RE-REGISTRATION ELIGIBILITY DOCUMENT

ENVIRONMENTAL FATE AND EFFECTS SCIENCE CHAPTER

Environmental Fate and Ecological Risk Assessment

for

Mefluidide (PC Code 114001)
CAS # 53780-34-0

AND

Mefluidide-DEA (PC Code 114002)
CAS # 53780-36-2

AND

Mefluidide-K (PC Code 114003)
CAS #83601-83-6

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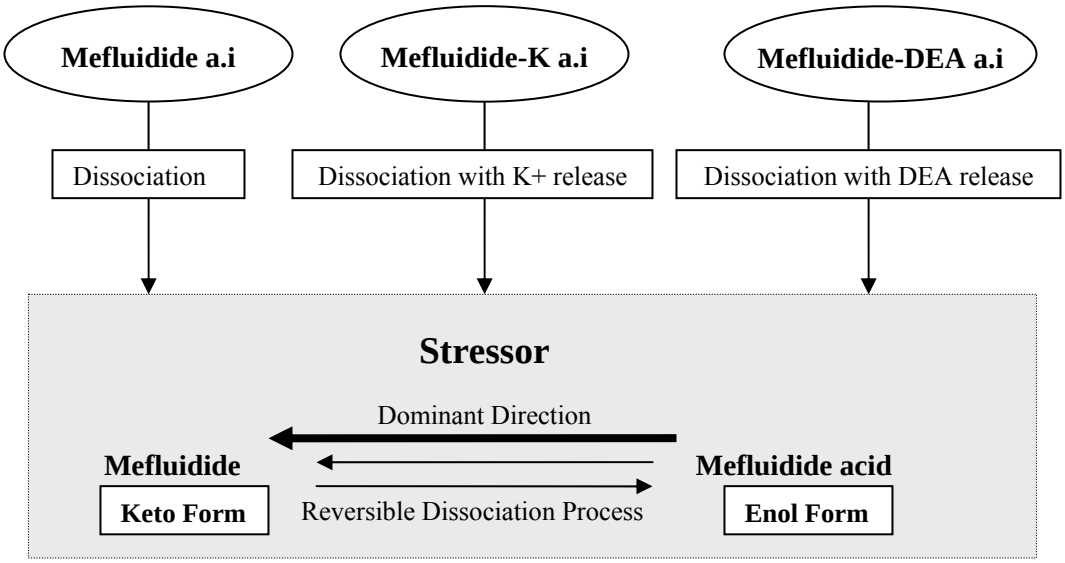
TABLE OF CONTENTS

1. Executive Summary

1.1 Nature of Stressor

Mefluidide is a post-emergent, anilide growth regulator used to control ornamental and non-ornamental woody plants, ground cover, hedges trees, turf grasses, grass and broadleaf weeds. It is also registered for growth control of low maintenance turf on rights-of-ways, airports, and industrial sites. It is formulated as the mefluidide, diethanolamine salt of mefluidide (mefluidide-DEA), and potassium salt of mefluidide (mefluidide-K). Based on the ionic nature of mefluidide-K and mefluidide-DEA and two unreviewed dissociation studies, mefluidide-K and mefluidide-DEA will dissociate rapidly and completely to form mefluidide acid. The two unreviewed dissociation studies (MRIDs 422833-01 and 42282001) indicated mefluidide-K completely dissociated in 7 minutes and mefluidide-DEA completely dissociated in 3 minutes. Mefluidide acid is in equilibrium[1] with mefluidide (Figure 1). In order to assess the environmental fate and effects of mefluidide-K, mefluidide-DEA, mefluidide, the risk assessment strategy was to bridge the environmental fate and ecological toxicity data for the mefluidide, mefluidide-K, and mefluidide-DEA to the formation of mefluidide acid. For purposes of this assessment, mefluidide acid will be used as an analog for mefluidide, mefluidide-DEA and mefluidide-K.

Figure 1. Enol-Keto Equilibrium of Mefluidide-K and Mefluidide



[1] The acetamide functional group in mefluidide exhibits in a enol-keto equilibrium with mefluidide acid . This equilibrium is expected to favor the formation of the keto form (mefluidide) over the enol form (mefluidide acid) (Morrison and Boyd, 1976).

1.2 Potential Risk to Non Target Organisms

This screening-level (Level I) risk assessment focused on the use of mefluidide-K, mefluidide-DEA, and mefluidide on ornamental and turf areas. Results suggest that levels of mefluidide in the environment, when compared with measured toxicity for the most sensitive organisms of selected taxa, are likely to result in direct risks to listed and non-listed species from several different taxa. Indirect risks are also identified for listed and non-listed non-target organisms.

For the aquatic assessment, estimated environmental concentrations (EECs) in surface water were calculated for mefluidide acid using the Tier II PRZM/EXAMS models and employing maximum label application rates for mefluidide, mefluidide-K, mefluidide-DEA. Turf application scenarios in Florida and Pennsylvania were modeled for the exposure assessment.

This screening level risk assessment shows that use of **mefluidide is below the Agency's level of concern for direct acute (listed and non-listed) and chronic toxic exposure to aquatic freshwater and estuarine marine organisms and acute aquatic plants**. In contrast, the use of **mefluidide is above the Agency's level of concern for direct acute (listed and nonlisted) and chronic toxic exposure to mammals, birds and acute (listed and nonlisted) exposure to terrestrial and semi aquatic plants.**

The following toxicity data was not available for Agency review[3]:

- Chronic freshwater fish (72-5)
- Chronic freshwater invertebrates (72-4 b)
- Chronic estuarine marine fish (72-4 a)
- Chronic estuarine marine invertebrates (72-4 b)
- Seedling emergence (123-1 a) A preliminary assessement was completed from a recently submitted seedling emergence study (MRID47190701) however, these results are uncertain until a full review of the study is performed.
- Chronic bird (74-1)
- (EC_{05} or NOAEC) was not provided for vascular and nonvascular plants (123-2)

- In the absence of data, EFED:

    - Used available toxicity data of propanil[2] a structurally similar anilide herbicide
    - Assumed that EC_{25} toxicity values for terrestrial plants (vegetative vigor) are equivalent to (seedling emergence) measurement endpoints

[2] Other anilide herbicides considered were chloranocryl, monalide and pentanochlor, however no ecotoxicity data were-available for these chemicals. The chemical structures of mefluidide and propanil are provided in Appendix B. [3] Submitted ecotoxicity data are summarized in Appendix A.

- Used available data from mefluidide mammal toxicity data to evaluate chronic toxicity to birds.

The Tier I terrestrial plant model, TERRPLANT, was used to assess risks to terrestrial and semi-aquatic plants. LOCs were exceeded for both terrestrial and semi-aquatic plants (monocots and dicots) for both spray and granular applications. All the above modeled scenarios with T-REX and TERRPLANT are summarized in APPENDIX D. Specific direct risks of concern to non-target terrestrial organisms are summarized as follows:

- **Mammalian Acute Listed** LOCs were exceeded for 15 g and 35 g mammals exposed to application rates for mefluidide-DEA and mefluidide-K (1.0 lb ae/A at 3 applications) consuming short grass, broadleaf plants, or small insects and 1000 g mammals that consume short grass.

- **Mammalian Acute Listed** LOCs were exceeded for the LD_{50}s/sq-ft for 15g and 35 g mammals based on one granular application of mefluidide at 0.5 lbs ae/acre.

- **Mammalian Acute Restricted Use** LOCs were exceeded for 15 g and 35 g mammals that consume short grass exposed to application rates for mefluidide-DEA and mefluidide-K (1.0 lb ae/A at 3 applications).

- **Mammalian Acute Restricted Use** LOCs were exceeded for the LD_{50}s/sq-ft for small and medium-sized mammals based on one granular application of mefluidide at 0.5lbs ae/acre.

- **Mammalian Chronic** LOCs (dose-based) were exceeded for 15 g mammals that consume short grass exposed to application rates for mefluidide-DEA and mefluidide-K (1.0 lb ae/A at 3 applications)

- **Avian Acute Listed** LOCs were exceeded for 20 g birds that consume short grass, tall grass and broadleaf plants and small insects and 100 g birds that consume short grass for the 1.0 lb ae/A modeled scenario. Non-definitive toxicity endpoints do not allow for calculations of definitive RQs, however the ratio of non- definitive endpoints (EECs) in this case results in acute RQs ranging from <0.0 to <0.25.

- **Avian Acute Listed** LOCs were exceeded for the LD_{50}s/sq-ft for 20 g birds based on one granular application of mefluidide at 0.5 lbs ae/acre.

- **Avian Acute Restricted Use** LOCs were exceeded for 20 g birds that consume short grass for the 1.0 lba ae/A application rate modeled scenario. Non-definitive toxicity endpoints do not allow for calculations of definitive RQs, however the ratio of non-definitive endpoints (EECs) in this case results in acute RQs of < 0.25.

