingredient (Technical Grade), greater than solubility limit (0.5 mg/L), and although concentrations were measured, they were not centrifuged, and therefore do not represent total dissolved soluble concentrations.
2a Product tested contains Technical Grade material, could not determine actual exposure concentration, concentrations were not measured.
2b Product tested contains 75% active ingredient (Dacthal W-75), could not determine actual exposure concentration,

concentrations were not measured.
3 Product tested contains Technical Grade material, could not determine actual exposure concentration, concentrations were not measured, and therefore, the concentrations are likely at least the solubility limit (0.5 mg/L).
4 Product tested contains Technical Grade material, could not determine actual exposure concentration, concentrations were not measured, therefore the concentrations are likely at least the solubility limit (0.5 mg/L).
5 Product tested contains Technical Grade material, could not determine actual exposure concentration, concentrations were not measured, therefore the concentrations are likely at least the solubility limit (0.5 mg/L).
6 Test substance was not completely in solution; throughout the test the treatment solution appeared cloudy with white particulates; test material was neither centrifuged nor measured, therefore the studies are considered invalid, and not for use in risk assessments.

Effects to Aquatic Organisms

Fish

Available freshwater and estuarine/marine acute fish toxicity studies (MRID 41054827, 40154826, and 40228401) indicated issues with the solubility of the TGAI in water, and are not usable for quantitative assessment. Although there were issues with the solubility of the compound, no mortality was observed in the treatment concentration for the rainbow trout, and 3.3% mortality was observed in treatment concentration for the bluegill sunfish. No information is available to determine if there was or was not *any* mortality observed for the sheepshead minnow. Given that one can assume the exposure was at least at the level of solubility and fish may have consumed or had contact with the precipitate. The available data suggest that DCPA does not result in mortality to freshwater and/or estuarine/marine fish (based on TGAI exposure) at the limit of solubility (0.5 ppm).

Estimated chronic effects of DCPA exposure for freshwater and estuarine/marine fish are uncertain because no chronic data were submitted by the registrant for freshwater or estuarine/marine fish, and as a result these studies are considered to be data gaps. In the absence of data chronic risk to freshwater and estuarine/marine fish will be assumed. Chronic toxicity data are important to this ecological risk assessment given the high Kow, persistence, and bioconcentration potential of DCPA.

Aquatic Invertebrates

Available acute toxicity data for freshwater and estuarine/marine invertebrates (MRID 40098001, and 40228401) using the TGAI also indicated issues with solubility in water, and are not usable for quantitative assessment. Although there were issues with the solubility of the compound, 20% of freshwater invertebrates (daphnids, scuds, and midges) were affected in the highest treatment concentration, and no information is available to determine if there was or was not *any* mortality/affects observed for the estuarine/marine invertebrates (mysid, or oyster). There is toxicity data available for the formulated product (Dacthal W-75) for freshwater invertebrates only that can be used for quantitative assessment; however, there are still limitations with the data. Given that one can assume the exposure was at least at the level of solubility and invertebrates may have consumed or had contact with the precipitate, the available data suggest that DCPA may result in effects to freshwater invertebrates (based on TGAI exposure) at the limit of solubility (0.5 ppm). For estuarine/marine invertebrates, from available data, DCPA is highly toxic on an acute exposure basis. For freshwater invertebrates, available data for the end use formulated product data DCPA is slightly toxic on an acute exposure basis.

Estimated chronic effects of DCPA exposure for freshwater and estuarine/marine invertebrates are uncertain because no chronic data were submitted by the registrant for freshwater or estuarine/marine invertebrates, and as a result these studies are considered to be data gaps. In the absence of data chronic risk to freshwater and estuarine/marine invertebrates will be assumed. Chronic toxicity data are important to this ecological risk assessment given the high Kow, persistence, and bioconcentration potential of DCPA.

Aquatic Plants

As with the other aquatic taxa, DCPA toxicity data for aquatic plants are limited by solubility. Tier I testing was conducted with *Lemna gibba, Skeletonema costatum, Navicula pelliculosa,* and *Anabaena flos-aquae* (MRID 42882401, 42836103, and 42836101), and in all tests a white precipitate was observed. In addition, there was large variability within the data that prevented the statistical analysis from detecting a significant difference even if one was present, and are considered not usable for quantifying risk to non-target aquatic plants. Based on the number of target species and the adverse effects observed in the submitted aquatic plant toxicity studies, effects to aquatic plants can be expected at or below solubility. Without a Tier II study, it is not possible to determine the level at which no effects will occur.

Effects to Terrestrial Organisms

Birds

One avian acute oral toxicity study is available for DCPA exposure to Northern bobwhite quail (MRID 41155705). No treatment related effects were observed during the study and the LD_{50} value was determined to be *greater than* 2250 mg/kg-body weight (bw). DCPA is therefore classified as practically non-toxic to birds on an acute oral basis.

An avian subacute dietary toxicity study was submitted for Northern bobwhite quail (MRID 41155706), and mallard duck (MRID 41155707). Both bobwhite chicks and mallard ducklings were exposed to 560, 1000, 1780, 3160, and 5620 ppm in their diet for five days. There were no treatment related mortalities at any exposure level for either the bobwhite quail or the mallard duck, and therefore the LC_{50} was *greater than* 5620 ppm for both species. DCPA is therefore classified as practically non-toxic to birds on a subacute dietary basis.

Avian reproductive toxicity studies were submitted for two species: mallard duck (MRID 47550002) and Northern bobwhite quail (MRID 47550001). Both studies followed the same DCPA exposure scheme, which was 0 (control), 1280, 3170, and 8020 mg a.i./kg-diet. There are concerns with the overall health of the test birds (both mallard duck and bobwhite quail) and the results are not reliable for use in a quantitative risk assessment. Bobwhite quail were more sensitive and thirteen treatment related mortalities were observed during the study. A NOAEC of 1280 mg a.i./kg-diet and a LOAEC of 3170 mg a.i./kg-diet were found, based on mortality, signs of toxicity, and effects on reproduction and offspring. Treatment related reductions in multiple reproductive parameters were detected at the top two treatment levels. More specifically, reproductive and offspring effects included the ratios of live 3-week embryos to viable embryos, number hatched to live 3-week embryos, hatchling survivors to eggs set and to number hatched, as well as survivor weights. Some animals at the higher treatment levels were so debilitated that they were sacrificed after week 18, three weeks prior to the end of the 21-week observation period. However, the results are not reliable for use in a quantitative risk assessment. Therefore, avian reproductive toxicity is considered a data gap, and new studies are needed.

Mammals

Acute mammalian toxicity studies resulted in no observable effects to rats exposed to DCPA. In an acute oral toxicity study with Sprague-Dawley rats, no effects were observed at 5000 mg/kg-bw throughout the 14-day observation period and therefore, the acute LC_{50} was *greater than* 5000 mg/kg-bw for mammals (MRID 41054810).

In a 2-generation reproduction study in rats (MRID 41750103), DCPA was administered in the feed to Sprague-Dawley rats. The F0 parental generation produced two litters, F1a and F1b. The F1b generation was mated to produce two litters, F2a and F2b. There were 35 rats/sex/dose group in the F0 and F1 generations with a ten week growth phase for the F0 generation before the first mating and a ten week growth phase for the F1b generation before the first mating. There were 20 rats/sex/dose group in the F2b generation which were observed for a six week growth period.

Dietary concentrations were 0, 1000, 5000, or 20000 ppm (equivalent to 0, 50, 250, or 1000 mg/kg/day using a 0.05 mg/kg/day per ppm conversion factor). Doses were changed to 0, 200, 500, or 20000 ppm on day 0 of lactation for the F2b litters (equivalent to 10, 25, or 1000 mg/kg/day using a 0.05 conversion factor) in order to ensure a NOAEL for F2 pup body weight decrements.

The parental NOAEL is 50 mg/kg/day and the parental LOAEL is 250 mg/kg/day based upon body weight decreases, gross and microscopic changes in kidneys and lungs, and microscopic changes in liver and thyroids (MRID 41750103). There were no treatment-related effects upon reproductive indices. Mating index, fertility index, pregnancy rates, and litter size were not affected by treatment. Pup body weights in the 500 ppm F2b litters were not affected by treatment. Body weight decrements in weaned pups were accompanied by decreased food consumption in F1 animals but not in F2 animals. There were no treatment-related effects seen at pup necropsy. The offspring NOAEL is 50 mg/kg/day and the offspring LOAEL is 250 mg/kg/day based upon pup body weight decrements.

Terrestrial Invertebrates

A honey bee acute contact study (formulation was not identified) resulted in honey bee LD_{50}>230 µg a.i./bee, 3.2% mortality was observed at this concentration (MRID 00018842). DCPA is therefore classified as practically non-toxic to bees.

Terrestrial Plants

For Tier II seedling emergence test with DCPA, tomato was the most sensitive test species of all (soybean, lettuce, carrot, tomato, cucumber, cabbage, oat, ryegrass, corn, and onion) that were tested based on fresh weight. The tomato EC_{25} and NOAEC values were 5.36 lbs a.i./A and 0.47 lbs a.i./A, respectively, based on fresh weight. The seedling emergence study was classified as supplemental because the test material was not applied to the maximum labeled rate, DCPA was not applied at low enough concentrations to determine the NOAEC for corn, lettuce, and oat radicle length, and tolerant plant species were used.

For the Tier II vegetative vigor test with DCPA, of the ten species (ryegrass, corn, oat, onion, soybean, lettuce, carrot, tomato, cucumber, and cabbage) tested; soybean, tomato, and cucumber were visually affected (phytotoxicity) by DCPA. Phytotoxicity (crinkled leaves, and mottled chlorosis) was observed in soybean plants at all rates of DCPA, and slight necrosis was observed at 1.88 lbs a.i./A on both soybean and cucumber plants. Tomato plants were affected at 3.75 and 7.5 lbs a.i./A. Although phytotoxicity was observed, no treatment effects were observed with the single measurement of fresh weight. Therefore, the soybean EC_{25} and NOAEC values based on fresh weight were >7.5 lbs a.i./A, and 7.5 lbs a.i./A, respectively. The vegetative vigor study was classified as supplemental because the percent active ingredient was not specified, the material was not applied to the maximum labeled rate, only one parameter (fresh weight) was recorded and measured, and tolerant plant species were used.

