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

APR 19 1994

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT Ecological Effects Branch Chapter for Metalaxyl
(Shaughnessy # 113501) for Registration
Eligibility Document (D197034)

TO Linda Propst, PM 73
Special Review and Registration Division 7508W

FROM Anthony F. Maciorowski, Chief *Anthony F. Maciorowski*
Ecological Effects Branch
Environmental Fate and Effects Division 7507C

Attached is the Ecological Effects Branch Chapter for the Metalaxyl Reregistration Eligibility Document.

The fungicide Metalaxyl is characterized as slightly toxic to freshwater fish, invertebrates and aquatic plants, and non-toxic to birds and honey bees.

EEB concludes that there are minimal risks to birds and aquatic organisms from exposure to Metalaxyl. The registered uses of Metalaxyl do not present a hazard to endangered terrestrial animals or plants species.

For additional information, contact Joseph Sylvester, Ecological Effects Branch at 305-7463.



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Ecological Effects Branch
Reregistration Eligibility Document (RED) for
Metalaxyl

This document presents the Ecological Effects Chapter for the Metalaxyl RED. The systemic fungicide Metalaxyl is registered for use on over 100 agricultural crops and seed treatments. Metalaxyl is also registered for ornamental and turf uses. Information pertaining to this RED Chapter was obtained from the LUIS Report dated July 11, 1991.

I. Ecological Hazard
Data requirements and review summations

A. Avian
1. Acute

GLN #	Test Type	MRID	Date	Class.	% AI	Result
71-1a	mallard acute LD ₅₀	234439	1977	core	96.9	LD ₅₀ 1466 mg/Kg
71-2a	quail, dietary LC ₅₀	77335	1977	core	96.9	LC ₅₀ > 10,000 ppm
71-2b	mallard, dietary LC ₅₀	63989	1977	core	96.9	LC ₅₀ > 10,000 ppm
71-2b	Japanese quail, LC ₅₀	234439	1976	suppl.	tech.	LC ₅₀ > 10,000 ppm

The minimum data requirements required to establish toxicity of Metalaxyl to birds are, 1) an avian acute oral LD₅₀ for one waterfowl species or upland game bird species, 2) a dietary LC₅₀ for one waterfowl species and 3) a dietary LC₅₀ for one upland game bird. The preferred test species are the mallard duck (waterfowl) and bobwhite quail (upland game bird). The acute oral LD₅₀ of Metalaxyl to the mallard duck is 1,466 mg/Kg, while the subacute LC₅₀ value to the mallard and bobwhite quail are greater than 10,000 ppm. Based on these data, Metalaxyl has been characterized as being practically non-toxic to avian species on a dietary basis and slightly toxic on an acute basis. These data fulfill the minimum avian toxicity data requirements for metalaxyl.

2. Chronic

Avian reproduction studies on an upland gamebird (bobwhite quail preferred and waterfowl (mallard duck preferred) are required when a chemical has a widespread use (metalaxyl is registered on over 100 agricultural crops), is labelled for multiple applications and is persistent in the field. There are no avian reproduction studies in the current metalaxyl database. These studies are required so the chronic risk of metalaxyl to birds can be assessed.

B. Freshwater fish- Acute tests

GLN #	Test Type	MRID	Date	Class.	% AI	Result
72-1a	Bluegill, acute LC ₅₀	236854	1978	core	94.4	LC ₅₀ 150mg/L
72-1a	Bluegill acute LC ₅₀	71302	1979	core	95.1	LC ₅₀ 139mg/L
72-1	Rainbow trout LC ₅₀	71303	1979	core	95.1	LC ₅₀ 132mg/L
72-1	Rainbow trout LC ₅₀	100447	1979	core	94.4	LC ₅₀ 130mg/L

The minimum data required to establish toxicity of Metalaxyl to fish is a 96-hour acute toxicity test with a coldwater and a warmwater species. The preferred species are the Rainbow trout and Bluegill sunfish.

The 96-hour LC₅₀ values for Bluegill sunfish and Rainbow trout are 139 and 130 ppm respectively. Based on these data, Metalaxyl can be characterized as being practically non-toxic to freshwater fish. These data fulfill the minimum data requirements for establishing the toxicity of technical Metalaxyl to fish.