- **Avian Acute Restricted Use** LOCs were exceeded for the LD_{50}s/sq-ft for 20 g birds based on one granular application of mefluidide at 0.5 lbs ae/acre.

- **Avian Chronic** LOCs (dietary-based) exceedances occurred for birds for the 1.0 lb ae/A modeled scenario. Non-definitive toxicity endpoints do not allow for calculations of definitive RQs, however the ratio of non- definitive endpoints (EECs) in this case results in acute RQs ranging from 2.9 to 6.32.

- **Terrestrial and Semi-aquatic Plants (Listed Species and Non-Listed Species)** LOCs were exceeded for monocots and dicots with the 1.0 lb ae/A spray applications of mefluidide-K and mefluidide-DEA. LOCs were exceeded for dicots and monocots (granular applications) with 0.5 lb ae/acre of mefluidide. Dicots demonstrated more sensitivity than monocots in all application scenarios.

A summary of the potential for direct and indirect effects to listed species, summarized by taxonomic group, is provided in **Table 1.1**.

The results of this risk assessment suggest that the patterns of mefluidide use are such that they coincide in time and space to areas frequented by avian and mammalian wildlife. These areas have been demonstrated as use by wildlife as sources of food and cover. The potentially problematic wildlife food items suggested by this risk assessment are likely to be present in and around the treated areas. In addition, there is potential for indirect effects to all taxonomic groups due to changes in habitat caused by vegetation changes. Some uses of mefluidide may not pose a threat for avian and mammalian wildlife, such as industrial sites that are not frequented by wildlife

Table 1. 1 Listed Species Risks Associated With Direct or Indirect Effects Due to Applications of Mefluidide

Listed Taxonomy	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants – monocots	Yes	Yes [c]
Terrestrial and semi-aquatic plants – dicots	Yes	Yes [c]
Terrestrial invertebrates	None	Yes [c]
Birds	Yes (acute estimated values), Yes(chronic estimated values),	Yes [c,d, e]
Terrestrial phase amphibians	Yes (acute estimated values), Yes(chronic estimated values),	Yes [c, e]
Reptiles	Yes (acute estimated values), Yes(chronic estimated values),	Yes [c,d, e]
Mammals	Yes (acute and chronic)	Yes [c, d, e]
Aquatic vascular plants	None Acute and None (EC_{05} estimated values)	Yes [c]
Aquatic non-vascular plants [a]	None Acute and None (EC_{05} estimated values)	Yes [c]
Freshwater fish	None(acute), None(chronic estimated values)	Yes [c]
Aquatic phase amphibians	None(acute), Unknown(chronic) [b]	Yes [c]
Freshwater crustaceans	None (acute), None (chronic estimated values)	Yes [c]
Mollusks	None (acute), None chronic estimated values	Yes [c]
Marine/estuarine fish	None (acute), None (chronic estimated values)	Yes [c]

[a] At the present time no aquatic non-vascular plants are included in Federal listings of threatened and listed species. The taxonomic group is included here for the purposes of evaluating potential contributions to indirect effects to other taxonomy and as a record of exceedances should future listings of non-vascular aquatic plants warrant additional evaluation of Federal actions.

[b] Terrestrial phase amphibians and reptiles estimated using birds as surrogates. Aquatic amphibians estimated using freshwater fish as surrogates.

[c] Listed and Non-listed LOC exceeded for terrestrial and semi-aquatic plants.

[d] Listed, Restricted Use, and Acute LOC exceeded for some feeding guilds and size classes of birds.

[e] Listed, Restricted Use, and Chronic LOC exceeded for some feeding guilds and size classes of mammals.

1.3 Conclusions Exposure Characterization

The risk assessment strategy is designed to bridge the environmental fate and effects data for the mefluidide-K and mefluidide-DEA, mefluidide to mefluidide acid. Based on the ionic nature of mefluidide-K and mefluidide-DEA and two unreviewed dissociation studies, mefluidide-K and mefluidide-DEA will dissociate rapidly and completely to form mefluidide acid. The two unreviewed dissociation studies (MRIDs 422833-01 and 42282001) indicated mefluidide-K completely dissociated in 7 minutes and mefluidide-DEA completely dissociated in 3 minutes. The reported pKa for mefluidide acid (4.6) occurs at pH~7, with 50% or greater dissociation at pHs $\leq$ 4.6. Mefluidide acid is in equilibrium[3] with mefluidide (Figure 1). The only degradation product identified for mefluidide was 5-amino-2,4-dimethyltrifluoromethanesulfonilide. Mefluidide is moderately persistent and mobile in soil. Estimated environmental concentrations (EECs) in surface water were calculated for mefluidide acid using the Tier II PRZM/EXAMS models with the maximum proposed application rates for mefluidide, mefluidide-K, and mefluidide-DEA on turf. Estimated concentrations are expressed in acid equivalence because mefluidide acid is a common intermediate compound among mefluidide, mefluidide-K, and mefluidide-DEA. Peak (1-in-10 year) surface water EECs were approximately 7.054 µg ae/L and 10.573 µg ae/L for the Pennsylvania Turf and Florida turf scenarios, respectively.

Routes of exposure evaluated in this risk assessment focused on runoff and spray drift from ground spray with mefluidide applied at application rates of mefluidide-K and mefluidide-DEA and runoff from granular applications with mefluidide.

For the terrestrial assessment, EECs for mefluidide were calculated using the terrestrial Tier I model T-REX using the maximum application rate for mefluidide, mefluidide-K, and mefluidide-DEA. Modeling was based on a foliar half-life of 4 days, 3 applications per season and 42 day interval. Upper bound dietary EECs for mefluidide-DEA and mefluidide-K application rate of 1.0 lb ae/A (spray application) were 240.17 mg ae /kg on short grass, 110.08 mg ae /kg on tall grass, 135.09 mg ae /kg on broadleaf plants, or small insects and 15.01 mg ae /kg for fruits, pods, seeds, and large insects.

For a single granular application of mefluidide at the maximum application rate, 0.5 lbs ae/acre, the EEC was calculated as 5.21 mg ae/sq ft. This LD_{50} / sq ft approach can only be applied for single applications. Since the chemical is not incorporated into the soil immediately after application, it is assumed that 100% of the material is available to birds and mammals (USEPA 1992).

1.4 Conclusions Effects Characterization

The risk assessment strategy is designed to bridge the environmental fate and effects data for the mefluidide-K and mefluidide-DEA, mefluidide to mefluidide acid. Therefore, the most sensitive endpoint for the three mefluidide compounds (mefluidide, mefluidide-K, mefluidide-DEA) was selected to represent all mefluidide compounds for aquatic and terrestrial organisms in each category. Most of the toxicity endpoints are within one order of magnitude when comparing the mefluidide and mefluidide-DEA. There was an incomplete toxicity database on mefluidide-K to allow for comparisons of toxicity.

Table 1.2, 1.3 and 1.4 provides a summary of acute and chronic toxicity data used for risk quotient calculation for mefluidide-K, mefluidide-DEA and mefluidide application.

Table 1.2: Summary of endpoints (LC_{50} or EC_{50}, mg ae/L) for Aquatic Toxicity used in RQ calculations for Mefluidide [1]

TAXONOMIC GROUP	Acute endpoint	Chronic endpoint	MRID/ Estimated value
Acute freshwater fish	>68.47* Rainbow Trout		MRID 418937-02
Chronic freshwater fish		>0.267[2]	Estimated value acute to chronic ratio
Acute freshwater inverts	>77.25* Daphnid		MRID 418937-03
Chronic freshwater inverts		>5.54[2]	Estimated value acute to chronic ratio
Acute estuarine/marine fish	>84.75* Sheepshead minnow		MRID 425623-03
Chronic estuarine/marine fish		>0.267[2]	Estimated value acute to chronic ratio
Acute estuarine/marine inverts	67* Eastern oyster		MRID 425624-01
Chronic estuarine/marine inverts		>5.54[2]	Estimated value acute to chronic ratio

[1]For terrestrial plants data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the terrestrial risk assessment. *most sensitive species tested

[2] acute to chronic ratio from propanil extrapolation

Table 1.3: Summary of endpoints (LC_{50} or EC_{50}, mg ae/L aquatic organisms) for Plant Toxicity used in RQ calculations for Mefluidide[1]			
TAXONOMIC GROUP	**Acute endpoint**	**NOAEC or EC_{05}**	
Acute vascular plant	0.515* Lemna		MRID 435266-01 Tier I (8% growth stimulation) Used this value as EC_{50}
Vascular plant(EC_{05})		>0.29[2]	Estimated value acute to chronic ratio
Acute non-vascular plant	0.629* Navicula		MRID 435266-05 Tier I (11.5% growth reduction) Used this value as EC_{50}
Non-vascular plant(EC_{05})		>0.786[2]	Estimated value acute to chronic ratio
Terrestrial Plant: Vegetative Vigor	Monocot:* Sorghum EC_{25} 0.105 lb ae/A Dicot:* Mustard EC_{25} 0.0054 lb ae/A	Monocot:* Sorghum NOAEC 0.045 lb ae/A Dicot:* Mustard NOAEC 0.0029 lb ae/A	MRID 435496-01
Terrestrial Plant: Seedling Emergence	Monocot: Sorghum EC_{25} 0.105 lb ae/A Dicot:* Mustard EC_{25} 0.0054 lb ae/A	Monocot: Sorghum NOAEC 0.045 lb ae/A Dicot:* Mustard NOAEC 0.0029 lb ae/A	Estimated value from vegetative vigor study MRID 435496-01

[1]For terrestrial plants data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the terrestrial risk assessment.

