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Review No.

Registration Standard for methamidophos

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EEB has completed the review of fish and wildlife studies received under the registration standard for methamidophos. The following information is included: topical discussion, disciplinary summary and data compensation table. DER's will be forwarded upon completion of typing.

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ECOLOGICAL EFFECTS TOPICAL DISCUSSION

Effects On Birds

Ten studies were received and evaluated under this topic (Table 1). All are acceptable for use in hazard assessments of effects on birds.

TABLE 1 - Studies Evaluated

Author	ID
Beavers, et al.	00014114
Beavers, et al.	No ID
Fink	00014113
Fletcher	00014094
Fletcher	00014095
Jackson	00014064
Lamb and Burke	00014304
Nelson, et al.	00041313
Nelson, et al.	00041658
Zinkl, et al.	No ID

The minimum testing required for establishing the acute toxicity of methamidophos to birds is the single-dose oral toxicity test on either an upland game bird (preferably bobwhite or ring-necked pheasant) or a waterfowl (preferably mallard duck). The acceptable data, based on Subdivision E, Section 71-1 of the guidelines, are listed in Table 2.

TABLE 2 - Single-dose oral LD50

Species	Test Material	LD50	Author	Date	ID	Fulfills Guideline Requirements
Bobwhite	Technical	10.1 mg/kg (males) 11.0 mg/kg (females)	Nelson et al.	1979	00041313	Yes
Bobwhite	Technical	8.0 mg/kg	Fletcher	1971	00014094	Partial
Mallard	Technical	29.5 mg/kg	Fletcher	1971	00014095	Partial
Junco	Technical	8.0 mg/kg	Zinkl	1981	No ID	Partial

The available single-dose oral toxicity studies satisfy guideline requirements and demonstrate that technical methamidophos is highly toxic to bobwhite quail.

The minimum testing required for establishing the short-term subacute toxicity of methamidophos to birds are two avian dietary toxicity tests: one on an upland game bird (preferably bobwhite quail) and one on a waterfowl (preferably mallard duck). The acceptable data, based on subdivision E, Section 71-2 of the guidelines, are listed in Table 3.

TABLE 3 - Eight - day dietary LC50 studies

Species	Test Material	LC50	Author	Date	ID	Fulfills Guideline Requirements
Bobwhite	Technical	42 ppm	Beavers, et al.	1979	No ID	Yes
Mallard	Technical	1302 ppm	Nelson, et al.	1979	00041658	Yes
Bobwhite	Technical	57.5 ppm	Jackson	1968	00014064	Partial
Mallard	Technical	847.7 ppm	Lamb and Burke	1977	00014304	Partial
Bobwhite	Technical	47.04 ppm	Lamb and Burke	1977	00014304	Partial

The available eight-day dietary toxicity studies satisfy guideline requirements and demonstrate that technical methamidophos is very highly toxic (bobwhite) to slightly toxic (Mallard) by dietary exposure.

Two avian reproduction studies (bobwhite and mallard) are required when available information indicates that reproduction in birds may be adversely affected by the anticipated use of the pesticide product. In the case of methamidophos, its labeling contains directions for using the product under conditions where birds may be subjected to repeated or continued exposure to the pesticide, especially during the breeding season. For example, methamidophos can be applied to potatoes as a foliar application with an interval of 7 to 10 days. Treatments can be made soon after emergence until a couple weeks prior to digging. Plantings can be as early as January in Georgia to as late as May in Maine. Gusey and Maturgo (1973) report that song birds feed and nest in potato fields from January through May, and ducks and geese will feed in these fields during the same time period. The acceptable data, based on Subdivision E, Section 71-4 of the guidelines, are listed in Table 4.

TABLE 4 - Avian reproduction studies

Species	Test Material	NEL	Author	Date	ID	Fulfills Guideline Requirements
Mallard	Technical	>15 ppm	Fink	1977	00014113	Yes
Bobwhite	Technical	>3 ppm <5 ppm	Beavers et al.	1978	00014114	Yes

Avian reproduction studies satisfy guideline requirements and indicate 'no effect' levels (NEL) of >15 ppm for mallards and >3 ppm but <5 ppm for bobwhite under 22 week and 18 weeks of dietary exposure, respectively.