Acute tests- Formulation

GLN #	Test Type	MRID	Date	Class.	% AI	Result
72-1b	Bluegill TEP EC ₅₀	71301	1979	Suppl	27.9	EC ₅₀ 27mg/L
72-1b	Rainbow trout EC ₅₀	72396	1979	Suppl	27.9	EC ₅₀ 18.4 mg/L

Formulated product testing was required on fish by the Guidance for the Reregistration of Pesticide Products Containing Metalaxyl as the Active Ingredient (1988). The 96 hour EC₅₀ values of Ridomil 2E-G (27.9% AI) to the Bluegill and Rainbow trout are 27 and 18.4 ppm respectively. Based on these data, the formulated product can be characterized as being slightly toxic to freshwater fish. These data fulfill the minimum data requirements for establishing the toxicity of formulated Metalaxyl to fish.

Chronic Test- Early Life Stage

GLN #	Test Type	MRID	Date	Class	% AI	Result
72-4(a)	Fathead minnow	71308	1980	core	90.1	NOEC 9.1mg/L

The fish early life stage is required to support reregistration of Metalaxyl as its presence in water is likely to be continuous, recurrent or persistent, and multiple applications of the chemical may occur. The minimum data required to establish chronic toxicity of Metalaxyl to fish is the early life stage toxicity test based on survival of fish embryos and post-hatch larvae. The results of the toxicity tests of Metalaxyl to Fathead minnow eggs and fry were submitted and reviewed 3/16/80. The highest concentration tested was 9.1 mg/L. Due to 90-100% survival the NOEC was established at 9.1 mg/L. Based on these data, Metalaxyl can be characterized as being slightly toxic to freshwater fish eggs and larvae. These data fulfill the minimum data requirements for establishing the chronic toxicity of Metalaxyl to fish.

C. Aquatic Invertebrates

GLN #	Test Type	MRID	Date	Class.	% AI	Result
72-2	Daphnia LC ₅₀	244183	1979	core	95.1	LC ₅₀ 121mg/L
72-2	Daphnia LC ₅₀	234439	1977	suppl.	96.9	LC ₅₀ 29mg/L
72-2	Daphnia LC ₅₀	236854	1978	core	94.4	LC ₅₀ 28mg/L

The minimum data requirement to establish acute toxicity to freshwater invertebrates is a 48-hour acute study. The 48-hour LC₅₀ for Metalaxyl to Daphnia magna is 28ppm. Based on these data, Metalaxyl can be characterized as being slightly toxic to freshwater aquatic invertebrates. These data fulfill the minimum freshwater invertebrate toxicity data requirement for metalaxyl.

Acute Test- Formulation

GLN #	Test Type	MRID	Date	Class.	% AI	Result
72-2b	Daphnia LC ₅₀	244183	1979	core	27 FM	LC ₅₀ 12mg/L

The minimum data requirement to establish acute toxicity of the formulated product to freshwater invertebrates is a 48-hour acute study. The 48-hour LC₅₀ for formulated Metalaxyl (Ridomil 2-5G) is 12 ppm. Based on these data, formulated Metalaxyl can be characterized as being slightly toxic to freshwater aquatic invertebrates. The minimum data requirements for establishing the toxicity of Metalaxyl to freshwater invertebrates has been fulfilled.

Chronic Test - Daphnia

GLN #	Test Type	MRID	Date	Class	% AI	Result
72-4b	Daphnia	71307	1980	core	90.1	NOEC 1.27 LOEC 2.70 MATC 1.85

The Daphnia Life Cycle is required to support reregistration of Metalaxyl as its presence in water is likely to be continuous, recurrent or persistent, and multiple applications of the chemical may occur. The minimum data required to establish chronic toxicity of Metalaxyl to invertebrates is the Daphnia life cycle test based on reproduction, growth and survival. Based on the data submitted, the NOEC was established at 1.27 mg/L, LOEC 2.70 mg/L and the MATC was calculated to be 1.85 mg/L. Based on these data, Metalaxyl can be characterized as being slightly toxic to freshwater invertebrates. These data fulfill the minimum data requirements for establishing the chronic toxicity of Metalaxyl to invertebrates.

D. Estuarine Species

GLN #	Test Type	MRID	Date	Class.	% AI	Result
72-3b	Mysid LC ₅₀	412881 -03	1991	core	96.1	LC ₅₀ 25.7ppm
72-3f	Mysid LC ₅₀	423375 -01	1992	core	25.0	LC ₅₀ 5.98ppm
72-3e	Oyster EC ₅₀	423781 -01	1992	core	25.0	EC ₅₀ 4.4ppm

The minimum data required in the Guidance Document (1988) to establish toxicity of Metalaxyl to estuarine and marine organisms is a 96-hour acute toxicity test with an estuarine shrimp and a mollusc. The preferred species are the Mysid and the Eastern oyster, with the technical (TGAI) and a typical

end-use product.