Degradate toxicity

The *Health Effects Support Document for Dacthal Degradates: Tetrachloroterephthalic Acid (TPA) and Monomethyl Tetrachloroterephthalic Acid (MTP)* summarized the data for the degradates for TPA and MTP in the following excerpts (U.S. EPA, 2008a).

> "Both DCPA and TPA do cause adverse health effects in laboratory animals. Currently, no toxicological studies are available to assess the toxicological effects of MTP (the mono-acid degradate). Three studies in rats (30- and 90-day feeding studies and a developmental study) are available for TPA. The effects of exposure were mild (weight loss and diarrhea) and occurred at doses greater than or equal to 2000 mg/kg/day. No reproductive effects were observed. The critical effects for DCPA, the parent compound, include effects on the lung, liver, kidney, and thyroid in male and female rats in a 2-year chronic bioassay (ISK Biotech, 1993). The available data indicate that the adverse effects associated with TPA are much milder than those for the parent and tend to occur at doses that are lower by approximately an order of magnitude." Page 1-2
>
> "The only noncancer health effects noted with TPA were soft stools and occult blood in urine at doses of greater than 2000 mg/kg/day (Major, 1985). Doses of 2500 mg/kg/day administered during gd 6-15 also caused soft stools, increased salivation, decreased body weight gain, and decreased food consumption (Mizen, 1985). No effects were observed in the single study of MTP (Hazelton, 1961)." Page 7-7
>
> "The results from the short-term TPA study differed from those for DCPA in a 28-day dietary study in groups of five male and female Sprague-Dawley rats given doses of 0, 250, 1000, or 2000 mg/kg/day (ISK Biotech Corp., 1990b). In the DCPA study, there was a dose-related increase in liver weight and centrilobular hypertrophy of hepatocytes. The lowest dose tested (250 mg/kg/day) was the LOAEL for these effects (U.S. EPA, 1994c). The difference in the effect levels suggests that the parent DCPA is more acutely toxic than the TPA degradate. The results of a 28-day study of MTP by Hazleton Laboratory (1961), comparable to Hazleton's TPA study described above, did not identify any signs of toxicity at the 1% (860 mg/kg/day) dietary dose tested." Page 7-2

Based on this analysis, we concluded that TPA was less toxic than DCPA and therefore, terrestrial risk from exposure to DCPA is considered to encompass potential sources of risk from degradates.

No aquatic toxicity (acute or chronic, animal or plant) data are currently available for TPA, and are required for registration review. TPA is structurally similar to the parent DCPA, and other benzoic acid herbicides, and thus may retain the herbicidal mechanism of action. Since the terrestrial animal data indicate this chemical is generally toxic on a chronic exposure basis but not an acute exposure basis, these data are critical to the future ecological risk assessments. In the absence of toxicity data for TPA, EFED will assume equal toxicity to the parent compound, DCPA.

Contaminant toxicity (dioxins and HCB)

As indicated above, when using the TEQ approach, the exposure concentration of each dioxin congener is adjusted relative to the toxicity of 2,3,7,8-TCDD.

In 1993, EPA developed a report (interim) on the available data and methods for assessing ecological risks associated with 2,3,7,8-TCDD (USEPA 1993). This section summarizes the ecological effects data for aquatic organisms that are described in that report. Because of the low solubility and high Koc and Kow values of dioxins, a more appropriate method for characterizing toxicity is based on the concentration of dioxin in the organism (tissue-based residues), rather than freely dissolved in the water. Therefore, this section will report toxicity data in terms of organism concentrations.

Currently, the toxicity and risk associated with the presence of the contaminant HCB has not been fully characterized. However, information from available scientific literature, including the Toxicological Profile for HCB (ATSDR, 2002) will be used characterize the toxicity and estimate the risk associated with the presence of HCB as a contaminant of DCPA.

Fish

Toxicity data are available for several species of freshwater and saltwater fish exposed to 2,3,7,8-TCDD. A review of the data indicates that the most sensitive life stage is fish fry. According to the 1993 EPA report, "[T]here is no definitive evidence of adverse effects in any of the fish species tested if accumulation in eggs is less than 34 pg TCDD/g [ng TCDD/kg], the highest no observed effect level for trout fry. This likely corresponds to an accumulation in parent fish, with lipid content similar to the eggs, of less than 50 pg TCDD/g." Based on this information, the NOAEC for effects of 2,3,7,8-TCDD on fish fry is 34 ng/kg, which corresponds to an accumulation in parent fish (who transfer dioxins to eggs) of <50 ng/kg. Effects to fish fry survival are expected when concentrations of 2,3,7,8-TCDD in eggs are 50-500 ng/kg, which corresponds to concentrations of 75-705 ng/kg in parent fish. Mortality in adult fish is expected with body concentrations of 2,3,7,8-TCDD are 1000-15000 ng/kg (USEPA 1993).

Aquatic Invertebrates

Data are available from toxicity studies where a species of freshwater invertebrates, *i.e.*, the cladoceran *Daphnia magna*, and a snail (*Physa sp.*) were exposed to 2,3,7,8-TCDD. After 33-d exposures, no adverse effects were observed in either species. Concentrations of 2,3,7,8-TCDD in the cladoceran and snail were 1,570,000 and 502,000 ng/kg, respectively (Inensee and Jones 1975; Inensee 1978). These concentrations are based on measured levels of 2,3,7,8-TCDD in tissues.

Aquatic Plants

Data are available from toxicity studies where non-vascular, i.e., algae (Oedogonium cardiacum) and vascular, i.e., duckweed (Lemna minor), aquatic plants were exposed to 2,3,7,8-TCDD. After 33-d exposures, no toxic effects were observed in either species. Concentrations of 2,3,7,8-TCDD in duckweed and algae were 30,700 and 2,295,000 ng/kg, respectively, without any apparent adverse effects on the aquatic plants (Inensee and Jones 1975; Inensee 1978). These concentrations are based on measured levels of 2,3,7,8-TCDD in aquatic plants.

Birds

In 2003, EPA finalized a document summarizing available laboratory and field studies involving reproductive toxicity in birds that are exposed to dioxins. A review of available studies indicates that exposures of birds to dioxins leads to mortality, deformity and inhibited development in offspring (USEPA 2003b).

In the Great Lakes Water Quality Initiative Criteria for the Protection of Wildlife for 2,3,7,8-TCDD, OW also identified several studies reporting toxicity data involving chronic exposures of birds to 2,3,7,8-TCDD. From these studies, OW selected a reproduction study with the ring-necked pheasant (*Phasianus colchicus*) exposed to 2,3,7,8-TCDD (Nosek *et al.* 1992a, 1992b, 1993) to derive the avian wildlife value used for the 2,3,7,8-TCDD criteria. In this study, female birds were dosed intraperitonieally with 2,3,7,8-TCDD for 10 weeks at 1.4, 14 and 140 ng/kg-day. Relative to control birds, no effects were observed in the lowest two treatments, resulting in a NOAEL of 14 ng/kg-day. At the highest test concentration which represents the study LOAEL (*i.e.,* 140 ng/kg-day), egg production was significantly reduced and mortality of embryos was significantly increased.

The NOAEL from Nosek *et al.* (1992a, 1992b, 1993) will be used as the chronic effect endpoint for birds exposed to dioxins. Although studies involving intraperitoneal injections are not typically used by EFED to determine measures of effects for avian reproduction, no feeding studies have been identified where birds were exposed to dioxins.

Mammals

Chronic toxicity endpoints for mammals exposed to 2,3,7,8-TCDD have been identified by the USEPA Office of Water (OW) for the Great Lakes Water Quality Initiative Criteria for the Protection of Wildlife (USEPA 1995). OW defined a no observed adverse effect level (NOAEL) of 1 ng/kg-bw/day (i.e., 0.001 µg/kg-bw/day or 1x10-6 mg/kg-bw/day) for reproductive effects to mammals exposed to 2,3,7,8-TCDD in food. This NOAEL was based on reduced fertility in first (f1) and second generation (f2) rats at the lowest observed adverse effect level (LOAEL) of 10 ng/kg-bw/day (Murray et al. 1979).

Ecological Incidents

A preliminary review was made on December 1, 2010, of the Ecological Incident Information System (EIIS, version 2.1.1), which is maintained by the Agency's Office of Pesticide Programs, and the Avian Monitoring Information System (AIMS), which is maintained by the American Bird Conservancy. One incident was found in AIMS, however this incident is also found in the EIIS database as well. EIIS indicates a total of 2 reported ecological incidents associated with the use of DCPA (chlorthal dimethyl), the incidents involve both fish and birds. These incidents are summarized in Table 10.

The reported DCPA (named "chlorthal dimethyl" in the EIIS database) incidents occurred in 1984 and 1988. The certainty categories on the likelihood that the use of DCPA caused 2 incidents are both listed as possible. Both incidents also involved other chemicals besides DCPA. Residues of both DCPA and the other chemicals involved are available for one of the incidents (B0000-501-87).

In addition to the incidents recorded in EIIS, additional incidents may have been reported to the Agency in aggregated incident reports. Pesticide registrants report certain types of incidents to the Agency as aggregate counts of incidents occurring per product per quarter. Ecological incidents reported in aggregate reports include those categorized as "minor fish and wildlife" (W-B), "minor plant" (P-B), and "other nontarget" (ONT) incidents. "Other non-target" incidents include reports of adverse effects to insects and other terrestrial invertebrates. For DCPA there were no aggregate incidents reported by the registrant(s).

In the risk assessment, the incidents will be further evaluated to determine if the reported incidents represent current patterns of use for DCPA (chlorthal dimethyl). Examples of additional considerations are mitigation (*e.g.*, reduced application rates), product cancellations, and changes in use patterns that have occurred since the date of the reported incident(s).