Avian simulated field studies

A short-term (small pen) simulated field study on birds using an end-use product is required when the use of the product is likely to result in adverse effects on avian wildlife exposed to the pesticide. In the case of methamidophos, three registered end-use products (Monitor 4 Spray, Monitor 6 Spray and Monitor 4) can be used on cotton, potatoes and vegetable crops at rates (1 lb. active ingredient/ acre) that will very likely have adverse effects on birds. The maximum calculated residues on avian food items (ppm) and the calculated amount of toxicant that different size birds might be exposed to in their diets (mg/kg) (from Kenaga, 1973), are in many cases greater than the laboratory acute (LD50) and subacute (LC50) toxicity levels. In addition, a 1980 bird kill in Wisconsin was reported to be the result of an aerial application of Monitor 4 to cabbage.[1]

No data based on Subdivision E, Section 71-5 of the guidelines were submitted for review. In addition, the Agency does not have any data to partially or totally satisfy this requirement. Therefore, data on the acute effects of Monitor 6 Spray[2] on birds which are confined to pens in a field planted to either potatoes, cotton or a vegetable crop are required [See Subdivision E, Section 71-5(a)(1)(ii) of the guidelines].

Precautionary Labeling

The acute toxicity demonstrated in the acute oral and dietary studies requires a bird toxicity statement on the methamidophos labels.

[1] Report submitted by N. T. Zuelsdorff, Field Supervisor, Plant Industry Division, Department of Agriculture, Trade & Consumer Protection, State of Wisconsin, January 25, 1982. Report includes a description of circumstances, location, investigation, product information, testimonies, residue findings in dead birds and on plant material collected in and around spray location, and findings of cholinesterase in the dead birds. A suspected violation was termed "Careless or reckless use of pesticide resulting in drift." No charges have been filed in this case to date [Case no. 422-81-5]. Monitor 4, EPA Reg. 3125-280, was applied at registered label rates (1/2 to 1 lb a.i./A) with winds estimated at 3.5 to 6 mph at the time of application (6:30 PM, July 23, 1980). At least 14 dead or dying birds were reported by nearby residents. Dead birds and vegetation samples were collected for residue analysis from the treated field and from adjacent areas 12 to 18 hours after treatment. Residues of methamidophos were detected in six samples collected within and around the margins of the cabbage field at levels between 0.08 and 24.0 ppm. Brain cholinesterase activity and analysis of gastrointestinal tracts of the birds for residues of methamidophos show that brain ChE activity was significantly inhibited (39 to 76 percent in five house sparrow) in house sparrows and one killdeer. Approximately 50 percent inhibition of brain ChE activity is considered indicative of potentially lethal exposure to an anticholinesterase agent (Ludke, et al., 1975). The bird specimens contained methamidophos residues ranging from 0.60 ppm to 5.8 ppm. The conclusion reached was that the birds died from methamidophos. See Ecological Effects Branch file for complete report.

[2] This formulation was selected because it has the highest concentration of active ingredient.

Effects on Freshwater Fish

Two studies were received and evaluated under this topic (Table 1). Both are acceptable for use in hazard assessments of effects on freshwater fish.

TABLE 1 - Studies Evaluated

Author	ID
Nelson, et al.	00041312
Schoenig	00014063

The minimum testing required for establishing the acute toxicity of technical methamidophos to freshwater fish are two 96-hour LC50 tests: one on a coldwater fish species (preferably rainbow trout) and one on a warmwater fish species (preferably bluegill sunfish). The acceptable data, based on Subdivision E, Section 72-1 of the guidelines, are listed in Table 2.

TABLE 2 - Freshwater fish acute toxicity studies

Species	Test Material	96-hour LC50	Author	Date	ID	Fulfills Guideline Requirements
Rainbow Trout	Technical	25 ppm	Nelson, et al.	1979	00041312	Yes
Bluegill Sunfish	Technical	34 ppm	"	"	"	Yes
Rainbow Trout	Technical	51 ppm	Schoenig	1968	00014063	Partial
Bluegill Sunfish	Technical	46 ppm	"	"	"	Partial

The available 96-hour acute toxicity studies satisfy guideline requirements and demonstrate that technical methamidophos is slightly toxic to rainbow trout and bluegill sunfish. No fish toxicity statement is required.

Effects on Freshwater Invertebrates

Three studies were received and evaluated under this topic (Table 1). All are acceptable for use in hazard assessments of effects on freshwater invertebrates.