Based on mean measured concentrations, the 96-hour LC₅₀ of Ridomil 2E (a formulation) for the Mysid, Mysidopsis bahia was 5.98ppm, and the 96-hour LC₅₀ of the TGAI was 25.7 ppm. Therefore, Ridomil 2E is classified as moderately toxic whereas the TGAI is slightly toxic to Mysid shrimp. The 96-hour EC₅₀ of Ridomil 2E for the Eastern oyster, Crassostrea virginica was 4.4ppm. Ridomil 2E is classified as moderately toxic to the Eastern oyster. The data requirement for the TGAI with oysters is still outstanding.

E. Non Target Insect

GLN #	Test Type	MRID	Date	Class.	% AI	Result
141-1	Honey Bee LD ₅₀	402767	1987	core	27.0	LD ₅₀ >100ug/ bee

The minimum data requirement to establish toxicity to non-target insects is an acute contact honey bee study. The acute 48-hour contact LD₅₀ for honey bees is greater than 100 ug/bee. Metalaxyl may be classified as practically non-toxic to honey bees. The minimum data requirements for establishing the toxicity of Metalaxyl to non-target insects is fulfilled.

F. Aquatic Plants

GLN #	Test Type	MRID	Date	Class.	% AI	Result
122-2	Duckweed EC ₅₀	257626	1985	core	90	EC ₅₀ 92ppm
122-2	Algae EC ₅₀	257626	1985	core	90	EC ₅₀ 140 ppm

The minimum data requirement to establish toxicity to non-target aquatic plants evaluates the effect of maximum exposure level on these plants. The preferred test species are Duckweed, Lemna gibba and the alga, Selenastrum capricornutum. Metalaxyl with an EC₅₀ of 92ppm (frond counts) is not expected to exert a detrimental effect on Duckweed at application rates up to 3.0lb AI/acre. Metalaxyl with an EC₅₀ of 140ppm

(cells/ml) is not expected to exert a detrimental effect on the alga Selenastrum at application rates up to 3.0lb AI/acre. The minimum data requirements for establishing the toxicity of Metalaxyl to aquatic plants are fulfilled.

G. Mammals

The minimum data requirement to establish toxicity to mammals is an oral acute toxicity study.

The lowest acute oral LD₅₀ value for the rat is 1250 ppm. Metalaxyl may be characterized as slightly toxic to mammals on an acute oral basis. (OPPTS Pesticide Fact Sheet 540/FS-88-116, 1988).

II. Ecological Effects Risk Assessment

A. Use Profile

Metalaxyl is a fungicide registered for use on over 100 agricultural crops, (including more than 30 seed treatment uses). Metalaxyl is also registered for ornamental and turf uses.

Metalaxyl is applied to soil or foliage. Application rates range from 0.135 to 8.0 lb AI/acre for agricultural crops, from 0.25 to 1.12 oz AI/100 lb seed for agricultural seed treatment, from 0.33 to 1.35 lb AI/acre for ornamental turf and from 0.90 to 7.20 lb AI/acre for ornamental trees and plants.

Methods of application include foliar, soil incorporation, surface spraying, drenching, sprinkler irrigation, soil mixing and trunk spraying. For seed treatment, Metalaxyl is applied with conventional slurry or mist seed treating equipment. Metalaxyl can be applied multiple times.

B. Environmental Fate Profile

Metalaxyl is resistant to hydrolysis, having a half-life of greater than 4 weeks at pH 5, 7 and 9 at 20 C. This chemical is stable to photolysis on the surface of soil. In water, the half-life was one week on exposure to sunlight. Under aerobic conditions, Metalaxyl had a half-life of about 7 weeks. Under anaerobic conditions, the half-life was about 9 weeks. Metalaxyl readily leaches in sandy soils and those low in organic matter. In soil field dissipation studies, Metalaxyl had a half-life of two weeks. In fish accumulation studies, Metalaxyl parent or residues did not accumulate beyond 10X in whole fish and depuration (14 days) removed 80% of the parent/residues, EFGWB Metalaxyl Science Chapter (1994).