[2] acute to chronic ratio from propanil extrapolation

*most sensitive species tested

Table 1.4: Summary of endpoints (LD_{50} or LC_{50} mg ae/kg) for Terrestrial Toxicity data used in RQ calculations for Mefluidide[1]			
TAXONOMIC GROUP	**Acute endpoint**	**Chronic endpoint**	
Acute Avian	>1500* Bobwhite quail		MRID 416019-01 Used this non-definitive endpoint as LD50
Chronic Avian		38	Estimated value acute to chronic ratio based on mefluidide mammal data
Acute Dietary Avian	>3750*		
Acute mammal	829.8* mouse		MRID 00047116
Chronic mammal		102* rat	MRID 00082748

[1]For terrestrial plants data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the terrestrial risk assessment.

[2] acute to chronic ratio from propanil extrapolation

*most sensitive species tested

1.5. Uncertainties, Assumptions, Limitations, and Data Gaps

- Ecotoxicity data for chronic risks to birds exposed to mefluidide were not available. Therefore, EFED calculated estimates for measurement endpoints for chronic toxicity to birds by evaluating the available data from mammal toxicity data (acute and chronic) and extrapolating the findings to available data for mefluidide, mefluidide-DEA and mefluidide-K to estimate possible effects measurement endpoints. These extrapolated endpoints are uncertain and are not considered complete substitutes for missing effects data. Additional information on these estimated values are provided in Appendix E. Submission of a chronic bird study would quantify risks associated with exposure of mefluidide to birds.

- The magnitude of toxicity to terrestrial plants is uncertain because only one terrestrial vegetative vigor plant study was available for full review and conducted on fresh weight and not dry weight as required by EPA guidelines. . A preliminary review on a recently submitted seedling emergence study (MRID 471907-01) was conducted. These results are uncertain until a full review of the study is performed. The results of the preliminary review are summarized in Appendix E. Therefore, to estimate possible effects measurement endpoints for seedling emergence, EFED assumed that EC_{25} toxicity values for terrestrial plants (vegetative vigor) are equivalent to (seedling emergence) measurement endpoints for mefluidide, mefluidide-DEA and mefluidide-K. These estimated endpoints are uncertain and are not considered complete substitutes for missing effects data. Additional information on these estimated values are provided in Appendix E.

- The available dietary toxicity studies on avian species failed to established definitive acute LD_{50} values (i.e., the lethality values exceed the highest dose tested). Therefore, use of this value adds uncertainty and may overestimate risk to avian species. Submission of an acute bird study with definitive LD_{50} values would quantify risks associated with exposure of mefluidide to birds.

- Exposure estimates for this screening level risk assessment focused on the mefluidide, mefluidide-K and mefluidide-DEA. Information or data is not available to evaluate degradates as a potentially significant contributor to aquatic risk and which may affect the outcome of risk conclusions are not considered in this risk characterization. Therefore, this assessment may require further analysis to evaluate degradates as a potential contributor to aquatic risk.

- In all cases, EFED concluded that resulting estimated risk quotients, had they been based on definitive effects measurement endpoints, would not trigger concerns for acute or chronic risks to freshwater fish, chronic estuarine marine fish, chronic estuarine marine invertebrates, chronic freshwater invertebrates, vascular plants (EC_{05} or NOAEC) and non-vascular plants (EC_{05} or NOAEC). In contrast, EFED concluded that resulting estimated risk quotients for terrestrial organisms would trigger concerns for chronic risks to birds and (listed and nonlisted) terrestrial and semi aquatic plants.

2. Problem Formulation

Problem formulation is used to establish the direction and scope of an ecological risk assessment. According to the Guidelines for Ecological Risk Assessment (USEPA, 1998), problem formulation consists of defining the problem and purpose for the assessment, and developing a plan for analyzing and characterizing risk. The critical components of the problem formulation are selection of the assessment endpoints, formulation of risk hypotheses and the conceptual model, and development of an analysis plan. The analysis plan and supporting rationale are aimed at determining whether the uses of mefluidide as a growth regulator to control ornamental and non-ornamental woody plants, ground cover, hedges trees, turf grasses, grass and broadleaf weeds, turf on rights-of-ways, airports, and industrial sites could result in exposures that cause unreasonable adverse effects (risk) to non-target organisms including those federally listed as threatened or endangered (hereafter referred to as "listed"). The maximum application rate for mefluidide applied as ground spray is 1.0 lb ae/A for mefluidide-K and mefluidide-DEA. The maximum application rate for mefluidide, as a granular formulation, is 0.5 lb ae/A. Mefluidide, mefluidide-K, mefluidide-DEA can be applied 3 times per season.

2.1 Stressor Source and Distribution

2.1.1 Environmental Fate Summary

Based on the review of the environmental fate data, mefluidide is moderately persistent and mobile in terrestrial environments. Possible routes of dissipation for mefluidide are photodegradation on soil surfaces, microbial mediated degradation, leaching, and runoff. There are no aerobic aquatic metabolism data to assess the environmental fate of mefluidide in aquatic environments.

Because a bridging strategy was employed to link mefluidide-K, mefluidide-DEA, mefluidide to mefluidide acid, exposure estimates for this screening level risk assessment focused on mefluidide acid. Environmental fate data were not available to evaluate exposure for mefluidide degradation products.

2.1.2 Pesticide Type, Class and Mode of Action

Mefluidide is an herbicide in the anilide chemical class. The mode of action is through inhibiting plant cell division, stem elongation and seed head development.

2.1.3 Use Characterization

Mefluidide is used to control ornamental and non-ornamental woody plants, ground cover, hedges trees, turf grasses, grass and broadleaf weeds. It is also registered for growth control of low maintenance turf on rights-of-ways, airports, and industrial sites. There are multiple active ingredient products that contain an additional plant growth regulator and herbicides such as, paclobutrazol, imazapyr, and imazethapyr. Current formulations include; granular, liquid-ready to use, and soluble concentrate/liquid. Mefluidide can be applied as a band treatment, broadcast, spot treatment, and spray. The equipment used to apply mefluidide includes; backpack sprayer, boom sprayer, ground equipment, hand held sprayer, handgun, hose-end sprayer, power sprayer, pressure sprayer, and spreader.

The highest use areas for mefluidide include South Carolina, North Carolina, Virginia, West Virginia, California, Nevada, Arizona, and New Mexico. The maximum application rate for mefluidide applied as ground sprays is 1.0 lb ae/A for mefluidide-K and mefluidide-DEA. The maximum application rate for mefluidide, as a granular formulation, is 0.5 lb ae/A. Mefluidide, mefluidide-K, mefluidide-DEA can be applied 3 times per season.

The uses that will be included in the re-registration assessment are; agricultural/farm structures/buildings and equipment, agricultural/nonagricultural uncultivated areas/soils, airports/landing fields, commercial industrial lawns, commercial institutional/industrial premises/equipment (indoor/outdoor), golf course turf, hospitals/medical institutions premises (human veterinary), household domestic dwellings outdoor premises, industrial areas

(outdoor), nonagricultural outdoor buildings/structures, nonagricultural rights-of-way/fencerows/hedgerows, ornamental and or shade trees, ornamental ground cover, ornamental herbaceous plants, ornamental lawns and turf, ornamental non-flowering plants, ornamental woody shrubs and vines, paths/patios, paved area (private roads/sidewalks), recreational areas, and residential lawns.

2.2 Assessment Endpoints

2.2.1 Ecosystems Potentially at Risk

Ecosystems potentially at risk are expressed in terms of the selected assessment endpoints. The typical assessment endpoints for screening-level pesticide ecological risks are reduced survival and reproductive and growth impairment for both aquatic and terrestrial animal species. Aquatic animal species of potential concern include freshwater fish and invertebrates, estuarine/marine fish and invertebrates, and amphibians. Terrestrial animal species of potential concern include birds, mammals, and beneficial insects. For both aquatic and terrestrial animal species, direct acute and direct chronic exposures are considered. In order to protect threatened and listed species, all assessment endpoints are measured at the individual level. Although endpoints are measured at the individual level, they provide insight about risks at higher levels of biological organization (e.g. populations and communities). For example, pesticide effects on individual survivorship have important implications for both population rates of increase and habitat carrying capacity.