Table 10. Ecological Incidents Associated with DCPA.

Incident No. (EIIS, AIMS)	Year	State	Magnitude	Other Chemicals Associated with the Incident	Certainty index	Comments
I000636-014	1984	MO	UN	Chlorothalonil Cyclohexamide Benomyl	possible	A fish kill (of an unknown magnitude) occurred in a pond on the grounds of the St. Joe Minerals Corp (a golf course). Two days before the fish kill; the golf course was sprayed with dacthal (DCPA), Daconil, Tersan, and Acti-Dione. No analyses of fish or water were included in the report.
B0000-501-87 AIMS Event #396 CA: P-1140/1161	1988	CA	112	Diazinon Endosulfan	possible	Approximately 100 fish (50 catfish & 50 shad) and 12 birds (egrets) died at a pond at a duck club in Imperial County, CA, after an accidental misuse (a spill) that resulted in runoff to a nearby pond. The dead fish were analyzed and found to contain dacthal

Incident No. (EIIS, AIMS)	Year	State	Magnitude	Other Chemicals Associated with the Incident	Certainty index	Comments
						(DCPA) (26.3 ppm), DDE (0.11 ppm), diazinon (0.1 ppm), and endosulfan (0.92 ppm) based on whole body and fresh weight. An analysis of the water showed no pesticides present, but no mention was made of the time lag between the event and the sampling of the water. Analyses of the livers of several egrets showed dacthal to be present but at less than 1 ppm. Two weeks later, on May 24, several catfish were seined from the pond and high concentrations of dacthal were found in their livers (1.77 to 9.2 ppm). The source of the incident at the pond seemed to be a nearby crop dusting loading facility.

Characteristics of Ecosystems Potentially at Risk

The ecosystems potentially at risk are often extensive in scope; therefore, it may not be possible to identify specific ecosystems during the development of a nation-wide ecological risk assessment. However, in general terms, terrestrial ecosystems potentially at risk could include the treated field and immediately adjacent areas that may receive drift or runoff. Areas adjacent to the treated field could include cultivated fields, fencerows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats, and other uncultivated areas.

Aquatic ecosystems potentially at risk include water bodies adjacent to, or down stream from, the treated site and might include impounded bodies such as ponds, lakes and reservoirs, or flowing waterways such as streams or rivers including all adjacent off-channel habitats that are permanently or intermittently connected to flowing waters. For uses in coastal areas, aquatic habitat also includes marine ecosystems, including estuaries, embayment's, and near shore environments.

Assessment Endpoints

Assessment endpoints are defined as "explicit expressions of the actual environmental value that is to be protected." Defining an assessment endpoint involves two steps: 1) identifying the valued attributes of the environment that are considered to be at risk; and 2) operationally defining the assessment endpoint in terms of an ecological entity (*i.e.*, a community of fish and aquatic invertebrates) and its attributes (*i.e.*, survival and reproduction). Therefore, selection of the assessment endpoints is based on valued entities (*i.e.*, ecological receptors), the ecosystems potentially at risk, the migration pathways of pesticides, and the routes by which ecological receptors are exposed to pesticide-related contamination. The selection of clearly defined assessment endpoints is important because they provide direction and boundaries in the risk assessment for addressing risk management issues of concern. Changes to assessment endpoints are typically estimated from the available toxicity studies, which are used as the measures of effects to characterize potential ecological risks associated with exposure to a pesticide, such as DCPA. For a summary of the terrestrial and aquatic toxicological endpoints for DCPA see Tables 11 and 12 in the Ecological Effects section, respectively.

Conceptual Model

The conceptual model is a graphic representation of the structure of the risk assessment. It specifies the DCPA release mechanisms, biological receptor types, and effects endpoints of potential concern. The conceptual models for aquatic and terrestrial exposures are shown in Figure 4 and Figure 5, respectively. Dashed lines denote minor exposure routes.

Based on available fate and transport data for DCPA, potential transport mechanisms include surface water runoff, movement into ground water and subsequent recharge into surface water, spray drift, and volatilization and deposition to nearby fields, and long range transport in air. Significant amounts of DCPA have been shown to volatize off the field and be deposited to nearby fields. This could lead to exposure via inhalation or deposition of DCPA on nearby areas. Volatilization and deposition on nearby fields is expected to result in lower exposure than that estimated for runoff and spray drift for the field that DCPA is applied to and therefore, was not assessed separately. Exposure to DCPA due to long range transport of DCPA in ground water is also discussed qualitatively. In addition to DCPA terrestrial and aquatic organisms may be exposed to the degradate TPA, and the impurities hexachlorobenzene (HCB) and dioxins/furans, thereby increasing the bioaccumulation risk.

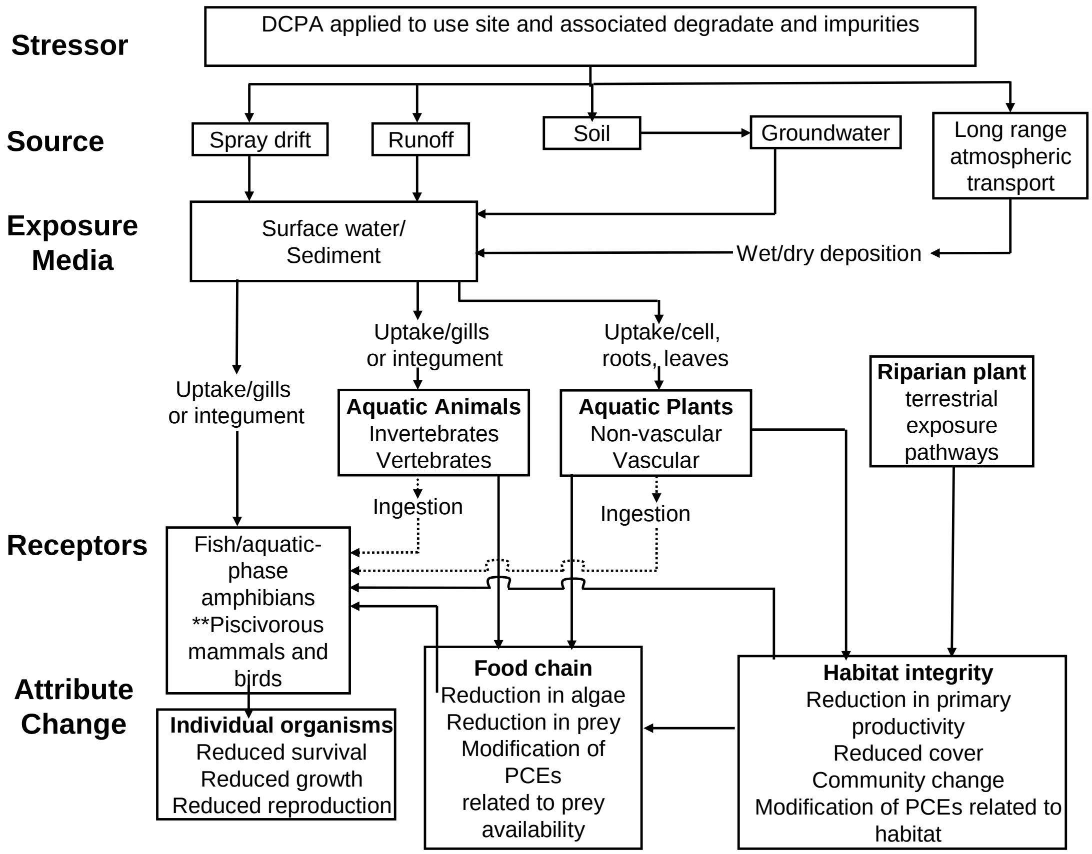


Figure 4. Conceptual Model for Pesticide Effects on Aquatic Systems

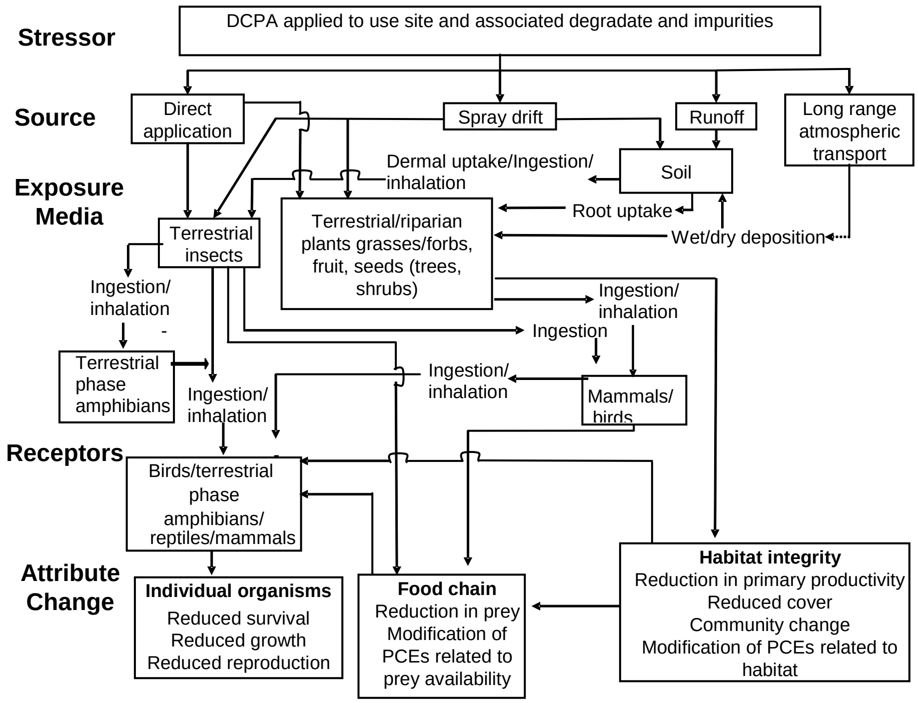


Figure 5. Conceptual Model for Pesticide Effects on Terrestrial Systems

Risk Hypothesis

A risk hypothesis describes the predicted relationship among the stressor, exposure, and assessment endpoint response along with the rationale for their selection. For DCPA, the following ecological risk hypothesis is being employed for this national-level ecological risk assessment:

> *DCPA, when used in accordance with current labels, can result in off-site movement of the compound via runoff, leaching to ground water, spray drift and atmospheric transport leading to exposure of non-target plants and animals. Direct applications to and atmospheric deposition to foliar surfaces may serve as a major source of DCPA exposure to wildlife. Exposure in these environmental compartments will result in adverse effects upon the survival, growth, and reproduction of non-target terrestrial and aquatic organisms. These non-target organisms include federally-listed threatened and endangered species.*

Analysis Plan

In order to address the risk hypothesis, the potential for adverse effects on the environment is estimated. The use, environmental fate, and ecological effects of DCPA are characterized and integrated to assess the risks. This is accomplished using a risk quotient (ratio of exposure concentration to effects concentration) approach. Although risk is often defined as the likelihood and magnitude of adverse ecological effects, the risk quotient-based approach does not provide a quantitative estimate of likelihood and/or magnitude of an adverse effect. However, as outlined in the Overview Document (USEPA 2004), the likelihood of effects to individual organisms from particular uses of DCPA is estimated using the probit dose-response slope and either the level of concern (discussed below) or actual calculated risk quotient value.