C. Risk Assessment

Metalaxyl is registered for numerous use sites. Exposure to

non-target organisms may result from direct applications, spray drift and/or runoff from treated areas. The maximum expected terrestrial residues based on a single application at different application rates and on different categories of plants is presented in the following table.

Application Rate (lbs AI/A)	Short Grass (ppm)	Long Grass (ppm)	Leaves and leafy crops (ppm)	Forage (ppm)	Pods with seeds (ppm)	Fruits (ppm)
0.14 ¹	34	15	18	8	2	1
0.33 ²	79	36	42	19	4	2
0.90 ³	216	99	113	52	11	6
1.0 ⁴	240	110	125	58	12	7
1.35 ⁵	324	149	169	78	16	10
1.5 ⁶	360	165	188	87	18	11
2.0 ⁷	480	220	250	116	24	14
3.0 ⁸	720	330	375	174	36	21
4.0 ⁹	960	440	500	232	48	28
6.0 ¹⁰	1440	660	750	348	72	42
7.2 ¹¹	1728	792	900	418	86	50
8.0 ¹²	1920	880	1000	464	96	56

- 1 broccoli, cabbage, cauliflower, cotton, cucumbers, melons, squash, onions, alfalfa, buckwheat, dill, cucumber
- 2 beans, lentils, potatoes, avocados, raspberries, cotton, onions, cucurbits, barley, cole crops
- 3 hops, peas, soybeans, melons, ornamental turf, cotton, forage and hay, brassica, spinach, rice, blueberries, tobacco
- 4 lettuce, peanuts, squash, ornamental plants, hops, strawberries
- 5 soybeans, tomatoes, ornamental plants, cotton, vegetable bedding plants, onions, legume vegetables, lawn and turf
- 6 apples, cucurbits, grapes, avocado, asparagus
- 7 spinach, pineapple, citrus, tomatoes, lettuce, legume vegetables, peanuts
- 8 tobacco, citrus, grapes, herbaceous plants
- 9 apples, citrus, nut trees, avocado
- 10 stone fruit, conifer trees, shrubs and vines
- 11 pome fruit, citrus trees
- 12 apples, citrus, stone fruit

a. Avian - Acute Risk

To calculate maximum mg ai/ft² for the granular formulation:

$$6.0 \text{ lb ai/A} \times 454,590 \text{ mg/lb} \times 1 \text{ A}/43,560 \text{ ft}^2 = 62.62 \text{ mg/ft}^2$$

The LD₅₀ for the mallard duck is 1466 mg/kg. According to Dunning (1984), the average weight of a mallard duck is 1.082 kg. To calculate the LD₅₀ per square foot:

$$\frac{62.62 \text{ kg mg/ft}^2}{1466 \text{ mg/kg}(1.082)} = 0.039 \text{ LD}_{50}/\text{ft}^2$$

To calculate LD₅₀ per day:

$$\frac{(\text{highest expected residue}) \times (\text{percentage eaten per day})}{\text{LD}_{50}}$$

Using the highest expected residue for the highest application rate and the LD₅₀ for the mallard duck, the following LD₅₀ per day is calculated as:

$$\frac{1920 \text{ ppm} \times 3.6\%}{1466 \text{ mg/kg}} = 0.047 \text{ LD}_{50} \text{ per day}$$

The risks to birds from exposure to granular Metalaxyl was analyzed by the above method, LD₅₀ per square foot, to characterize acute risk. When the LD₅₀ per square foot value equals or exceeds 0.5, then the pesticide is said to pose a high acute risk to birds. As the calculate value is only 0.047, the risk from granular metalaxyl to exposed birds is minimal.

Subacute dietary risks to birds from nongranular metalaxyl were analyzed by comparing EEC's to the LC₅₀ values. When the risk quotient (EEC/LC₅₀) is at least equal to 0.2, the chemical is a candidate for Restricted Use classification. When the quotient is at least 0.5, the chemical is said to be a high acute risk to birds. The EEC value for short grass based on the maximum application rate is 1920 ppm. The LC₅₀ from the avian dietary studies were shown to be in excess of 10,000 ppm. If the LC₅₀ were estimated as 5 times the no mortality level, then the estimated LC₅₀ would be 50,000 ppm. The quotient of the EEC/LC₅₀ (1920 ppm/50,000 ppm) is significantly less 0.2 and 0.5. Therefore, it can be concluded that there are minimal risks to birds from dietary exposure to Metalaxyl.

b. Avian - Chronic Risk

Chronic risk cannot be determined as there are no avian reproduction studies for metalaxyl. Due to its widespread use

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(registered on over 100 agricultural crops), multiple applications and persistence in the field these studies are needed.