For terrestrial and semi-aquatic plants, the screening assessment endpoint is the perpetuation of populations of non-target species (crops and non-crop plant species). Existing testing requirements have the capacity to evaluate emergence of seedlings and vegetative vigor. The endpoints of seedling emergence (estimated endpoint) and vegetative vigor may not address all terrestrial and semi-aquatic plant life cycle components, it is assumed that impacts at emergence and in active growth have the potential to impact individual ability to compete and reproductive success.

For aquatic plants, the assessment endpoint is the maintenance and growth of standing crop or biomass. Measurement endpoints for this assessment endpoint focus on vascular plants (*Lemna gibba*) and non-vascular plants (i.e., green algae) growth rates and biomass measurements.

The ecological relevance of selecting the above-mentioned assessment endpoints is as follows: (1) complete exposure pathways exist for these receptors; (2) the receptors may be potentially sensitive to pesticides in affected media and in residues on plants, seeds, and insects; and (3) the receptors could potentially inhabit areas where pesticides are applied, or areas where runoff and/or spray drift may impact the sites because suitable habitat is available.

2.2.2 Ecological Effects

Each assessment endpoint requires one or more "measures of ecological effect," which are defined as changes in the attributes of an assessment endpoint itself or changes in a surrogate entity or attribute in response to exposure to a pesticide. Ecological measurement endpoints for the screening level risk assessment are based on a suite of registrant-submitted toxicity studies performed on a limited number of organisms in the following broad groupings:

- Birds (mallard duck and bobwhite quail), also used as a surrogate for terrestrial phase amphibians and reptiles (no chronic data submitted on birds),
- Mammals (chronic data on laboratory rat, acute data on laboratory mouse),
- Freshwater Fish (bluegill sunfish and rainbow trout), also used as a surrogate for aquatic phase amphibians. (no chronic data submitted on freshwater fish)
- Freshwater invertebrates (waterflea) (no chronic data submitted on freshwater invertebrates),
- Estuarine/marine fish (no chronic data on estuarine/marine fish submitted),
- Estuarine/marine invertebrates (no chronic data on estuarine/marine invertebrates submitted),
- Aquatic plants (freshwater and estuarine/marine).
- Terrestrial Plants (vegetative vigor, preliminary review seedling emergence study)

Within each of these very broad taxonomic groups, an acute and chronic endpoint is selected from the available test data, as the data sets allow. Additional ecological effects data were available for other taxa and have been incorporated into the risk characterization as other lines of evidence, including acute contact and oral toxicity on honeybees and acute risk to earthworm.

A complete discussion of all toxicity data available for this risk assessment and the resulting measurement endpoints selected for each taxonomic group are included in Section 3 of this document. A summary of the assessment and measurement endpoints selected to characterize potential ecological risks associated with exposure to mefluidide is provided in Table 2.2.

Table 2.2 Summary of Assessment Endpoints and Measures of Effect for Mefluidide, Mefluidide-DEA[1] and Mefluidide-K[1]

Assessment Endpoint	Measures of Effect
1. Abundance (i.e., survival, reproduction, and growth) of individuals and populations of birds	1a. Bobwhite quail acute oral LD_{50} 1b. Bobwhite quail and mallard duck subacute dietary LC_{50} 1c. NOAEC estimated value
2. Abundance (i.e., survival, reproduction, and growth) of individuals and populations of mammals	2a. Laboratory mouse acute oral LD_{50} 2b. Laboratory rat LD_{50} 2c. Laboratory rat chronic NOAEC
3. Survival of individuals and communities of freshwater fish and invertebrates	3a. Rainbow trout and bluegill sunfish acute LC_{50} 3b. Water flea acute EC_{50} 3. NOAEC estimated values
4. Survival of individuals and communities of estuarine/marine fish and invertebrates	4 a. Sheepshead minnow LC_{50} 4 b. Eastern oyster EC_{50} 4 d. NOAEC estimated values
5. Survival of beneficial insect populations	5a. Honeybee acute contact LD_{50}
6. Maintenance and growth of individuals and populations of aquatic plants from standing crop or biomass	6a. Vascular plant (i.e., *Lemna*) EC_{50} values for growth rate and biomass measurements 6b. Non-vascular plant (i.e., *Navicula*) EC_{50} values for growth rate and biomass measurements 6c.EC05s estimated values for vascular and non-vascular plants
7. Maintenance and growth of individuals and populations of terrestrial plants from standing crop or biomass	7a. Vegetative Vigor EC_{25} values for growth rate and biomass measurements 7. Seedling Emergence EC_{25} estimated values for growth rate and biomass measurements

LD_{50} = Lethal dose to 50% of the test population.
LC_{50} = Lethal concentration to 50% of the test population.
EC_{50}/EC_{25} = Effect concentration to 50%/25% of the test population.
NOAEC = No observed adverse effect level.
LOAEC = Lowest observed adverse effect level.
[1] The risk assessment strategy is designed to bridge the environmental fate and effects data for the mefluidide-K and mefluidide-DEA to mefluidide. Therefore, the most sensitive endpoint for the three mefluidide compounds (mefluidide, mefluidide-K, mefluidide-DEA) was selected to represent all mefluidide compounds for aquatic and terrestrial organisms in each category.

2.3 Conceptual Model

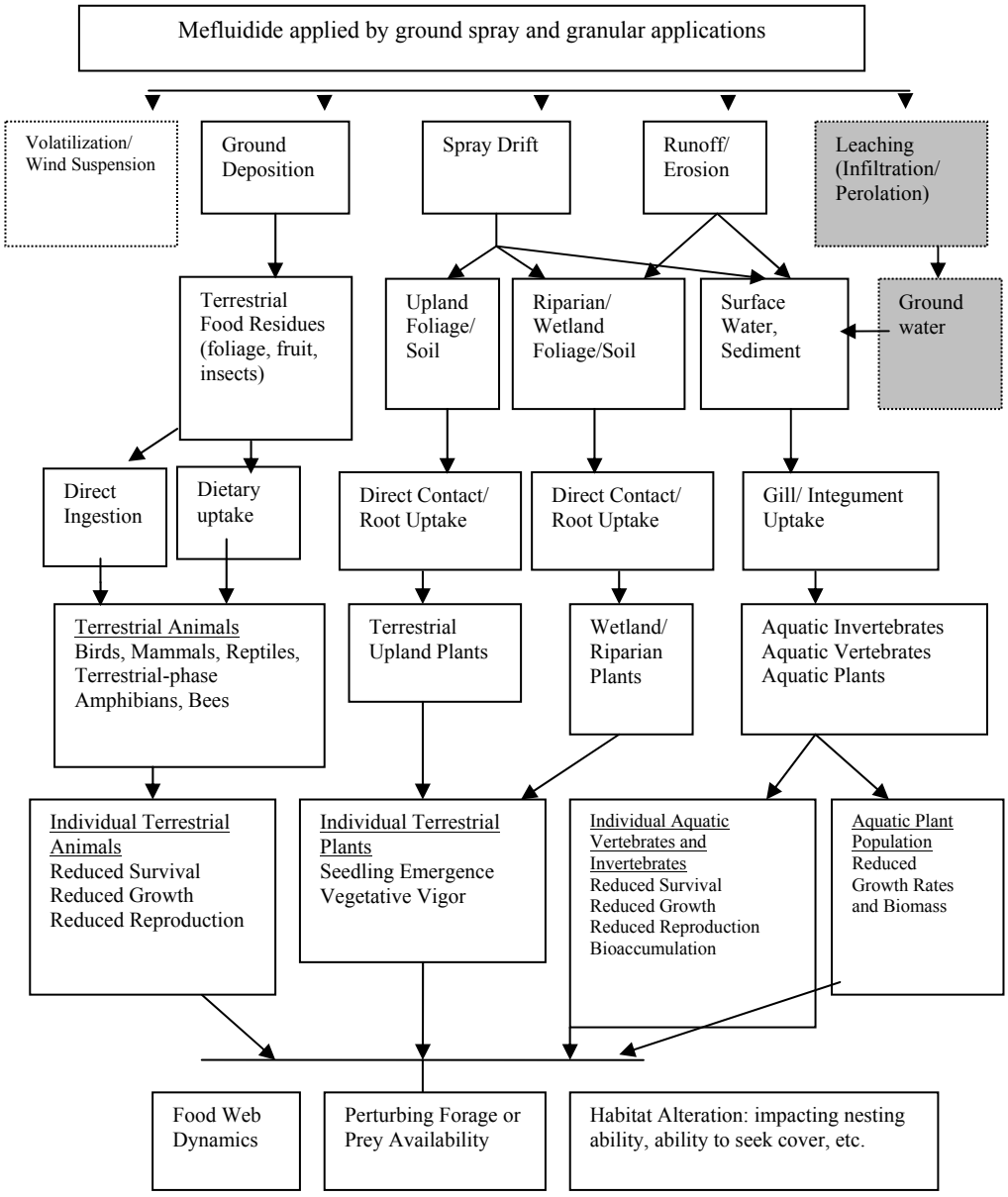
In order for a chemical to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a contaminant moves in the environment from a source to an ecological receptor. For an ecological exposure pathway to be complete,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

The source and mechanism of release of mefluidide and its salts is ground application (spray and granular) and is an herbicide growth regulator used to control ornamental and non-ornamental woody plants, ground cover, hedges trees, turf grasses, grass and broadleaf weeds. It is also registered for growth control of low maintenance turf on rights-of-ways, airports, and industrial sites. The conceptual model and subsequent analysis of exposure and effects are all based on mefluidide. Surface water runoff from the areas of application is assumed to follow topography. Additional release mechanisms include spray drift, and wind erosion, which may potentially transport site-related contaminants to the surrounding air. Potential emission of volatile compounds is not considered as a viable release mechanism for mefluidide of because of a low Henry's Constant ($2.27E^{-7}$ atm m^3/mol). The conceptual model shown in **Figure 2.1** generically depicts the potential source of mefluidide, release mechanisms, abiotic receiving media, and biological receptor types.