This analysis plan will be revisited and may be revised depending upon the information submitted by the public in response to the opening of the Registration Review docket for DCPA.

Stressors of Concern

DCPA or dacthal, a pre-emergence herbicide is used widely to control annual grass and certain broadleaf weeds. Two major degradates were observed in laboratory studies, tetrachloroterephthalic acid (TPA) and monomethyl tetrachloroterephthalic acid (MTP). In addition, the manufacturing processes of DCPA results in the formation of several known contaminants. Of toxicological concern are hexachlorobenzene (HCB), congeners (structurally related chemicals) of polyhalogenated dibenzo-p-dioxins/dibenzofurans (dioxins/furans), and other possible organochlorine contaminants.

Measures of Exposure

In order to estimate risks of DCPA exposures in aquatic and terrestrial environments, all exposure modeling and resulting risk conclusions will be based on maximum application rates and methods cited in **Table 1** and will be estimated for each use of DCPA. The environmental fate properties of DCPA along with available monitoring data indicate that runoff and spray drift may be the principle potential transport mechanisms of DCPA to the aquatic and terrestrial organisms. DCPA is also volatile and may travel to nearby fields in the air or to remote areas via long range transport. In this assessment, transport of DCPA through runoff and spray drift will be considered in deriving quantitative estimates of DCPA. Additionally, exposure due to deposition of DCPA in precipitation and movement of DCPA and TPA into ground water will be qualitatively assessed. Bioaccumulation may occur; however, rapid depuration was observed in fish and residues measured in organisms are very low (MRID 41155716, 41197602). Therefore, we do not expect bioaccumulation of DCPA to be a major exposure pathway. However, this measure of exposure will be looked at more closely during the risk assessment.

Measures of exposure are based on aquatic and terrestrial models that predict estimated environmental concentrations (EECs) of DCPA using maximum labeled application rates and methods of application. The models used to predict aquatic EECs are the Tier I model GENeric Estimated Environmental Concentration (GENEEC) and the Tier II Pesticide Root Zone Model coupled with the Exposure Analysis Model System (PRZM/EXAMS). PRZM (currently version 3.12.2; 5/15/05) and EXAMS (currently version 2.98.04.06; 4/25/05) are simulation models coupled with the linkage program shell: PE5 (PRZM EXAMS Model Shell; v5.0; 11/15/06), which incorporates the standard scenarios developed by EFED. The models generate daily exposures and calculated 1-in-10 year EECs of DCPA and separate EECs for its two major degradates, TPA and MTP, which may occur in surface water bodies adjacent to application sites. The major degradates of DCPA (TPA and MTP) are not naturally-occurring compounds and are formed in significant quantities. Degradates will likely be modeled using the total toxic residue approach unless data are submitted that suggest the degradates are not a toxicological concern.

PRZM simulates pesticide fate and transport as a result of leaching, direct spray drift, runoff and erosion from an agricultural field, and EXAMS estimates environmental fate and transport of pesticides in a surface water body for a 30-year period. The combined model is designed to estimate pesticide concentrations found in water (standard pond) at the edge of the treated field. As such, it provides high-end values of the pesticide concentrations that might be found in ecologically sensitive environments following pesticide application. The location of the field is specific to the crop being simulated using site-specific information on the soils, weather, cropping, and management factors associated with the scenario. The crop/location scenario is intended to represent a high-end exposure site on which the crop is normally grown. Based on historical rainfall patterns, the receiving water body receives multiple runoff events during the years simulated. Weather and agricultural practices are simulated for 30 years so that the 10-year exceedance probability at the site can be estimated. The simulation is generated using 30 years of meteorological data, encompassing the years from 1961 to 1990. Additional information on these models can be found at: http://www.epa.gov/oppefed1/models/water/index.htm.

The standard scenarios used for ecological pesticide assessments assume application to a 10-hectare agricultural field that drains into an adjacent 1-hectare water body that is 2 meters deep (20,000 m^3 volume) with no outlet. PRZM/EXAMS is used to estimate screening-level exposure of aquatic organisms to DCPA. The measure of exposure for aquatic species is the 1-in-10 year return peak or rolling mean concentration. The 1-in-10 year peak is used for estimating acute exposures of direct effects to aquatic organisms. The 1-in-10-year 60-day mean is used for assessing chronic exposure to fish and aquatic-phase amphibians. The 1-in-10-year 21-day mean is used for assessing chronic exposure to aquatic invertebrates.

Exposure estimates for terrestrial animals assumed to be in the target area or in an area exposed to spray drift are derived using the T-REX model (version 1.4.1, 10/09/2008). This model incorporates the Kenega nomograph, as modified by Fletcher *et al.* (1994), which is based on a large set of field residue data. The upper limit values from the nomograph represent the upper bound of residue values from actual field measurements (Hoerger and Kenega 1972). The Fletcher *et al.* (1994) modifications to the Kenega nomograph are based on measured field residues from 249 published research papers, including information on 118 species of plants, 121 pesticides, and 17 chemical classes.

EECs for terrestrial plants inhabiting dry and wetland areas are derived using TerrPlant (version 1.2.2, 12/26/2006). This model uses estimates of pesticides in runoff and in spray drift to calculate EECs. EECs are based upon solubility, application rate and minimum incorporation depth.

In general, deposition of drifting or volatilized pesticides is expected to be greatest close to the site of application. Two spray drift models, AgDisp and AgDRIFT are used to assess exposures of terrestrial plants to DCPA deposited in terrestrial habitats by spray drift. AgDisp (version 8.13; dated 12/14/2004) (Teske and Curbishley 2003) is used to simulate aerial and ground applications. AgDrift (version 2.01; dated 5/24/2001) is used to simulate spray blast applications to orchard crops. The distance of potential impact away from the use sites is determined by the distance required to fall below the LOC for chronic effects to small mammals consuming short grass.

Aquatic exposure to the impurities, HCB and dioxins, will be characterized. PRZM/EXAMS will be used to estimate screening-level exposure of aquatic organisms to these compounds. Terrestrial exposure to HCB and 2,3,7,8-tetrachlorodebenzo-*p*-dioxin (TCDD) will be estimated using TREX, and KABAM, as bioaccumulation is a major transport pathway for these chemicals. The application rate input value will be either the maximum allowed amount of the impurity in the final formulation or an upper estimate of the amount in the final formulation, respectively.

The Screening Imbibition Program (SIP v.1.0, Released June 15, 2010) was used to calculate an upper bound estimate of exposure using DCPA's solubility (0.5 ppm), the most sensitive acute and chronic (not available) avian toxicity endpoints (Bobwhite Quail with LD_{50} >2250 mg/kg-bw), and the most sensitive acute and chronic mammalian toxicity endpoints (Rat LD_{50} >5000 mg/kg-bw and NOAEL = 1000 mg/kg-bw, respectively). Drinking water exposure alone was determined not to be a potential pathway of concern for avian and mammalian species on an acute basis, and mammalian species on a chronic basis. Risk cannot be precluded for avian species on a chronic basis, as there is no acceptable avian reproduction data available for DCPA. Results for mammalian and avian species are presented in Table 11 and Table 12 respectively.

Table 11. Mammalian SIP Results

Parameter	Acute	Chronic
Upper bound exposure (mg/kg-bw)	0.0860	0.0860
Adjusted toxicity value (mg/kg-bw)	3845.8028	769.1606
Ratio of exposure to toxicity	0.0000	0.0001
Conclusion*	**Drinking water exposure alone is NOT a potential concern for mammals**	**Drinking water exposure alone is NOT a potential concern for mammals**

Table 12. Avian SIP Results

Parameter	Acute	Chronic
Upper bound exposure (mg/kg-bw)	0.4050	0.4050
Adjusted toxicity value (mg/kg-bw)	1620.9664	0.0000
Ratio of exposure to acute toxicity	0.0002	0.0000
Conclusion*	**Drinking water exposure alone is NOT a potential concern for birds**	**Due to insufficient data, risk cannot be precluded**
*Conclusion is for drinking water exposure alone. This does not combine all routes of exposure. Therefore, when aggregated with other routes (*i.e.*, diet, inhalation, dermal), pesticide exposure through drinking water may contribute to a total exposure that has potential for effects to non-target animals.		

This pathway will be explored further with the development of SIP v.2.0 in the Ecological Risk Assessment for DCPA. For a sample of the output generated by SIP v.1.0, please see Appendix B. Detailed information about the SIP v.1.0, as well as the tool, can be found on the EPA's website at http://www.epa.gov/pesticides/science/models_pg.htm#terrestrial.