2. Aquatic Risk

Estimated aquatic environmental concentrations were calculated using the methods of Kenaga and Hoerger (1972) and are presented in the following table.

Application Rate (lbs ai/A)	EEC Ground ¹³ Application (ppb)	EEC Aerial ¹⁴ Application (ppb)	EEC Direct ¹⁵ Application (ppb)
0.14	0.85	0.94	8.54
0.33	2.01	2.23	20.13
0.90	5.49	6.04	54.90
1.0	6.10	6.71	61.00
1.4	8.24	9.06	82.35
1.5	9.15	10.07	91.50
2.0	12.2	13.2	122.0
3.0	18.3	20.1	183.0
4.0	24.4	26.8	244.0
6.0	36.6	40.3	366.0
7.2	43.9	48.3	439.2
8.0	48.8	53.7	488.0

13 The total aquatic EEC from a 10-acre field treated by un-incorporated ground application and draining into a 6-foot deep one acre pond.

14 The total loading from both runoff (1%) and drift (5%) of a 10-acre field treated by aerial application and draining into a 6 foot deep one acre pond. Aerial application includes mist blowers.

15 A single inadvertent direct application to a 6 foot deep one acre pond.

a. Aquatic - Acute Risk

The Risk Quotients (RQ) are calculated by comparing the EEC values for ground and aerial applications to the lowest LC₅₀ values for freshwater and estuarine fish and invertebrates for technical and formulated metalaxyl. When the RQ's equal or exceed the levels of concern (LOC) the associated risk can be presumed:

<u>LOC</u>	<u>Risk Presumption</u>
0.5	high acute risk
0.1	Restricted Use
0.05	risk to endangered species

The following RQ's were calculated for ground and aerial applications for freshwater and estuarine fish and invertebrates.

Organism	Ground appl.	Aerial appl.
Freshwater fish technical formulate	0.0004 0.003	0.0004 0.003
Daphnia technical formulate	0.002 0.004	0.002 0.005
Mysid technical formulate	0.002 0.008	0.002 0.009
Oyster formulate	0.011	0.012

As the RQ's are below the levels of concern, there are minimal risks to non-endangered and endangered freshwater and estuarine species.

b. Aquatic - Chronic Risk

When the risk quotient of the EEC/NOEC is less than 1.0, it is presumed that the chemical will not pose a high chronic risk. Metalaxyl can be applied on many of the registered crops up to four times per season. As it is persistent, the maximum residues from ground and aerial application are 0.193 ppm ground application and 0.213 ppm aerial application. As these residue levels are below the NOEC of 9.1 mg/L from the fathead minnow chronic study, chronic risks to freshwater fish are minimal.

3. Plants

The risk to aquatic plants is determined by comparing the EEC's from ground and aerial applications to the EC₅₀ values for duckweed and algae. As the highest EEC's, 48.8 ppb and 53.7 ppb, respectively, are less than the EC₅₀ values of 92 and 140 ppm, metalaxyl is not expected to adversely affect aquatic plants.

4. Endangered Species

The registered uses of Metalaxyl do not present a hazard to endangered terrestrial and aquatic animals or plant species.

III Precautionary Label Statement

Manufacturing Use

"Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your state Water Board or Regional Office of the EPA."

End-Use Product

"For terrestrial uses. Do not apply to water or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from treated areas. Do not contaminate water when disposing of equipment wash water or rinsate."

Endangered Species Protection Statement

Due to the low toxicity of this chemical, endangered species precautionary labeling will not be required.