TABLE 1 - Studies Evaluated

Author	ID
Nelson and Burke	00014305
Nelson and Roney	00041311
Wheeler	00014110

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The minimum testing required for establishing the acute toxicity of methamidophos to freshwater invertebrates is a 48-hour LC50 test on a daphnid, amphipod, stonefly, mayfly or midge. Daphnia magna is preferred. The acceptable data, based on Subdivision E, Section 72-2 of the guidelines, are listed in Table 2.

TABLE 2 - Freshwater invertebrate acute toxicity studies

Species	Test Material	48-hour LC50	Author	Date	ID	Fulfills Guideline Requirements
Daphnia magna	Technical	26 ppb	Nelson and Roney	1979	00041311	Yes
Daphnia magna	Technical	50 ppb	Wheeler	1978	00014110	Yes
Daphnia magna	Technical	27 ppb	Nelson and Burke	1977	00014305	No

The available 48-hour acute toxicity studies satisfy guideline requirements and demonstrate that technical methamidophos is very highly toxic to Daphnia magna. The following hazard statement is required for methamidophos labels: "This Pesticide is Toxic to Aquatic Invertebrates."

Effects on Estuarine/Marine Invertebrates

Testing is required for establishing the acute toxicity of the technical pesticide to estuarine/marine invertebrates when the end-use product is expected to enter the estuarine or marine environment in significant concentrations because of its use or mobility pattern. In the case of methamidophos, it is very soluble in water and mobile in the soil and it is used on cotton and on vegetable crops in Florida and other Gulf coastal states adjacent to aquatic estuarine and marine habitat. This area contains numerous molluscs and crustaceans important to the structure of the estuarine/marine ecosystem and also economically important to the local shellfish industry. In addition, technical methamidophos is very highly toxic to freshwater aquatic invertebrates (LC50 = 0.025 ppm). Estuarine and marine invertebrates are likely to be as or more sensitive. Methamidiophos could enter this environment via runoff or drift from the treated areas, or direct application (misuse) to adjacent aquatic habitat. The maximum calculated concentration of methamidophos in water after one application at the highest application rate of 1 pound active ingredient per acre is 0.73 ppm. While this figure is a somewhat unrealistic, it is possible for 0.5% to 1.5% of the total amount applied (1 lb a.i./A) to reach aquatic habitat via runoff (Wauchope, 1978). This would result in a concentration in water of between 0.004 ppm to 0.01 ppm methamidophos, which is very close to the LC50 value for freshwater aquatic invertebrates.

No data based on Subdivision E, Section 72-3 of the guidelines were submitted for review. In addition, the Agency does not have any data to partially or totally satisfy this requirement. Therefore, data on the acute effects of technical methamidophos on shrimp and oysters are required [See Subdivision E, Section 72-3 of the guidelines].

Effects on Wild Mammals

No studies were submitted for review under this topic. The Agency currently has no minimum data requirements for wild mammals. There are no wild mammal studies required for currently registered methamidophos uses.

ECOLOGICAL EFFECTS PROFILE

A. Manufacturing Use - Technical Methamidophos

AQUATIC ORGANISMS

Short-term fish bioassays with technical material indicate that methamidophos is slightly toxic. Nelson, et al. (1979, ID# 00041312) reports that the 96-hour LC50 for rainbow trout and bluegill sunfish are 25 ppm and 34 ppm, respectively. Short-term tests with the aquatic invertebrate, Daphnia magna, demonstrate that technical methamidophos is very highly toxic to these organisms. The 48-hour LC50 value for Daphnia magna ranges from 26 ppb to 50 ppb (Nelson and Roney, 1979, ID# 00041311; and Wheeler, 1978, ID# 00014110).

BIRDS

Laboratory acute and subacute testing indicates that technical methamidophos is slightly to very highly toxic to birds. Fletcher (1971, ID# 00014094) and Zinkl (1981, NO ID#) report the single-dose acute oral LD50 for bobwhite quail and dark-eyed juncos (juncos hyemalis) as 8.0 mg/kg. Similarly, Nelson et al. (1979, ID# 00041313) reports values of 10.1 mg/kg and 11.0 mg/kg for male and female, bobwhite. Fletcher (1971, ID# 00014095) reports a slightly higher value, 29.5 mg/kg, for mallard ducks. Eight-day subacute dietary feeding studies indicate a range of LC50 values from 42 ppm to 1302 ppm. Beavers, et al. (1979, No ID#) reports an LC50 value of 42 ppm for bobwhite quail. Jackson (1968, ID# 00014064) reports a similar value 57.5 ppm. Eight-day tests on mallard ducks suggest a lower sensitivity. Nelson, et al. (1979, ID# 00041658) and Lamb and Burke (1977, ID# 00014304) report LC50 values for mallard equal to 1302 ppm and 847.7 ppm, respectively.