The Screening Tool for Inhalation Risk (STIR v.1.0, November 19, 2010) could not be used to calculate an upper bound estimate of exposure as no valid mammalian inhalation data was available. The inhalation pathway via spray drift of the pesticide may be of potential significance for avian and mammalian species given DCPA's vapor pressure and method of application. In addition, without a valid mammalian inhalation study available the potential differences in toxicity via the inhalation route as compared to the oral cannot be estimated. Therefore, an acute avian inhalation toxicity test is being requested for the bobwhite quail. This study will aid in evaluating this pathway of concern for avian taxa. If inhalation acute toxicity data are not submitted for birds, then risk to birds from acute inhalation exposure to DCPA will be presumed.

Measures of Toxicity

Ecological effect data are used as measures of direct and indirect effects to biological receptors. Data were obtained from registrant-submitted studies. Also, prior to completion of the risk assessment, literature studies identified by ECOTOX will also be incorporated as appropriate. The ECOTOXicology database (ECOTOX) will be searched in order to provide more ecological effects data to bridge existing data gaps. ECOTOX is a source for locating single chemical toxicity data and potential chemical mixture toxicity data for aquatic life, terrestrial plants, and wildlife. ECOTOX was created and is maintained by the USEPA, Office of Research and Development, and the National Health and Environmental Effects Research Laboratory's Mid-Continent Ecology Division (USEPA 2007*d*).

Information on the potential effects of DCPA on non-target animals is also collected from the Ecological Incident Information System (EIIS; USEPA 2007*c*). The EIIS is a database containing adverse effect (typically mortality) reports on non-target organisms where such effects have been associated with the use of pesticides.

Where available, sublethal effects observed in both registrant-submitted and open literature studies will be evaluated qualitatively. Such effects have included behavioral changes (*e.g.*, lethargy, changes in coloration and effects olfaction). Quantitative assessments of risks, though, are limited to those endpoints that can be directly linked to the Agency's assessment endpoints of impaired survival, growth and reproduction.

The assessment of risk for direct effects to non-target organisms makes the assumption that toxicity of DCPA to birds is similar to terrestrial-phase amphibians and reptiles. The same assumption is made for fish and aquatic-phase amphibians.

The acute measures of effect used for animals in this screening-level assessment are the LD_{50}, LC_{50} and EC_{50}. LD stands for "Lethal Dose", and LD_{50} is the amount of a material, given all at once, that is estimated to cause the death of 50% of the test organisms. LC stands for "Lethal Concentration" and LC_{50} is the concentration of a chemical that is estimated to kill 50%

of the test organisms. EC stands for "Effective Concentration" and the EC_{50} is the concentration of a chemical that is estimated to produce a specific effect in 50% of the test organisms. Endpoints for chronic measures of exposure for listed and non-listed animals are the NOAEL/NOAEC and NOEC. NOAEL stands for "No Observed-Adverse-Effect-Level" and refers to the highest tested dose of a substance that has been reported to have no harmful (adverse) effects on test organisms. The NOAEC (*i.e.*, "No-Observed-Adverse-Effect-Concentration") is the highest test concentration at which none of the observed effects were statistically different from the control. The NOEC is the No-Observed-Effects-Concentration. For non-listed plants, only acute exposures are assessed (*i.e.*, EC_{25} for terrestrial plants and EC_{50} for aquatic plants); for listed plants, either the NOAEC or EC_{05} is used.

The Agency will conduct a search of the open literature to ensure that all best available science is utilized. The Agency uses the ECOTOX database as its mechanism for searching the open literature for ecological effects information. ECOTOX integrates three previously independent databases - AQUIRE, PHYTOTOX, and TERRETOX - into a system which includes toxicity data derived predominately from the peer-reviewed literature, for aquatic life, terrestrial plants, and terrestrial wildlife, respectively.

Measures of Risk

Previously completed screening level risk assessments and exceedances of Agency levels of concern indicate a need to further examine and refine phytotoxic risk to aquatic and terrestrial plant species. Analysis of potential indirect effects on listed species (both aquatic and terrestrial) is also required. This analysis plan will be revisited and may be revised depending upon the data available in the open literature and the information submitted by the public in response to the opening of the Registration Review docket.

Use information will be retrieved from registration labels and used as inputs for estimating exposure concentrations from the various use scenarios. DCPA's use patterns (aerial application) suggest potential risk concerns to non-target aquatic and terrestrial plants. The range of potential exposure to DCPA to non-target plants can vary on application method (aerial or ground), application rate, and use pattern.

Integration of Exposure and Effects

Risk characterization is the integration of exposure and ecological effects characterization to determine the potential ecological risk from the use of DCPA on crops listed in **Table 1** and the likelihood of direct and indirect effects to non-target organisms in aquatic and terrestrial habitats. The exposure and toxicity effects data are integrated in order to evaluate the risks of adverse ecological effects on non-target species. For the assessment of DCPA risks, the risk quotient (RQ) method is used to compare exposure and measured toxicity values. EECs are divided by acute and chronic toxicity values. The resulting RQs are then compared to the Agency's LOCs (USEPA 2004). These criteria are used to indicate when DCPA's uses, as directed on the label, have the potential to cause adverse direct or indirect effects to non-target organisms. As noted previously, where data are lacking on the toxicity of DCPA, risk will be presumed.

Deterministic and Probabilistic Assessment Methods

The quantitative assessment of risk will primarily depend on the deterministic point-estimate based approach described in the risk assessment. An effort will be made to further qualitatively describe risk using probabilistic tools that the Agency has developed. These tools have been reviewed by FIFRA Scientific Advisory Panels and have been deemed as appropriate means of refining assessments where deterministic approaches have identified risks.

Drinking Water Assessment

A drinking water assessment will be conducted to support future human health dietary risk assessments of DCPA. The drinking water assessment will incorporate model estimates of DCPA in surface water and ground water. Concentrations of DCPA residues in surface waters will be estimated using PRZM/EXAMS. The major degradates, TPA and MTP, are not naturally-occurring compounds and may be formed in significant quantities. These degradates have not been considered in previous drinking water assessments, however, this will be revisited during the risk assessment process.

An Estimated Drinking Water Concentration (EDWC) of DCPA residues in ground water will be developed. Since DCPA/TCP are among the most frequently detected pesticides in groundwater, in all likelihood, SCI-GROW will not be used. EFED will likely use available monitoring and a refined/Tier 2 groundwater model that is currently being finalized. Output from that model represents the concentrations that might be expected in shallow unconfined aquifers under sandy soils, which is representative of the ground water most vulnerable to pesticide contamination likely to serve as a drinking water source.

The drinking water assessment will also include available surface and ground water monitoring data with consideration of changes in use patterns that may have occurred. States are encouraged to submit monitoring data for review.

Endangered Species Assessments

Consistent with the Agency's responsibility under the Endangered Species Act (ESA), the Agency will evaluate risks to Federally-listed threatened and/or endangered (listed) species from registered uses of DCPA. This assessment will be conducted in accordance with the Overview Document (USEPA, 2004), provisions of the ESA, and the Services' *Endangered Species Consultation Handbook* (USFWS/NMFS, 1998).

The action area is used to identify all listed (threatened and endangered) species and designated critical habitat that could be affected by the Federal action. The Federal action is the authorization or registration of pesticide use or uses as described on the label(s) of pesticide products containing a particular active ingredient. The action area is defined by the Endangered Species Act as, "all areas to be affected directly or indirectly by the Federal action and not merely the immediate are involved in the action" (50 CFR §402.2). Based on an analysis of the Federal action, the action area is defined by the actual and potential use of the pesticide.

In the case of nationwide ecological risk assessment conducted for DCPA under Registration Review, the action area will encompass the entire United States and its territories. The purpose of defining the action area as the entire United States and its territories is to ensure that the initial area of consideration encompasses all areas where DCPA may be used now and in the future, including the potential for off-site transport via spray drift and downstream dilution. Additionally, the concept of a nationwide action area takes into account the potential for direct and indirect effects and any potential modification to critical habitat based on ecological effect measures associated with reduction in survival, growth, and reproduction, as well as the full suite of sublethal effects available in the effects literature. It is important to note that the nationwide action area does not imply that direct and/or indirect effects and critical habitat modification are expected to or are likely to occur over the full extent of the action area, but rather to identify all listed species and critical habitat that may potentially be affected by the action. The Agency will use more rigorous analysis including consideration of available land cover data, toxicity data, and exposure information to determine areas where individual listed species and designated critical habitat may be affected or modified via endpoints associated with reduced survival, growth, or reproduction.

Endocrine Disruptor Screening Program

As required under FFDCA section 408(p), EPA has developed the Endocrine Disruptor Screening Program (EDSP) to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, and or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Between October 2009 and February 2010, EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. This list of chemicals was selected based on the potential for human exposure through pathways such as food and water, residential activity, and certain post-application agricultural scenarios. This list should not be construed as a list of known or likely endocrine disruptors.

DCPA is among the group of 58 pesticide active ingredients receiving EDSP test orders. For information on the status of the orders issued under the EDSP for each chemical, please visit our website at http://www.epa.gov/endo/ and click on the "Status of EDSP Orders/DCIs" in the Highlights Box. Additional information on the EDSP, including the policies and procedures, the list of 67 chemicals, the test guidelines and the Tier 1 screening battery, can also be found at this website.

Preliminary Identification of Data Gaps

Environmental Fate

Several environmental fate studies have not been submitted, including: acceptable studies on the photolysis of DCPA in water, aerobic aquatic metabolism, anaerobic soil metabolism, and anaerobic aquatic metabolism. Additionally, anaerobic soil metabolism studies and terrestrial field dissipation studies were considered supplemental and therefore, the value of the information provided in the studies is limited. The photolysis data for soil indicate that DCPA is most likely stable to photolysis in water and an assumption that DCPA is stable was made. Metabolism in the aerobic aquatic environment was estimated using the aerobic soil study which was conducted under very moist conditions and at high temperatures (30^{o}C). DCPA was assumed to be stable to anaerobic metabolism because it is not known if an anaerobic environment was present in the submitted study. While data from terrestrial field dissipation studies do not allow the calculation of dissipation rates, they do provide some information on the degradates of concern likely to be found in the environment and on the mobility of DCPA and TPA. Any future terrestrial field dissipation study should include measurement of the volatilization of DCPA

TPA, a major degradate of DCPA, did not undergo any degradation in the aerobic soil metabolism study. It is more stable and more water soluble than DCPA and thus, higher exposure concentrations are likely. Little data are available on the environmental fate or toxicity of TPA.