2.3.1 Conceptual Model Diagram

The conceptual model employs a bridging strategy to account for the dissociation of mefluidide-K and mefluidide-DEA with the formation of form mefluidide acid. Additionally, mefluidide is in a keto-enol equilibrium with mefluidide acid. Therefore, the conceptual model is focused on the fate and disposition of mefluidide acid in the environment, and mode of application (e.g., ground spray and granular application). A conceptual model (**Figure 2.1**) was developed that represents the possible relationships between the stressor, ecological endpoints, and the measurement endpoints. Risk to non-target animals is also possible from dermal contact or inhalation, but because these are not considered in the risk assessment, they are not shown in the diagram below.

Figure 2.1) Conceptual Model[1]



[1] Shaded areas in the conceptual model are not assessed in the risk assessment.

2.3.2 Terrestrial Environment

The highest mefluidide residue levels are expected to be located on the surface soil and on foliage (e.g., short and tall grasses, broadleaf weeds), seeds, and insects on the treated agriculture field immediately following ground spraying.

While spray drift may result in transport of mefluidide to off-target field surface soil, foliage, and insects, the highest concentrations for these media are still expected to be those in the treated field. Birds, mammals, reptiles, and amphibians that ingest foliage, insects and/or soil invertebrates from either the treated area or from spray drift impacted areas are potentially exposed to mefluidide residues in their diet. Endpoints were included that represented reduced survival, growth, and reproduction in these taxonomic groups from dietary exposure. Because toxicity data for reptiles and terrestrial-phase amphibians are rarely available, risk assessment results for birds were used as surrogates to assess risks to reptiles and terrestrial-phase amphibians (USEPA 2004).

These animals may also be exposed to mefluidide by other exposure routes not accounted for in this risk assessment, such as incidental ingestion of the soil; dermal contact with the surface of the foliage or soil, direct impingement of sprayed material on the body at time of application , residues on dust particulates; and/or ingestion of residues in drinking water sources such as dew that form on plants and soil, puddles on the field or in spray drift impacted areas at the time of application or which form after a rain event, and/or surface water in spray drift and runoff impacted areas. Because of the low octanol/water partitioning coefficient (log K_{ow}=1.97; K_{ow}=94.5) and a low Henry's Constant of ($2.27E^{-7}$ atm m^3/mol) concerns for dermal and inhalation exposure would be minimal. Additional exposure pathways and routes following application includes uptake of mefluidide by plants from soil which can then be ingested by wildlife and which can then be ingested by other wildlife (i.e., food chain transfer).

Mefluidide may reach off-field terrestrial or riparian/wetland vegetation environments in spray drift at the time of application. Following a rain event mefluidide, may also reach off-field terrestrial or riparian/wetland vegetation environments in sheet and channel flow runoff.

2.3.3 Aquatic Environment

Direct application of mefluidide to streams, lakes, and ponds is forbidden by the product label. The highest mefluidide residue levels are expected to be located in surface waters adjacent to treated agricultural fields at the time of application due to spray drift and/or from runoff after a rain event.

Because mefluidide is moderately persistent in soils and has a low soil: water partition coefficient, there is high likelihood of transport by runoff. Exposure estimates for this screening level risk assessment focused on mefluidide. Information or data was not available

to evaluate degradates as a potentially significant contributor to aquatic risk and is not considered in this risk characterization. Fish, amphibians, and aquatic invertebrates that live in aquatic environments are potentially exposed to mefluidide residues in surface water by direct contact of their integument (covering of the body or a part such skin, gill membranes, cuticle, etc.) and via uptake through their gills or integument. Assessment endpoints were selected to assess reduced survival, growth, and reproduction in these taxonomic groups from combined direct contact with integument and uptake across the gill or integument. Because toxicity data for amphibians are rarely available, addressing risks for fish were used as a surrogate to assess risks to amphibians (USEPA 2004). Aquatic plants may be potentially exposed by contact with mefluidide residues in surface water or through sorption and uptake through roots from water compartments or across cell walls.

Leaching (infiltration/percolation) may result in transport of mefluidide through the soil column into groundwater which may, in some circumstances, flow into a surface water body. However, groundwater and surface water interactions are not in the exposure estimates for evaluating ecological risks.

Bioaccumulation of mefluidide in fish tissue is not expected due to a low octanol water partitioning coefficient (log K_{ow}=1.97; K_{ow}=94.5). Mefluidide was not found to substantially accumulate (BCF = 0 to 1.11) in catfish tissues during bioconcentration studies (Accession Number 226851).

2.4 Risk Hypothesis

- Terrestrial vertebrates (birds, mammals, reptiles, terrestrial-phase amphibians) are subject to adverse direct effects such as reduced survival, growth, and reproduction when exposed to mefluidide residues as a result of labeled use of the pesticide.

- Non-target terrestrial plants are subject to adverse effects such as reductions in vegetative vigor and seedling emergence when exposed to mefluidide residues as a result of labeled use of the pesticide.

- Aquatic invertebrates, fish, and amphibians in surface waters (freshwater or saltwater) receiving spray drift or runoff from treated fields following mefluidide application are subject to adverse effects such as reduced reproduction, growth, and survival when exposed to mefluidide residues as a result of labeled use of the pesticide. Aquatic plants may be potentially exposed by contact with mefluidide residues in surface water or through sorption and uptake through roots from water compartments or across cell walls.

3 ANALYSIS

3.1 Use Characterization

Mefluidide is used to control ornamental and non-ornamental woody plants, ground cover, hedges trees, turf grasses, grass and broadleaf weeds. It is also registered for growth control of low maintenance turf on rights-of-ways, airports, and industrial sites. There are multiple active ingredient products that contain an additional plant growth regulator and herbicides such as, paclobutrazol, imazapyr, and imazethapyr. Current formulations include; granular, liquid-ready to use, and soluble concentrate/liquid. Mefluidide can be applied as a band treatment, broadcast, spot treatment, and spray. The equipment used to apply mefluidide includes; backpack sprayer, boom sprayer, ground equipment, hand held sprayer, hose-end sprayer, power sprayer, pressure sprayer, and spreader.

The highest use areas for mefluidide include South Carolina, North Carolina, Virginia, West Virginia, California, Nevada, Arizona, and New Mexico. The maximum application rate for mefluidide applied as ground spray is 1.0 lb ae/A for mefluidide-K and mefluidide-DEA. The maximum application rates for mefluidide, as a granular formulation, is 0.5 lb ae/A. Mefluidide, mefluidide-K and mefluidide-DEA can be applied 3 times per season.

The uses that will be included in the reregistration assessment are: agricultural/farm structures/buildings and equipment, agricultural/nonagricultural uncultivated areas/soils, airports/landing fields, commercial industrial lawns, commercial institutional/industrial premises/equipment (indoor/outdoor), golf course turf, hospitals/medical institutions premises (human veterinary), household domestic dwellings outdoor premises, industrial areas (outdoor), nonagricultural outdoor buildings/structures, nonagricultural rights-of-way/fencerows/hedgerows, ornamental and or shade trees, ornamental ground cover, ornamental herbaceous plants, ornamental lawns and turf, ornamental non-flowering plants, ornamental woody shrubs and vines, paths/patios, paved area (private roads/sidewalks), recreational areas, and residential lawns.