Avian reproduction studies with technical methamidophos indicate dietary "no effect" levels >15 ppm for mallards and >3 ppm but <5 ppm for bobwhite quail. The reproductive success of the mallard was not adversely affected by 5 ppm or 15 ppm methamidophos in the diet when compared to controls. Two studies were conducted using bobwhite quail. In the first, the bobwhite received dietary levels of 5 and 15 ppm and showed symptoms of toxicity and reproductive failure at both levels. The parameters significantly ($p=0.05$) affected at 5 ppm were eggs cracked, 14 day-old survivors and eggshell thickness. The following were significantly affected at 15 ppm: viable embryos, live three-week embryos, normal hatchlings, 14 day-old survivors, and eggshell thickness. In the second study, methamidophos had no effect on reproductive success of bobwhite at 1 and 3 ppm. However, statistically significant ($p=0.05$) reproductive impairment occurred at 5 ppm in viable embryos, live three-week embryos, normal hatchlings and 14 day-old survivors. The number of survivors at 14 days was reduced 72% at the 5 ppm level.

HAZARD ASSESSMENT

INTRODUCTION

The principal registered field crop uses of methamidophos, an insecticide and acaricide, are on potatoes (37-39% of the estimated 911,000 to 1,156,000 lbs produced annually), cotton (24-30%), cole crops like cabbage, broccoli, cauliflower, brussels sprouts and chinese cabbbage (12-18%), and tomatoes (10-19%) [M.I. Dow, Qualitative Use Assessment for Methamidiphos, and K. Devine, Quantitative Usage Analysis of Methamidophos, EPA (BFSD), 1980]. Methamidophos can be applied by ground equipment or by air at up to 1 pound active ingredient per acre.

AQUATIC ORGANISMS

Methamidophos could enter the aquatic environment via runoff or drift from treated areas, or inadvertant direct application to aquatic habitat adjacent to the treated areas. The latter represents a maximum hazard scenario, i.e., where methamidophos is applied at 1 lb.a.i./A directly to a body of water 6" deep (misaplication). The maximum calculated concentration of methamidophos in the water after one application would be 0.73 ppm. Laboratory testing indicates that the most sensitive fish species (rainbow trout) has a 96-hour LC50 value of 25 ppm (Nelson, et al., 1979, ID# 00041312). Thus, the concentration in the water under the maximum hazard scenario is sufficiently below toxic levels that the normal use of methamidophos is unlikely to cause significant impact on fish populations.

When the laboratory 48-hour LC50 value for a freshwater aquatic invertebrate (Daphnia magna LC50 = 0.025 ppm) is compared to the maximum hazard calculation (0.73 ppm), the the latter is significantly greater than the toxic level. Consequently, the normal use of this chemical poses a potential significant acute hazard to freshwater aquatic invertebrates located adjacent to the treated areas. Daphnid populations, like many micro-invertebrates, often experience wide fluctuations in their population numbers (see Slobodkin and Richman, 1956). Therefore, the fact that methamidophos is very highly toxic to daphnids is not highly significant except as it indicates a potential high toxicity to aquatic invertebrates which can not tolerate such wide fluctuations in their population numbers or which can not sustain a significant population reduction due to the toxicity of the pesticide, i.e., larger crustaceans and molluscs. Estuarine and marine invertebrates are likely to be as sensitive or more sensitive to methamidophos as Daphnia magna. Methamidophos is very soluble in water and mobile in the soil and it is used on cotton and on vegetable crops in Florida and other Gulf coastal states adjacent to aquatic estuarine and marine habitat. This area contains numerous molluscs and crustaceans important to the structure of the estuarine/ marine ecosystem and also economically important to the local shellfish industry. The maximum hazard calculation for methamidophos in water (0.73 ppm) is somewhat unrealistic. However, it has been reported that that 0.5% to 1.5% of the total amount of water-soluble insecticides like methamidophos that are applied in agricultural areas usually reach aquatic habitat via runoff alone (Wauchope, 1978). With the maximum application rate of 1 lb a. i./A, the concentration in water would be between 0.004 ppm to 0.01 ppm methamidophos. This is very close to the LC50 value for freshwater aquatic invertebrates.