The final environmental fate data gaps involve label information. The labels do not specify a maximum number of applications or a minimum application interval. Assumptions will be made using the best information available for each use scenario. However, conservative assumptions will be unless labels are clarified to specify maximum annual application rates.

The status of environmental fate studies for the parent compound is presented in Table 17. In addition to the data gaps noted for the parent, EFED notes the need for a full suite of studies, with the exception of soil photolysis, for the TPA degradate. EFED does not anticipate requiring any environmental fate-related data for HCB and dioxin. The following studies are required for the TPA degradate:

- Guideline 835.2120 Hydrolysis
- Guideline 835.2240 Aqueous Photolysis
- Guideline 835 4100 Aerobic Soil Metabolism
- Guideline 835 4200 Anaerobic Soil Metabolism
- Guideline 835 4300 Aerobic Aquatic Metabolism
- Guideline 835 4400 Anaerobic Aquatic Metabolism
- Guideline 835 1230/40 Adsorption/ desorption and Leaching
- Guideline 835 6100 Terrestrial Field Dissipation
- Guideline 835 1730 Fish Bioconcentration

Table 13. Environmental fate data requirement table for parent DCPA

OPPTS Guideline	Data Requirement	Submitted Studies (MRID)	Classification	Data Gap?	Comments
835.2120	Hydrolysis	00114648	Acceptable	No	
835.2240	Aqueous photolysis	143063; 41508607	Unacceptable	No	Technically, this is a gap in guideline studies; however, there is not much evidence that photolysis is going to be a route. Therefore, we will continue to assume stability.
835.2410	Soil photolysis	41508608	Acceptable	No	
835.4100	Aerobic soil metabolism	00114649; 41648801; 00114652	Supplemental	No	Data from a new study would be of limited utility
835.4200	Anaerobic soil metabolism	00114651; 41648802	Supplemental	No	Data from a new study would be of limited utility
835.4300	Aerobic aquatic metabolism	No studies		Yes	Data are needed
835.4400	Anaerobic aquatic metabolism	No studies		No	Data from a new study would be of limited utility
835.1230 835.1240	Adsorption/ desorption and leaching	41648803	Supplemental	No	
		41648804	Acceptable		
		43661101	Acceptable		
835.6100	Terrestrial field dissipation	41508609	Supplemental	Yes	The field studies, though limited, suggest that DCPA/TPA may persist longer than what is predicted in the lab metabolism studies. A new study could be used to confirm persistence of both parent AND degradates. In the absence of such data, EFED assumes that DCPA moves off site because of the evidence from field measurements.
		41508610	Supplemental		
850.1730	Fish bioconcentration	41155716	Acceptable	No	

Effects

Although many submissions have been made to provide data on the effects of DCPA to aquatic and terrestrial organisms, numerous data gaps exist (Tables 18, 19 and 20). Previously submitted acute toxicity data for DCPA has been found to be insufficient for use in quantitative assessment, and as a result new acute aquatic toxicity data for fish, aquatic invertebrates, and aquatic plants (vascular and non-vascular) are needed. Chronic aquatic toxicity data for fish or aquatic invertebrates for DCPA were never submitted by the registrant. Chronic toxicity data in particular are important to this ecological risk assessment given the high Kow, persistence, and bioconcentration potential of DCPA. In addition, submitted chronic avian reproductive toxicity data were found to be insufficient and not reliable for use in a quantitative risk assessment, there are questions regarding the health of the birds and as a result new chronic avian toxicity studies are needed.

Due to the potential for persistence and movement into water for both the parent, DCPA, and the degradate, TPA, a full suite of aquatic toxicity (both acute and chronic) data are needed to evaluate the potential risk to freshwater and estuarine/marine fish, aquatic invertebrates, and aquatic plants, resulting from use of DCPA, and subsequent degradation to TPA.

The log K_{ow} of DCPA is 4.28-4.40 and therefore, as the log K_{ow} is greater than 3 for the parent DCPA, the data requirement of both freshwater and marine whole sediment acute toxicity data was triggered.

A major uncertainty is the amount of dioxins and HCB in technical DCPA, therefore more information is needed to characterize risk to non-target organisms relative to the amount of the contaminant(s) they are exposed to.

Acute avian oral toxicity data need to be submitted for a passerine species exposed to DCPA. Although the available acute oral toxicity data for bobwhite quails, when compared to estimated environmental concentrations, indicate that levels of concern are not exceeded for birds on an acute basis, the high application rate of DCPA indicate that any small change in toxicity could result in a change to the risk conclusions. In addition, passerine species have higher metabolic rates due to their smaller sizes, than either waterfowl or upland game bird species and because they may utilize different metabolic pathways, they may be more sensitive to DCPA. In order to properly characterize risk to passerines, an avian oral toxicity test is required for passerine birds.

DCPA is considered to be volatile, and is frequently found at great distances from applied field locations. As a result, more information is needed to evaluate other potential exposure pathways to non-target avian species. In addition, there is no valid mammalian inhalation study available to estimate potential differences in toxicity via the inhalation route as compared to the oral. Therefore, an acute avian inhalation toxicity test is being requested using the most sensitive avian species as shown by avian acute oral studies. The study being requested will aid in evaluating this pathway of concern for avian taxa. An avian inhalation study protocol must be submitted for review and approval by the Agency prior to initiation of this study. If inhalation acute toxicity data are not submitted for birds, then risk to birds from acute inhalation exposure to DCPA will be presumed.

As an herbicide, it is important to identify the potential risk to non-target plants. A revised terrestrial plant study was requested by the Agency using different plant species at publication of the RED in 1998 for DCPA. At this date, these studies have not been submitted and therefore are considered data gaps. Without submission of these data, it is not possible to make an effects determination for plants or animals that depend on plants for food or shelter.

More thorough rationale for the data is contained in **Appendix C**. There will be a revision of the risk assessment in the event that new or revised information becomes available that changes the outcome or determinations made in this document. The following data needs may result in reassessment of risks. Other changes may be made if current information is substantially re-evaluated.

The terrestrial studies listed below are requested for the parent, DCPA, and the seedling emergence study is also requested for its major degradate, TPA, to increase certainty in the risk estimation.

- Guideline Number: Non-guideline, Study Title: Avian Inhalation Toxicity, DCPA only.
- Guideline Number: 850.2100, Study Title: Acute Avian Oral Toxicity Test using a Passerine species, DCPA only.
- Guideline Number: 850.2300, Study Title: Avian Reproduction, Two species, DCPA only.
- Guideline Number: 850.4100, Study Title: Tier II Seedling Emergence Toxicity Testing – Terrestrial Plants, non-tolerant species, extended study time (28-days).
- Guideline Number: 850.4150, Study Title: Tier II Vegetative Vigor Toxicity Testing– Terrestrial Plants, non-tolerant species, extended study time (28-days).

The full suite of aquatic toxicity studies below are requested for the parent, DCPA, and its major degradate, TPA, to increase certainty in the risk estimation.

- Guideline Number: 850.1010, Study Title: Acute Toxicity to Freshwater Invertebrates, Daphnid (*Daphnia magna*) is the preferred species.
- Guideline Number: 850.1025, Study Title: Oyster (*Crassostrea virginica*) Acute Toxicity Test (shell deposition)
- Guideline Number: 850.1035, Study Title: Mysid (*Mysidopsis bahia*) Acute Toxicity Test
- Guideline Number: 850.1075, Study Title: Freshwater Fish Toxicity, Rainbow trout (*Oncorhynchus mykiss*) and Bluegill sunfish (*Lepomis macrochirus*) are the preferred species.
- Guideline Number: 850.1075 , Study Title: Estuarine/Marine Fish Acute Toxicity, Sheepshead minnow (*Cyprinodon variegates*) is the preferred species
- Guideline Number: 850.1300, Study Title: Aquatic Invertebrate Life Cycle Toxicity Daphnid (*Daphnia magna*) is the preferred species.
- Guideline Number: 850.1350, Study Title: Aquatic Invertebrate Life Cycle Toxicity (estuarine/marine) Mysid shrimp (*Mysidopsis bahia*) is the preferred species.
- Guideline Number: 850.1400, Study Title: Early Life-Stage Toxicity Test, Rainbow trout (*Oncorhynchus mykiss*) and Bluegill sunfish (*Lepomis macrochirus*) are the preferred species.
- Guideline Number: 850.1400, Study Title: Early Life-Stage Toxicity Test, Sheepshead minnow (*Cyprinodon variegates*) is the preferred species.
- Guideline Number: 850.1735, Study Title: Whole Sediment Acute Toxicity invertebrates, freshwater.
- Guideline Number: 850.1740, Study Title: Whole Sediment Acute Toxicity invertebrates, marine.
- Guideline Number: 850.4400, Study Title: Aquatic Plant Toxicity Test Using *Lemna* spp., Tier II.
- Guideline Number: 850.5400, Study Title: Algal Toxicity Test, Tier II – The four species typically submitted are *Pseudokirchneriella subspicata* (formerly *Selanastrum capricornutum*), a freshwater green algae; *Anabaena flos-aquae*, a

freshwater cyanobacterium; *Navicula pelliculosa*, a freshwater pinnate diatom and *Skeletonema costatum*, an estuarine/marine centric diatom.

Table 18. Available Ecological Effects Data for Terrestrial Animals Exposed to DCPA and Remaining Data Gaps.