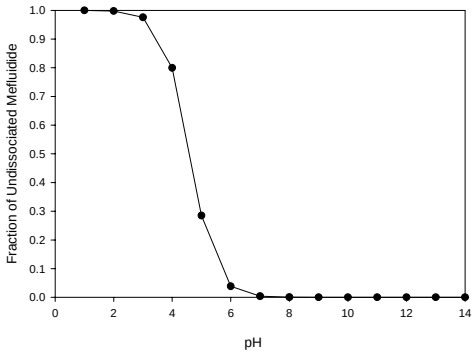
3.2 Exposure Characterization

3.2.1 Environmental Fate and Transport Characterization

The risk assessment strategy is designed to bridge the environmental fate data for the mefluidide-K, mefluidide-DEA, mefluidide to mefluidide acid. Based on the ionic nature of mefluidide-K and mefluidide-DEA and two unreviewed dissociation studies, mefluidide-K and mefluidide-DEA will dissociate rapidly and completely to form mefluidide acid. The two unreviewed dissociation studies (MRIDs 422833-01 and 42282001) indicated mefluidide-K completely dissociated in 7 minutes and mefluidide-DEA completely dissociated in 3 minutes. The reported pKa for mefluidide acid is 4.6. These data suggest complete dissociation of

mefluidide acid is expected to occur at pH~7 (Figure 2), with 50% or greater dissociation at pHs ≤ 4.6. Mefluidide exhibits an enol-keto equilibrium with mefluidide acid (Figure 1).

Figure 2: Fraction of Undissociated Mefluidide as a Function of pH



Possible routes of dissipation for mefluidide are photodegradation on soil surfaces, microbial mediated degradation, leaching, and runoff. Mefluidide is not prone to abiotic hydrolysis or photolysis in sterile buffer solutions within the environmentally relevent pH range of 4 to 9 (Accession No. 226846, MRID 42935401). There are data showing mefluidide undergoes rapid photodegradation ($t_{1/2}$ = 2 to 3 days) in natural well water (Accession No. 226851). On soil surfaces, mefluidide photodegraded with a half-life of 4.85 days. Nine unidentified photodegradation products were detected in the soil (MRID 43040801).

Mefluidide in aerobic soils degraded with a half-life of 12 days (MRID 43162201). The only degradation product was 5-amino-2,4-dimethyltrifluoromethanesulfonilide. It was found at a maximum daily concentration of 2.8% of applied mefluidide at 22 days post-treatment. Diethanolamine is a degradation product of mefluidide-DEA. Non-extractable radiolabeled mefluidide residues accounted for 32 to 37% are 366 days post-treatment. Evolved CO_2 accounted for 20.9% at 366 days posttreatment mefluidide was stable ($t_{1/2}$ > 1 year) in anaerobic environments (MRID 43120001).

Mefluidide has Freundlich adsorption coefficients of 0.22 (1/n=0.35) in sand, 0.14 (1/n=0.95) in silt loam soil, 0.083 (1/n=1.3) in clay soil, and 0.11 (1/n=1.0) in sand sediment (MRID 42998201). There was no relationship of soil OC content and Kd. Aged residues of mefluidide were detected in the leachate of aged residue soil column leaching studies (MRID 43020801).

Mefluidide dissipated with a half-life of 2.0 to 3.3 days in warm-season turf soil in Georgia and 1.2 to 1.4 days in cool-season grass soil in Missouri (MRID 43276802 and 43276801). It was not detected in soil samples at depths greater than 6 inches. Degradation products were not evaluated in the field dissipation studies. Mefluidide dissipated from grass

foliage at half-lives of 1.7 to 6.91 days (upper 90th percentile of mean half-life=4.0414 day, k=0.1715 days$^{-1)}$.

Bioaccumulation of mefluidide in fish tissue is not expected due to a low octanol water partitioning coefficient (log Kow=1.97; Kow=94.5). It also was not found to substantially accumulate (BCF = 0 to 1.11) in catfish tissues during bioaccumulation studies (Accession Number 226851).

There are no environmental fate data on 5-amino-2, 4-dimethyltrifluoro-methane-sulfonilide. Diethanolamine (DEA) degrades rapidly ($t_{1/2}$= 1.7 to 5.8 days) in aerobic soil and water environments (MRID 43685901, 43685902, 44439401). In contrast, DEA is persistent ($t_{1/2}$= 990 days) in anaerobic aquatic environments (MRID 43882901). Degradation products of diethanolamine are glycine, ethanolamine, and CO_2.

3.2.2 Measures of Aquatic Exposure

3.2.2.1 Aquatic Exposure Modeling

PRZM (3.12 beta) and EXAM (2.97.5) using PE4V01.pl (August 13, 2003) were used to estimate mefluidide residue concentrations in surface water. Because mefluidide use is associated with turf, the aquatic exposure assessment was conducted using the PA and FL turf scenarios. These use scenarios were selected to represent of rights-of-way, residential turf, industrial areas with turf (i.e., airports, etc.), and golf courses. It is important to note that all mefluidide uses (i.e., spot treatments, etc.) were expressed on a lbs ae/A basis. This approach is expected to be conservative because it assumes 100% of the watershed is treated with mefluidide. Application rates of mefluidide are expressed in acid equivalence to address the bridging of mefluidide-K, mefluidide-DEA, mefluidide to the assigned stressor (the two forms of mefluidide: enol/keto; same molecular weight). Table 3.4 contains a summary of the various labled application rates which suggests that the maximum rate is that of mefluidide-DEA. Foliar dissipation half-lives for mefluidide were estimated from field dissipation studies for warm-season and cool season grasses (MRID 43276801 and MRID 43276802). PRZM /EXAMS input parameters for mefluidide are shown in **Table 3.1**. Estimated environmental concentrations are shown in **Table 3.2.**

Table 3.1. Input Parameters for Mefluidide Acid for PRZM/EXAMS Modeling for Aquatic Exposure Assessment

Variable Description	Input Value	Source of Info/Reference
Application date(s) (day/mo/yr)	15/05	Product label
Number of Applications	3	Label Recommendation
Application Interval (days)	42 days	Label Recommendation
Incorporation depth (cm)	Default=0	Product label
Application rate (kg a.e. ha^{-1})	Acid- 0.56 DEA salt- 1.12 K salt- 1.12	Bead Use Closure Memorandum
Application efficiency (fraction)	0.99	Spray Drift Task Force Data
Spray drift fraction: For aquatic ecological exposure assessment, use 0.05 for aerial spray; 0.01 for ground spray. For drinking water assessment, use 0.16 for aerial 0.064 for ground spray.	0.01	Spray Drift Task Force Data
Foliar extraction (frac./cm rain)	0.5 is the default unless field data is available	Default or field data
Decay rate on foliage (days-1)	$T_{1/2}$=4.0414 days Rate constant = 0.1715/day	Derived as 90th percentile of the mean foliar dissipation half-life from field dissipation studies. This value also used for terrestrial modeling (MRID 43276801 MRID 43276802).
Volatilization rate from foliage (day-1)	0.0 is the default unless field data is available	Default or field data
Plant uptake factor (frac. of evap)	0.0	Default
Aerobic soil metabolism Half-life (days)	$T_{1/2}$ =36 days Estimation = 3 X 12 days	MRID 43162201
Anaerobic Aquatic Metabolism Half-life (days)	Stable	MRID 43120001
Aerobic Aquatic Metabolism Half-life (days)	72 days Estimation= 2 X 36 days	No Data Available

Photodegradation in Water Half-life (days)	Stable	MRID 42935401
Adsorption Soil: Water Partitioning Coefficients	0.073 (lowest non-sand Kd)*	MRID 42998201
Molecular Weight (grams/mole)	310.6	Calculated for Mefluidide structure
Henry's Constant (atm m^3/mol)	$2.27E^{-7}$	EFED One Liner
Vapor Pressure (torr)	1E-4	EFED One Liner
Solubility (mg/L)	180	EFED One Liner
Chemical Application Method	2	Foliar Application

[1] Acid equivalence was calculated using the following equations:
Mefluidide-DEA= 310 g/mole (MW mefluidide)/415.24 g/mole (MW mefluidide-DEA)=0.75*concentration of ai
Mefluidide-K= 310 g/mole (MW mefluidide)/348.29 g/mole (MW mefluidide-K)=0.89*concentration of ai
Mefluidide = 310 g/mole (MW mefluidide)/310 g/mole (MW mefluidide acid)= 1.0* concentration of ai
*there was no relationship of soil OC content. Therefore the lowest non-sand Kd was used.

The 1 in 10 year peak concentration for mefluidide is not expected to exceed 10.573 µg/L. The 1 in 10 year 21-day and 60-day average concentrations are not expected to exceed 9.623 µg/L and 8.448 µg/L, respectively. A major uncertainty in the assessment is the persistence of mefluidide acid in aerobic aquatic environments. This assessment was conducted using an estimated aerobic aquatic half-life of 72 days (Guidance for Chemistry and Management Practice Input Parameters for Use in Modeling the Environmental Fate and Transport of Pesticides, Version 2, 11/7/2000). Because this estimated half-life was designed to approximate upper 90th percentile of the mean half-life, it is anticipated to be a conservative estimate of mefluidide acid persistence in aquatic environments.