Data are currently insufficient to fully understand the environmental fate of methamidophos. However, currently available data indicate that methamidophos residues will not accumulate in aquatic organisms, and will be transformed (hydrolsis) upon entering aquatic systems [Enviro-Control, Inc., 1981, Methamidophos, Task:3 Environmental Fate Profile]. It is unlikely that methamidophos, even with repeat applications, will pose a significant chronic hazard to aquatic organisms.

TERRESTRIAL ORGANISMS

Methamidophos is very highly toxic to avian wildlife via acute oral dosing and dietary exposure [Bobwhite LD50 = 8.0 mg/kg, Fletcher, ID# 00014094; Bobwhite LC50 = 42 ppm, Beavers, et al., No ID#]. It is highly toxic to mammals via acute oral dosing [Rat LD50 = 18-21 mg/kg, Farm Chemicals Handbook, 1981], but only slightly toxic via dietary exposure [Rat LC50 = 894 ppm, McCann, et al., 1981].

There are three registered end-use products for methamidophos (Monitor 4 Spray, Monitor 6 Spray and Monitor 4) that are used on cotton, potatoes and vegetable crops at rates (1 lb. active ingredient/ acre) that will very likely have adverse effects on birds. Numerous bird and mammal species will be active in the fields during and after applications of Monitor (Gusey and Maturgo, 1973; Roach, 1973). These wildlife species will be exposed to Monitor via diet, skin (dermal exposure), and inhalation. There are no minimum data requirements for determining dermal or inhalation toxicity and the Agency does not have any data on methamidophos to estimate hazards from these exposures. However, there are data to estimate hazards to birds from dietary exposure to methamidophos. The hazards to mammals from dietary exposure is slight compared to that of birds. The maximum calculated residues on avian food items (ppm) and the calculated amount of toxicant that different size birds might be exposed to in their diets (mg/kg) (from Kenaga, 1973) are found in Table 1:

TABLE 1 - Estimation of the mg of toxicant/kg of body weight/day intake by birds of varying sizes resulting from eating different foods from an area treated uniformly with an application of 1 pound of toxicant per acre.

Illustrative Examples of Ppm[1] In or On Different Types of Food Eaten by Birds	Mg/kg/Day Ingested by Different Sized Birds		
	20 gm 18%[2]	100 gm 9.2%	1000 gm 3.6%
240 (sparse foliage	43	22	9
58 (dense foliage, insects)	10	5.3	2.1
10 (seeds, fruit, large insects)	1.8	0.9	0.4

[1] Ppm pesticide residue immediately after application based on maximum values cited.
[2] Per cent of body weight ingested in dry food per day.

These residues are, in many cases, greater than the laboratory acute (LD50) and subacute (LC50) toxicity levels for birds. The typical diet of young bobwhite quail is composed of 80% small to medium sized insects (58 ppm x 80%) and 20% seeds such as ragweed, lespedeza and corn (10 ppm x 20%). Therefore, the expected body burden from exposure to an application of 1 lb a.i./A of a methamidophos end-use product would be 48.4 ppm. This residue is greater than the LC50 for bobwhite quail (42 ppm), and thus the RPAR criterion has been exceeded for birds. Further, all application rates greater than 1/5 lb a.i./A exceed the Restricted Use criterion for birds.

In addition, a 1980 bird kill in Wisconsin was reported to be the result of an aerial application of Monitor 4 to cabbage.[1] At least 14 dead or dying birds were reported by nearby residents. Residues of methamidophos were detected in six plant samples collected within and around the margins of the cabbage field at levels between 0.08 and 24.0 ppm. Brain cholinesterase activity and analysis of gastrointestinal tracts of the birds for residues of methamidophos show that brain ChE activity was significantly inhibited in house sparrows and one killdeer. The bird specimens contained methamidophos residues ranging from 0.60 ppm to 5.8 ppm. The conclusion reached was that the birds died from methamidophos. Based on the above information, the normal use of this chemical is likely to pose a significant acute hazard to birds exposed to it.

Beavers, et al. (1978; ID# 00014114) reports that the 'no effect level' for reproductive impairment in bobwhite quail is >3 ppm but <5 ppm under 18 week of dietary exposure. Significant impairment occurred at 5 ppm. Data are currently insufficient to fully understand the environmental fate of methamidophos. However, currently available data indicate that methamidophos has a half-life in soil of <2 weeks, is very water soluble, will leach and does not accumulate in aquatic organisms [Enviro-Control, Inc., 1981, Methamidophos, Task:3 Environmental Fate Profile]. Fate data are not available to determine if the normal use of monitor will provide dietary residues over time that would create a chronic hazard to avian wildlife. Considering the available data, where repeat applications of methamidophos are used, avian reproductive impairment is possible.