Guideline	Description	MRID	Classification	Data Gap?	Comments
850.2100	Avian oral toxicity	41155705	Acceptable	No	*There are questions regarding the health of the birds, in both avian reproduction studies and as a result the studies are classified as Supplemental, and are considered data gaps. **The formulation was not clearly identified in the study; therefore, the TGAI is considered a data gap. However, due to low mortality (3.2% at 220 µg/bee), the study is not necessary to call in at this time.
850.2200	Avian dietary toxicity	41155706	Acceptable	No	
		41155707	Acceptable		
850.2300	Avian reproduction	47550001	Supplemental	**Yes***	
		47550002	Supplemental		
850.3020	Honeybee acute contact toxicity	00018842	Supplemental	**Yes****	

Table 19. Available Ecological Effects Data for Aquatic Animals Exposed to DCPA and Remaining Data Gaps.

Guideline	Description	MRID	Classification	Data Gap?	Comments
850.1075	Freshwater fish – Acute toxicity	41054827	Supplemental	**Yes**	Issues with solubility, precipitated out over time, measured samples were not centrifuged. Test system should be flow-through.
		41054826	Supplemental		
		40227001, TN0908	Supplemental		Form. product W-75, limited information
		40227002, TN0878	Supplemental		Form. product W-75, 10% mortality in highest treatment level.
		00107142, TN0481	Supplemental		Solubility issues – addition of acetone as solvent apparently increased toxicity of product to fish.
		00114686, TN0711	Supplemental		2 active ingredient's (chlordane & DCPA); no information provided on solubility problems
		TN0437	Supplemental		Concentrations were not measured

Guideline	Description	MRID	Classification	Data Gap?	Comments
		00045822	Supplemental		Study was only 48h, 30% mortality in highest concentration, Used Dacthal W-75.
		40098001	Invalid		Solubility issues with TGAI, nominal only, Solvent concentrations were not known.
850.1400	Freshwater fish – early life stage test	No data	No data	**Yes**	The submission of studies is needed.
850.1010	Freshwater invertebrates – Acute toxicity	40226901, TN0933	Supplemental	**Yes**	Issues with solubility of chemical (TGAI only), which is expected with such a low solubility limit in water (0.5 ppm). Definitive EC_{50} and NOAEC values cannot be determined. Test concentrations were not measured.
		40098001	Supplemental & Invalid		
850.1300	Freshwater invertebrate – life cycle test	No data	No data	**Yes**	The submission of studies is needed.
850.1075	Saltwater fish – Acute toxicity	40228401	Supplemental	**Yes**	Issues with solubility of chemical, which is expected with such a low solubility limit in water (0.5 ppm). Test concentrations were not measured, and the exchange rate as a flow-through study was not provided. Definitive EC_{50} and NOAEC values cannot be determined.
850.1025 850.1035 850.1045 850.1055	Saltwater invertebrates – Acute toxicity	40228401	Supplemental	**Yes**	
850.1400	Saltwater fish – early life stage test	No data	No data	**Yes**	The submission of studies is needed.
850.1350	Saltwater invertebrates – life cycle test	No data	No data	**Yes**	

Table 14. Available Ecological Effects Data for Plants Exposed to DCPA and Remaining Data Gaps.

Guideline	Description	MRID	Classification	Data Gap?	Comments
850.4100	Terrestrial Plant toxicity: seedling emergence (Tiers 1 and 2)	41564901	Supplemental	**Yes**	Test material was not applied to the maximum labeled rate to determine possible EC values. DCPA was not applied at low enough rates to determine the NOAEC for corn, lettuce, and oat radicle length. An EC_{25} value was calculated for the Tomato data; however, due to the lack of raw data a NOAEC could not be definitively calculated. It was recommended that additional studies be conducted following specific guidelines as outlined below in Appendix D after the study review in 1992. Since that time, new data has not been submitted, and is still considered a data gap.
850.4150	Terrestrial Plant toxicity: vegetative vigor (Tiers 1 and 2)	41440101	Supplemental	**Yes**	The percent active ingredient was not specified, the material was not applied to the maximum labeled rate, and only one parameter (fresh weight) was measured and recorded. It was recommended that additional studies be conducted following specific guidelines as outlined below in Appendix D after the study review in 1992. Since that time, new data has not been submitted, and is still considered a data gap.
850.5400	Aquatic Plant Growth: algae (Tier 1 & 2)	42836102	Invalid	**Yes**	Potential issues (interference) with the solvent. Test concentrations were not measured, above solubility limit without knowing the actual concentration that test species were exposed to. Test solutions were cloudy white with the presence of a precipitate, and were neither centrifuged nor measured. Tier II studies are needed to establish definitive EC_{50} and NOAEC values. The submission of new studies is needed.
		42836103	Invalid		
		42882401	Invalid		

Guideline	Description	MRID	Classification	Data Gap?	Comments
850.4400	Aquatic Plant Growth: vascular plants (Tier 1 & 2)	42836101	Invalid	**Yes**	Not a sufficient limit test. Potential issues (interference) with the solvent. Test concentration was not measured, above solubility limit without knowing the actual concentration that test species was exposed to. Test solutions were cloudy white with the presence of a precipitate, and were neither centrifuged nor measured. A Tier II study is needed to establish definitive EC_{50} and NOAEC values. The submission of new studies is needed.

Other Information Needs

There is specific information that will assist the Agency in refining the ecological risk assessment, including any species-specific effects determinations. The Agency is very much interested in obtaining the following information:

1. confirmation on the following label information
    a. frequency of application, application intervals, and maximum number of applications per season
    b. geographic limitations on use
2. use or potential use distribution (e.g., acreage and geographical distribution of relevant crops)
3. use history
4. median and 90th percentile reported use rates (lbs. a.i./acre) from usage data – national, state, and county
5. application timing (date of first application and application intervals) by crop – national, state, and county
6. sub-county crop location data
7. usage/use information for non-agricultural uses (e.g., forestry, residential, rights-of-way)
8. directly acquired county-level usage data (not derived from state level data)
    a. maximum reported use rate (lbs. a.i./acre) from usage data – county
    b. percent crop treated – county
    c. median and 90th percentile number of applications – county
    d. total pounds per year – county
    e. the year the pesticide was last used in the county/sub-county area
    f. the years in which the pesticide was applied in the county/sub-county area
9. typical interval (days)
10. state or local use restrictions
11. ecological incidents (non-target plant damage and avian, fish, reptilian, amphibian and mammalian mortalities) not already reported to the Agency
12. monitoring data

13. the amount of dioxins/furans, and HCB present in technical DCPA.

The analysis plan will be revisited and may be revised depending upon the data available in the open literature and the information submitted by the public in response to the opening of the Registration review docket.

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Appendix A. Maximum DCPA use rates and management practices by crop based on current labels.

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
NON-FOOD/NON-FEED USES							
golf course turf	15	lb A	FlC	NS	NS	NS	Sprayer //Broadcast (a)
nursery stock	12	lb A	WP	NS	NS	NS	Aircraft/ Sprayer/ Sprinkler irrigation //Soil treatment (a)
ornamental and/or shade trees	9	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	.2410	lb 1K sq.ft *C2	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.609E-04	lb sq.ft *C2	G	NS	NS	NS	Spreader //Soil treatment (c)
ornamental ground cover	2.609E-04	lb sq.ft *C2	G	NS	NS	NS	Spreader //Soil treatment (a)
ornamental herbaceous plants	9	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	.2410	lb 1K sq.ft *C2	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.609E-04	lb sq.ft *C2	G	NS	NS	NS	Spreader //Soil treatment (c)
ornamental lawns and turf	15	lb A	FlC G	NS	NS	NS	Sprayer/ Spreader //Broadcast/ Soil broadcast treatment (a)
	.3500	lb 1K sq.ft *C2	G	NS	NS	NS	Spreader //Soil broadcast treatment (b)
ornamental nonflowering plants	9	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	.2410	lb 1K sq.ft *C2	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.609E-04	lb sq.ft *C2	G	NS	NS	NS	Spreader //Soil treatment (c)
ornamental sod farm (turf)	15	lb A	FlC	NS	NS	NS	Sprayer //Broadcast (a)
ornamental woody shrubs and vines	9	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	.2410	lb 1K sq.ft *C2	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.609E-04	lb sq.ft *C2	G	NS	NS	NS	Spreader //Soil treatment (c)
recreation area lawns	15	lb A	FlC	NS	NS	NS	Sprayer //Broadcast (a)
residential lawns	.3500	lb 1K sq.ft *K1	G	NS	NS	NS	Spreader //Soil broadcast treatment (a)

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
FOOD/FEED USES							
arrowroot	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Ground/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
beans, dried-type	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A2	G	NS	NS	NS	Not on label //Soil treatment (b)
beans, succulent (snap)	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A2	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.078E-04	lb sq.ft *A1	G	NS	NS	NS	Spreader //Soil treatment (c)
brassica (head and stem) vegetables	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
broccoli	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.078E-04	lb sq.ft *A1	G	NS	NS	NS	Spreader //Soil treatment (c)
broccoli raab	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
brussels sprouts	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
							treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
cabbage	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.078E-04	lb sq.ft *A1	G	NS	NS	NS	Spreader //Soil treatment (c)
cabbage, chinese	10.5	lb A	WP	NS	NS	NS	Aircraft/ Soil incorporation equipment/ Sprayer/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment (a)
canola\rape	10.5	lb A	WP	NS	NS	NS	Aircraft/ Soil incorporation equipment/ Sprayer/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment (a)
cauliflower	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.078E-04	lb sq.ft *A1	G	NS	NS	NS	Spreader //Soil treatment (c)
chayote	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Ground/ Shaker can/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
collards	10.5	lb A	FlC G	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
			WP				Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
cucumber	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
eggplant	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
garlic	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
gherkin	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
ginseng (medicinal)	10.5~	lb A	WP	NS	NS	NS	Sprayer //Soil broadcast treatment (a)
gourd (wax), chinese	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
gourds	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
groundcherry (strawberry tomato/tomatillo)	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
hanover salad	10.5	lb A	FlC	NS	NS	NS	Aircraft/ Ground/ Soil