IV Adequacy of Data

Date: April 18, 1994
 Case No: 0081
 Chemical No: 113501

DATA REQUIREMENTS FOR METALAXYL
 ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition ¹	Use Pattern ²	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
6 Basic Studies in Bold					
71-1(a) Acute Avian Oral, Quail/Duck	TGAI	AB	Yes	234439	No
71-1(b) Acute Avian Oral, Quail/Duck	(TEP)	AB	No		No
71-2(a) Acute Avian Diet, Quail	TGAI	AB	Yes	77335	No
71-2(b) Acute Avian Diet, Duck	TGAI	AB	Yes	63989	No
71-3 Wild Mammal Toxicity	TGAI	AB	No		No
71-4(a) Avian Reproduction Quail	TGAI	AB	No		Yes ³
71-4(b) Avian Reproduction Duck	TGAI	AB	No		Yes ³
71-5(a) Simulated Terrestrial Field Study	TEP	AB	No		No
71-5(b) Actual Terrestrial Field Study	TEP	AB	No		No
72-1(a) Acute Fish Toxicity Bluegill	TGAI	AB	Yes	236854, 71302	No
72-1(b) Acute Fish Toxicity Bluegill	(TEP)	AB	Yes	71301	No
72-1(c) Acute Fish Toxicity Rainbow Trout	TGAI	AB	Yes	71303, 100447	No
72-1(d) Acute Fish Toxicity Rainbow Trout	(TEP)	AB	Yes	72396	No
72-2(a) Acute Aquatic Invertebrate Toxicity	TGAI	AB	Yes	236854, 244183, 234439	No
72-2(b) Acute Aquatic Invertebrate Toxicity	(TEP)	AB	Yes	244183	No
72-3(a) Acute Estu/Marl Tox Fish	TGAI	AB	No		No
72-3(b) Acute Estu/Marl Tox Mollusk	TGAI	AB	No		Yes ⁴
72-3(c) Acute Estu/Marl Tox Shrimp	TGAI	AB	Yes	41286103	No

* In Bibliographic Citation column indicates study may be upgradeable

Date: April 18, 1994
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DATA REQUIREMENTS FOR METALAXYL
 ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition ¹	Use Pattern ²	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
72-3(d) Acute Estu/Mari Tox Fish	(TEP)	AB	No		No
72-3(e) Acute Estu/Mari Tox Mollusk	(TEP)	AB	Yes	423781-01	No
72-3(f) Acute Estu/Mari Tox Shrimp	(TEP)	AB	Yes	423375-01	No
72-4(a) Early Life-Stage Fish	TGAI	AB	Yes	71308	No
72-4(b) Live-Cycle Aquatic Invertebrate	TGAI	AB	Yes	71307	No
72-5 Life-Cycle Fish	TGAI	AB	No		No
72-6 Aquatic Org. Accumulation	TGAI	AB	No		No
72-7(a) Simulated Aquatic Field Study	TEP	AB	No		No
72-7(b) Actual Aquatic Field Study	TEP	AB	No		No
122-1(a) Seed Germ./Seedling Emerg.	TEP	AB	No		No
122-1(b) Vegetative Vigor	TGAI	AB	No		No
122-2 Aquatic Plant Growth	TEP	AB	No		No
123-1(a) Seed Germ./Seedling Emerg.	TEP	AB	No		No
123-1(b) Vegetative Vigor	TGAI	AB	No		No
123-2 Aquatic Plant Growth	TGAI	AB	Yes	257626	No
124-1 Terrestrial Field Study	TEP	AB	No		No
124-2 Aquatic Field Study	TEP	AB	No		No
141-1 Honey Bee Acute Contact	TGAI	AB	Yes	402767	No
141-2 Honey Bee Residue on Foliage	TEP	AB	No		No
141-5 Field Test for Pollinators	TEP	AB	No		No

* In Bibliographic Citation column indicates study may be upgradeable

1. Composition: TGAI= Technical grade of the active ingredient; PAIRA= Pure active ingredient, radiolabeled; TEP= Typical end-use product

2. Use Patterns: A= Terrestrial Food Crop; B= Terrestrial Feed Crop; C= Terrestrial Non-Food Crop; D= Aquatic Food Crop; E= Aquatic Non-Food Outdoor; F= Aquatic Non-Food Industrial; G= Aquatic Non-Food Residential; H= Greenhouse Food Crop; I= Greenhouse Non-Food Crop; J= Forestry; K= Outdoor Residential; L= Indoor Food; M= Indoor Non-Food; N= Indoor Medical; O= Indoor Residential; Z= Use Group for Site 0000

3. Avian studies are required when a chemical has widespread use, has multiple applications and is persistent.

4. The oyster TGAI was requested in the Guidance Document of 1988

Dunning, J.B. 1984 . Body weights of 686 species of North American birds. Western Bird Banding Assoc. monograph no. 1.

Hoerger, F. and E.E. Kenaga. 1972. Pesticide residues on plants: correlation of representative data as a basis for estimation of their magnitude in the environment. In Environmental Quality and Safety. Vol. I pp.9-28, Academic Press Inc. New York.

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