CONCLUSION

Due to the absence of sufficient non-target toxicity data and field residues a hazard assessment can not be completed for field uses of formulated products of methamidophos.

SUMMARY OF MAJOR DATA GAPS

The major data gaps for Methamidophos are a simulated short-term (small-pen) field study on birds using Monitor 6 Spray and acute toxicity studies on estuarine/marine invertebrates which are listed in the tables in chapter III.

[1] See Ecological Effects Branch files.

Generic Data Requirements: Ecological Effects (See Chapter VIII)

Guidelines Citation	Name Of Test	Are Data Required?	Composition	Does EPA Have Data To Partially Or Totally Satisfy This Requirement?	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c) 2(B). Deficient studies must be submitted within 1 year of published Standard
71-1	Avian Single-Dose Oral LD_{50}	Yes	Tech	Yes Partial Partial Partial	00041313 00014094 00014095 Zinkl	
71-2	Avian Dietary LC_{50}	Yes	Tech	Yes Yes Partial Partial	Beavers et al. 00041658 00014064 00014304	
71-3	Wild Mammal Toxicity	No				
71-4	Avian Reproduction	Yes	Tech	Yes Yes	00014113 00014114	
71-5	Simulated and Actual Field Testing for Mammals & Birds	Yes	Formulated (Monitor 6 Spray)[1]	No		Yes[2]
72-1	Acute Toxicity to Feshwater Fish	Yes	Tech	Yes Partial	00041312 00014063	
72-2	Acute Toxicity to Freshwater Aquatic Invertebrates	Yes	Tech	Yes Yes Partial	00041311 00014110 00014305	
72-3	Acute Toxicity to Estuarine & Marine Organisms	Yes	Tech	No		Yes[3]
72-4	Fisn Early Life-Stage aquatic invertebrate Life cycle.	No				

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(CONTINUED)

Generic Data Requirements: Ecological Effects (See Chapter VIII)

uidelines itation	Name Of Test	Are Data Required?	Composition	Does EPA Have Data To Partially Or Totally Satisfy This Requirement?	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c) 2(B)? Deficient studies must be - submitted within 1 year of published Standard
72-5	Fish Life-Cycle	No				
72-6	Aquatic Organism Accumulation	No				
72-7	Simulated or Actual Field Testing for Aquatic Organisms	No				

Footnotes: [1] This formulation was selected because it has the highest concentration of active ingredient.

[2] A short-term (small pen) simulated field study on birds using an end-use product is required when the use of the product is likely to result in adverse effects on avian wildlife exposed to the pesticide. Three registered end-use products (Monitor 4 Spray, Monitor 6 Spray and Monitor 4) can be used on cotton, potatoes and vegetable crops at rates (1 lb. active ingredient/ acre) that will very likely have adverse effects on birds. The maximum calculated residues on avian food items (ppm) and the calculated amount of toxicant that different size birds might be exposed to in their diets (mg/kg) (from Kenaga, 1973), are in many cases greater than the laboratory acute (LD50) and subacute (LC50) toxicity levels. In addition, a 1980 bird kill in Wisconsin was reported to be the result of an aerial application of Monitor 4 to cabbage.

[3] Testing is required for establishing the acute toxicity of the technical pesticide to estuarine/marine invertebrates when the end-use product is expected to enter the estuarine or marine environment in significant concentrations because of its use or mobility pattern. In the case of methamidophos, it is very soluble in water and mobile in the soil and it is used on cotton and on vegetable crops in Florida and other Gulf coastal states adjacent to aquatic estuarine and marine habitat.

These data requirements are current as of March, 1981. Refer to the guidance package for updated requirements.

References

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PRECAUTIONARY STATEMENTS

For all field uses of methamidophos, the following label statement should be added to end-use products:

> This product is extremely toxic to birds and other wildlife. Birds and other wildlife in treated areas may be killed. Do not apply directly to water bodies or wetlands (e.g., lakes, streams ponds, canals). Do not contaminate water by cleaning of equipment or disposal of wastes

"This is a Restricted Use Pesticide"