Table 3.2 Tier II Estimated Environmental Concentrations for Mefluidide Acid

Scenario	Chemical	1 in 10 year Concentration (ug ae/L)		
		Peak	21 day average	60 day average
FL Turf	Mefluidide	4.835	4.399	3.890
	Mefluidide-DEA	10.573	9.623	8.448
	Mefluidide-K	10.573	9.623	8.448
PA Turf	Mefluidide	3.031	2.900	2.638
	Mefluidide-DEA	7.054	6.738	6.265
	Mefluidide-K	7.054	6.738	6.265

3.2.2.1 Monitoring Data

NAWQA surface or ground water monitoring data were not found for mefluidide, mefluidide-K and mefluidide-DEA.

3.2.3 Measures of Terrestrial Exposure

The measures of exposure for terrestrial receptors in Agency ecological risk assessments can be obtained from monitoring data, field studies, GIS analysis, and exposure modeling. The TREX (v.1.3.1) model was used to generate measures of exposure for terrestrial organisms that may come in contact with areas where mefluidide may be used. This assessment focuses on all methods of exposure for terrestrial birds and mammals as a result of spray and granular applications of mefluidide. Other routes of exposure, primarily dermal, inhalation, and incidental soil ingestion were not evaluated in this assessment. The degree to which these routes of exposure may be important compared to exposure from dietary ingestion is an uncertainty. Even though these routes of exposure may be important to the overall risk assessment, they require more analyses and data than those available for a screening-level assessment. However, inhalation is not likely to be an important exposure pathway because of the low Henrys Constant of mefluidide (2.27E-7 atm m^3/mole). Dermal exposure is not likely to be an important exposure pathway because of the low octanol/water partitioning coefficient (log K_{ow}=1.97; K_{ow}=94.5). Mammalian toxicity studies for both inhalation and dermal exposure to mefluidide indicate low acute toxicity are summarized in Appendix E. Incidental soil ingestion is another possible route of exposure; available data suggests that up to 15% of the diet can consist of incidentally ingested soil depending on the species and feeding strategy (Beyer et al, 1994). Because mefluidide is moderately persistent in soils, incidental soil ingestion is a possible exposure pathway.

Exposure of free-ranging receptors is a function of the timing and extent of pesticide application with respect to the location and behavior of identified receptors. EFED's terrestrial exposure model generates exposure estimates assuming that the receptor is present on the use site at the time that pesticide levels are their highest.
The maximum pesticide residue concentration on food items is calculated from both initial applications and additional applications taking into account pesticide degradation between applications. In this assessment, three applications of mefluidide per season are applied as recommended by the label. Because mefluidide dissipates rapidly from turf foliage ($t_{1/2}$ = 4 days) and the application intervals are long (42 days), the likelihood for carry-over of mefluidide residues between applications is low.

The current approach to screening-level terrestrial exposure estimation does not directly relate the timing of exposure to critical or sensitive population, community, or ecosystem processes. Therefore, it is difficult to address the temporal and spatial co-occurrence of mefluidide use based on application timing, application location and sensitive ecological processes. However, it is worth noting that pesticides are frequently used from spring through fall, which are times of active migrating, feeding, and reproduction for many wildlife species. The increased energy demands associated with these activities (as opposed to hibernation, for example) can increase the potential for exposure to pesticide contaminated food items since agricultural areas can represent a concentrated source of relatively easily obtained, high-energy food items. In this assessment, the spatial extent of exposure for terrestrial animal species is limited to the use area only.

It is assumed that given the typically lower metabolic demands of reptiles and amphibians compared to birds, exposure to birds would be greater due to higher relative food consumption. While this assumption is likely true, there are no supported relationships regarding the relative toxicity of a compound to birds and herpetofauna.

3.2.3.1 Terrestrial Exposure Modeling

Birds and Mammals

Estimated exposure concentrations for terrestrial receptors were determined using the standard screening-level exposure model, TREX (v.1.3.1) (US EPA,2006). Maximum exposure levels were calculated for spray applications of mefluidide using maximum proposed application rates, maximum number of applications, and minimum application intervals for all proposed uses (**Table 3.3**). These exposure estimates are based on a database of pesticide residues on wildlife food sources associated with a specified application rate. Essentially, for a single application, there is a linear relationship between the amount of pesticide applied and the amount of pesticide residue present on a given food item. These relationships for the various food items are determined from the Kenaga nomogram as modified by Fletcher (Hoerger and Kenaga, 1972; Fletcher et al., 1994). TREX (v.1.3.1) is a simulation model that, in addition to incorporating the nomogram relationship, also includes pesticide degradation in the estimation of EECs. These EEC values from the TREX model are summarized in Appendix D

TREX calculates pesticide residues on each type of food item on a daily interval for one year. A first order decay function is used to calculate the residue concentration at each day based on the concentrations present from both the initial and additional applications. The first-order rate equation is: $C_t = C_i e^{-kt}$ Where C_t is concentration at time t (days; t= 0 initially), C_i is initial concentration after application, k is the foliar dissipation half-life, and t is time in days. The initial concentration, C_i, is determined by multiplying the application rate by a constant specific to a food item**.**

For the ornamental turf control application for mefluidide-DEA and mefluidide-K at 1.0 lb a.e. of pesticide per acre the upper-bound, food item concentration (ppm) is: 240.17 for short grass, 110.08 for tall grass, 135.09 for broadleaf plants and small insects, and 15.01 for fruits, pods, and large insects.

The dose-based EECs (mg/kg-bw) derived above are compared with LD_{50} or NOAEL (mg/kg-bw) values from acceptable or supplemental toxicity studies that are adjusted for the size of the animal tested compared with the size of the animal being assessed (e.g., 20-gram bird). These exposure values are presented as mass of pesticide consumed per kg body weight of the animal being assessed (mg/kg-bw). EECs and toxicity values are relative to the animal's body weight (mg residue/kg bw) because consumption of the same mass of pesticide residue results in a higher body burden in smaller animals compared with larger animals. For

birds, only acute values (LD_{50}s) are adjusted because dose-based risk quotients are not calculated for the chronic risk estimation. Adjusted mammalian LD_{50}s and reproduction NOAELs (mg/kg-bw) are used to calculate dose-based acute and chronic risk quotients for 15 g, 35 g, and 1000 g mammals. The test weight value for the acute laboratory mouse (20 g), (Lehman,A.J.1975), replaced the (350 g) laboratory rat value in the TREX modeled equations. Equations and calculations for adjusted LD_{50s} (mammals and birds) are summarized in Appendix D.

In many cases, an empirically determined foliar dissipation half-life value is not available, in which case the default value of 35 days is used (Willis and McDowell, 1987**).** However, a 4 day foliar dissipation half life was estimated from field dissipation studies on warm-season and cool season grasses (MRID 43276801 and 43276802). The food item concentration on any given day is the sum of all concentrations up to that day taking into account the first-order degradation. The initial application is on day 0 (t = 0) and runs for 365 days. Over the 365 day run, the highest residue concentration is used in calculations of the RQ.

Table 3.3 lists exposure estimates for birds and animals obtained from TREX simulations for all the proposed uses of mefluidide at maximum label rates. Importantly, TREX considers exposure only in the area where mefluidide is applied. The underlying assumption is that most, if not all, of the applied pesticide will settle in the use area. However, depending on weather conditions and type of application, spray drift of pesticides may occur, increasing the likelihood of wildlife exposure outside the use area.

Table 3.3 Estimates of Foliar residues of Mefluidide for proposed uses (dietary based EECs)[1]

Use	Application Rate lbs. ae/A (# app / interval, days)	Food Items	Upper Bound EEC (mg/kg)
Ornamental Turf Ground sprays (Mefluidide salts only)	1.0 3 per season 42 Day interval	Short grass	240.17
		Tall grass	110.08
		Broadleaf plants/small insects	135.09
		Fruits, pods, seeds, and large insects	15.01

[1]Predicted maximum residues for specified application rates are based on Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994).

The residues or estimated environmental concentrations (EECs) on food items may be compared directly with subacute dietary toxicity data or converted to an ingested whole body dose (single oral dose), as is the case for small mammals and birds. Single-oral dose estimates represent, for many pesticides, an exposure scenario where absorption of the pesticide is maximized over a single ingestion event. Subacute dietary estimates provide for possible effects of the dietary matrix and more extended time of gut exposure on pesticide absorption across the gut. However dietary exposure endpoints are limited in their utility because the current food ingestion estimates are uncertain and may not be directly comparable from laboratory conditions to field conditions. The EEC is converted to an oral dose by multiplying

the EEC by the percentage of body weight consumed as estimated through allometric relationships. These consumption-weighted EECs (i.e. EEC equivalent dose) are determined for each food source and body size for mammals (15, 35, and 1000 g) and birds (20, 100, and 1000 g).. The EEC equivalent doses, formulas and calculations for adjusted body weights for birds and mammals based on 1.0 lb ae/A from TREX for turf are summarized in **Appendix D**.