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
			G WP				incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
horseradish	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
kale	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
lettuce, head	10.21	lb A	WP	1/cc	NS	NS	Sprayer //Spray (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
lettuce, leaf (black seeded simpson, salad bowl, etc.)	10.21	lb A	WP	1/cc	NS	NS	Sprayer //Spray (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
manioc (cassava)	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Ground/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
melons	10.21	lb A	WP	NS	NS	NS	Sprayer //Spray (a)
melons, bitter (balsam pear)	10.5	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
melons, cantaloupe	10.5	lb A	FlC	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
melons, honeydew	10.5	lb A	FlC	NS	NS	NS	Aircraft/ Ground/ Soil

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
							incorporation equipment/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
melons, musk	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
melons, water	10.5	lb A	FlCG WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
momordica spp.	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
	.2406	lb 1K sq.ft *A1	G	NS	NS	NS	Shaker can //Soil treatment (b)
mustard	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A2	G	NS	NS	NS	Not on label //Soil treatment (b)
onion	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.078E-04	lb sq.ft *A1	G	NS	NS	NS	Spreader //Soil treatment (c)
onions (green)	10.5	lb A	FlC	NS	NS	NS	Aircraft/ Ground/ Soil

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
			G WP				incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
onions (scallions)	10.5	lb A	FlC G	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
peas, southern	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A2	G	NS	NS	NS	Not on label //Soil treatment (b)
pepino (melon pear)	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
pepper	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
potato, white/irish	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A2	G	NS	NS	NS	Not on label //Soil treatment (b)
radish	10.5	lb A	FlC WP	NS	NS	NS	Soil incorporation equipment/ Sprayer/ Sprinkler irrigation //Chemigation/ Soil band treatment (a)
shallot	10.5	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
squash (all or unspecified)	10.21	lb A	WP	NS	NS	NS	Sprayer //Spray (a)
squash (summer)	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
squash (winter) (hubbard)	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.410E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (b)
strawberry	10.5	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)
	2.078E-04	lb sq.ft	G	NS	NS	NS	Spreader

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
		*A1					//Soil treatment (b)
	2.008E-04	lb sq.ft *A1	G	NS	NS	NS	Not on label //Soil treatment (c)
sweet potato	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
	2.078E-04	lb sq.ft *A1	G	NS	NS	NS	Spreader //Soil treatment (b)
taro	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Ground/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
tomatillo	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
tomato	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A2	G	NS	NS	NS	Not on label //Soil treatment (b)
	2.078E-04	lb sq.ft *A1	G	NS	NS	NS	Spreader //Soil treatment (c)
turmeric	10.5	lb A	G WP	NS	NS	NS	Aircraft/ Ground/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil treatment (a)
turnip (greens)	10.5	lb A	FlC G WP	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/ Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A2	G	NS	NS	NS	Not on label //Soil treatment (b)
turnip (root)	10.5	lb A	FlC G	NS	NS	NS	Aircraft/ Ground/ Soil incorporation equipment/

Use Site	Max. Rate per App	Max. Rate Unit/Area *UG	Form	Max.# Apps cc & yr	Max. App Rate/ cc & yr	Min. App Interval (days)	Application Equipment //Type (Reg # Code)
			WP				Sprayer/ Spreader/ Sprinkler irrigation //Chemigation/ Soil band treatment/ Soil broadcast treatment/ Soil incorporated treatment/ Soil treatment (a)
	2.410E-04	lb sq.ft *A2	G	NS	NS	NS	Not on label //Soil treatment (b)
yam	10.35	lb A	G	NS	NS	NS	Spreader //Soil treatment (a)

Appendix B. Output generated by SIP v.1.0

Table 1. Inputs

Parameter	**Value**
Chemical name	DCPA
Solubility (in water at 25°C; mg/L)	0.5
Mammalian LD_{50} (mg/kg-bw)	5000
Mammalian test species	laboratory rat
Body weight (g) of "other" mammalian species	
Mammalian NOAEL (mg/kg-bw)	1000
Mammalian test species	laboratory rat
Body weight (g) of "other" mammalian species	
Avian LD_{50} (mg/kg-bw)	2250
Avian test species	northern bobwhite quail
Body weight (g) of "other" avian species	
Mineau scaling factor	1.15
Mallard NOAEC (mg/kg-diet)	0
Bobwhite quail NOAEC (mg/kg-diet)	0
NOAEC (mg/kg-diet) for other bird species	
Body weight (g) of other avian species	
NOAEC (mg/kg-diet) for 2nd other bird species	
Body weight (g) of 2nd other avian species	

Table 2. Mammalian Results

Parameter	**Acute**	**Chronic**
Upper bound exposure (mg/kg-bw)	0.0860	0.0860
Adjusted toxicity value (mg/kg-bw)	3845.8028	769.1606
Ratio of exposure to toxicity	0.0000	0.0001
Conclusion*	**Drinking water exposure alone is NOT a potential concern for mammals**	**Drinking water exposure alone is NOT a potential concern for mammals**

Table 3. Avian Results

Parameter	**Acute**	**Chronic**
Upper bound exposure (mg/kg-bw)	0.4050	0.4050
Adjusted toxicity value (mg/kg-bw)	1620.9664	0.0000
Ratio of exposure to acute toxicity	0.0002	0.0000
Conclusion*	**Drinking water exposure alone is NOT a potential concern for birds**	**Due to insufficient data, risk cannot be precluded**

*Conclusion is for drinking water exposure alone. This does not combine all routes of exposure. Therefore, when aggregated with other routes (*i.e.*, diet, inhalation, dermal), pesticide exposure through drinking water may contribute to a total exposure that has potential for effects to non-target animals.

Appendix C: Additional Information for DCI Rationale

Environmental Fate

Ecological Effects

Fish, Aquatic Invertebrates and Aquatic Plants: Previously submitted DCPA TGAI toxicity data for freshwater and estuarine/marine fish, aquatic invertebrates and aquatic plants (vascular and non-vascular) are not acceptable, as there were issues with the solubility of the technical grade compound. The solubility of the DCPA is an issue that was not properly examined in the previously submitted studies for fish, aquatic invertebrates, and aquatic plants. Without measurement or centrifugation of the water samples, especially in the presence of precipitates, the actual dissolved soluble concentration the test organisms were exposed to is not known. The actual soluble, dissolved concentrations are likely lower than the nominal concentrations, resulting in a potential underestimation of risk to aquatic species. Therefore, new TGAI acute and chronic toxicity data are required for fish, aquatic invertebrates, and aquatic plants for DCPA.

No toxicity data are currently available to assess the risk of the DCPA degradate TPA to freshwater and estuarine/marine fish, aquatic invertebrates, and aquatic plants (vascular and non-vascular). Given the structural similarity between the parent chemical and the major degradate, the degradate may retain the toxicological properties of the parent. In addition, TPA is mobile and persistent, and has been detected in ground/surface water. Therefore, both acute and chronic toxicity data is needed to evaluate the risk potential resulting from the degradation of DCPA to TPA in the aquatic environment.

The log K_{ow} of DCPA is 4.28-4.40 and therefore, as the log K_{ow} is greater than 3 for the parent DCPA, the data requirement of both freshwater and marine whole sediment acute toxicity data was triggered. As acute sediment toxicity data for neither freshwater nor marine organisms were ever submitted to the Agency, this data requirement is considered a data gap. In addition, both fish and oyster BCF studies indicate that DCPA bioaccumulates in both test organisms. Thus indicating that bioaccumulation may be a potentially important pathway in aquatic organisms. In the fish BCF study a trace amount of the MTP degradate was observed in both fish viscera and whole fish tissue, with the greatest amount accumulating on day 14 of 30.

Although there is limited information regarding the log K_{ow} for the two the major degradates of DCPA, estimated values using data from EPI Suite version 3.20 (which used the SMILES string from Table 2 as input) determined values for TPA and MTP. For TPA the log K_{ow} was 2.13 and the log K_{ow} for MTP was 3.19, respectively. From this information, it can be understood that there is the potential for bioaccumulation in both organisms and the environment. Due to the significant amount of TPA reported in the environment via monitoring data, both BCF and sediment toxicity studies are needed to better characterize the risk to non-target organisms resulting from use of DCPA. Therefore, whole sediment toxicity for the parent DCPA, and bioaccumulation (BCF) and whole sediment (both acute and chronic) toxicity studies for the two major degradates, are needed to better characterize risk to non-target aquatic organisms.

Birds: An acute avian inhalation toxicity test is being requested using the bobwhite quail, the species that was tested in the acute oral studies. The study being requested will aid in evaluating this pathway of concern for avian taxa. An avian inhalation study protocol must be submitted for review and approval by the Agency prior to initiation of this study. If inhalation acute toxicity data are not submitted for birds, then risk to birds from acute inhalation exposure to DCPA will be presumed.

It is likely that, for most pesticide use patterns, passerines are more likely to be exposed to pesticides than upland game species and waterfowl. Because passerine species have higher metabolic rates due to their smaller sizes than either waterfowl or upland game bird species and because they may utilize different metabolic pathways, they may be more or less sensitive to DCPA. In order to properly characterize risk to passerines, an avian oral toxicity test is required for passerine birds. A passerine study protocol must be submitted for review by the Agency prior to initiation of the study.

Terrestrial Plants*:* The toxicity studies that were submitted did not provide enough information to definitively estimate the toxicity of DCPA to terrestrial plants. Both seedling emergence and vegetative vigor tests should be conducted for a minimum of 28 days to accommodate the delayed mode of action (mitotic disruption) of DCPA. In mitotic disruption, the chemical first will stop the growth of roots and shoots of seedlings. Then after a period of time it causes deterioration. This delay may be several weeks depending on environmental conditions and species tested, and the species that were tested originally were considered tolerant species, and others need to be used in subsequent studies.

The following information should be required from each replicate of the seedling emergence tests:

- Percentage of emergence and survival of seedlings every seven days;
- Height of shoots every seven days; and
- Fresh weights and dry weights of shoots at study termination

The following information should be required from each replicate of the vegetative vigor tests:

- Plant height every seven days
- Phytotoxicity rating every seven days; and
- Fresh weight of foliage, dried weight of foliage, fresh weight of roots, dried weight of roots at test termination.