A second approach for calculation of acute RQs for birds and mammals is the LD_{50} per ft^2 method. This method is used to address the exposure from granular pesticides (i.e., mefluidide). EECs for this approach are calculated from the application rate (lbs ae/acre) and converted to mg ae/sq ft using the formula:

lbs ae/acre * (453590 mg/lb) * (acre/43560 sq ft) = mg ae/sq ft.

Because the chemical is not incorporated into the soil immediately after application, it is assumed that 100% of the material is available to birds and mammals (USEPA 1992). For a single application of mefluidide at 0.5 lbs ae/acre, the EEC was calculated at 5.21 mg ae/sq ft. This approach can only be applied for single applications.

Terrestrial Plants

Terrestrial and semi-aquatic plants may be exposed to pesticides from runoff, spray drift or volatilization. Semi-aquatic plants are those that inhabit low-laying wet areas that may be dry at certain times of the year. The runoff scenario in TERRPLANT 1.2.1 is: (1) based on a pesticide's water solubility and the amount of pesticide present on the soil surface and its top one centimeter, (2) characterized as "sheet runoff" (one treated acre to an adjacent acre) for dry areas, (3) characterized as "channel runoff" (10 acres to a distant low-lying acre) for semi-aquatic or wetland areas, and (4) based on percent runoff values of 0.01, 0.02, and 0.05 for water solubilities of <10, 10-100, and >100 ppm, respectively. Spray drift is assumed as (1) 1% for ground application, (2) 5% for aerial, airblast, forced air, and spray chemigation applications, and (3) 0% for granular applications. Currently, EFED derives plant exposure concentrations from a single, maximum application rate only. EECs are calculated using the approach outlined in the text box below. The EECs for terrestrial plants for a single application of Mefluidide at the maximum label rate for ornamental turf are presented in **Table 3.4**

Table 3.4 EECs for Granular and Spray Applications to Terrestrial Plants Near Mefluidide Use Areas from TerrPlant (v 1.2.1)[1].

Application Rate, lbs a.e./A	Application method	EECs (lbs. a.e A)		
		Total Loading to Adjacent Areas (sheet runoff + drift)	Total Loading to Semi-Aquatic Areas (channelized runoff + drift)	Drift EEC
1.0 lb ae/A Turf	ground spray	0.06	0.51	0.01
0.5 lb ae/A Turf	granular	0.03	0.255	0.0050

[1] For terrestrial plant (seedling emergence and vegetative vigor) toxicity assessments, data evaluating mefluidide-K, mefluidide-DEA and mefluidide toxicity have been bridged. Therefore, the most sensitive Mefluidide endpoint was selected to represent terrestrial plants for all application scenarios.

[a] EECs for spray turf applications in this table were calculated for the maximum labeled application rates of (1.2 lbs ae/acre) and (1.0 lbs ae/acre) for mefluidide-DEA and mefluidide-K respectively..

[1]The runoff factor of 0.05 was used based on solubility of 180

Because mefluidide is a spray applied herbicide, a more in-depth spray drift exposure assessment utilizing Tier I AgDRIFT® (version 2.01) modeling is also provided to better characterize potential exposure of terrestrial plants. AgDRIFT® utilizes empirical data to estimate off-site deposition of aerial and ground applied pesticides, and acts as a tool for evaluating the potential of buffer zones to protect sensitive habitats from undesired exposures. AgDrift provided 90th percentiles estimates based on the distribution of field measurements at 10 to 900, feet distances from the edge of field. **Table 3.5** contains EECs at several distances from the edge of the field for fine to very fine droplet size and medium to course droplet size.

Table 3.5 Estimated environmental concentrations (EECs) Deposition (lb ae./acre) at Specified Buffer Distance From Edge of Field (feet) from off-target terrestrial exposure to Mefluidide through spray drift derived from Tier I AgDRIFT® (version 2.01) at varying distance from the edge of field.

Buffer Distance From Edge of Field (feet)	1.0 lb ae/A*	1.0 lb ae/A**
10	0.0923	0.0275
20	0.0437	0.0149
40	0.0218	0.0087
60	0.0149	0.0064
80	0.0115	0.0052
100	0.0095	0.0044
140	0.007	0.0035
180	0.0056	0.0029
200	0.0051	0.0026
250	0.0042	0.0022
500	0.0021	0.0012
900	0.0011	0.0007

* Ground application assumed conditions of low boom, ASAE very fine to fine droplet size, and 90th

** Ground application assumed conditions of low boom, ASAE medium to course droplet size, and 90th

3.3 Ecological Effects Characterization

3.3.1 Aquatic and Terrestrial Effects Characterization

In screening-level ecological risk assessments, effects characterization describes the types of effects a pesticide can produce in an animal or plant. This characterization is based on registrant-submitted studies and an ECOTOX database search that describe acute and chronic effects toxicity information for various aquatic and terrestrial animals and plants. In addition, a review of Ecological Incident Information System (EIIS) was conducted to further refine the characterization of potential ecological effects. **Tables 3.6, 3.7, 3.8,** summarize the most sensitive ecological toxicity endpoints for aquatic organisms, terrestrial organisms, and aquatic and terrestrial plants, respectively, which were used for risk characterization. Discussions of the effects of mefluidide-K, mefluidide-DEA and mefluidide on aquatic and terrestrial taxonomic groups are presented below. Concentrations of mefluidide are expressed in acid equivalence to address the bridging of mefluidide-K, mefluidide-DEA, mefluidide to mefluidide acid.
Acid equivalence was calculated using the following equations:

Mefluidide-DEA= 310 g/mole (MW mefluidide)/415.24 g/mole (MW mefluidide-DEA)=0.75 *concentration of ai
Mefluidide-K= 310 g/mole (MW mefluidide)/348.29 g/mole (MW mefluidide-K)=0.89 *concentration of ai
Mefluidide acid = 310 g/mole (MW mefluidide)/310 g/mole (MW mefluidide acid)= 1.0 *concentration of ai

Appendix E summarizes the results of all of the registrant-submitted toxicity studies for this risk assessment. Also, a search of the ECOTOX database was completed on mefluidide. Results of Ecotox search are listed in Appendix H. For mammals, toxicity studies are limited to the laboratory rat. Estuarine/marine testing is limited to a crustacean, a mollusk, and a fish. Also, no available data was available for reptiles or amphibians. The risk assessment assumes that avian and reptilian and terrestrial-phase amphibian toxicities are similar. The same assumption is used for fish and aquatic-phase amphibians. The most sensitive ecological toxicity endpoints for aquatic organisms, terrestrial organisms, and aquatic and terrestrial plants were used for risk characterization.

. **Table 3.6, .3.7 and 3.8** provides a summary of acute and chronic toxicity data used for risk quotient calculation for mefluidide-K, mefluidide-DEA and mefluidide application.

Table 3.6: Summary of endpoints (LC_{50} or EC_{50}, mg ae/L) for Aquatic Toxicity used in RQ calculations for Mefluidide [1]			
TAXONOMIC GROUP	**Acute endpoint**	**Chronic endpoint**	**MRID/ Estimated value**
Acute freshwater fish	>68.47* Rainbow Trout		MRID 418937-02
Chronic freshwater fish		>0.267	Estimated value acute to chronic ratio
Acute freshwater inverts	>77.25* Daphnid		MRID 418937-03
Chronic freshwater inverts		>5.54	Estimated value acute to chronic ratio
Acute estuarine/marine fish	>84.75* Sheepshead minnow		MRID 425623-03
Chronic estuarine/marine fish		>0.267	Estimated value acute to chronic ratio
Acute estuarine/marine inverts	67* Eastern oyster		MRID 425624-01
Chronic estuarine/marine inverts		>5.54	Estimated value acute to chronic ratio

[1] For fish and invertebrates data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the runoff risk assessment.
* most sensitive species tested

Table 3.7: Summary of endpoints (LC_{50} or EC_{50}, mg ae/L) for Plant Toxicity used in RQ calculations for Mefluidide[1]			
TAXONOMIC GROUP	**Acute endpoint**	**NOAEC or EC_{05}**	
Acute vascular plant	0.515* Lemna		MRID 435266-01 Tier I (8% growth stimulation) Used this value as **EC_{50},**
Vascular plant(EC_{05})		>0.29	Estimated value acute to chronic ratio
Acute non-vascular plant	0.629* Navicula		MRID 435266-05 Tier I (11.5% growth reduction) Used this value as **EC_{50},**
Non-vascular plant(EC_{05})		>0.786	Estimated value acute to chronic ratio
Terrestrial Plant: Vegetative Vigor	Monocot:* Sorghum EC_{25} 0.105 lb ae/A Dicot:* Mustard EC_{25} 0.0054 lb ae/A	Monocot:* Sorghum NOAEC 0.045 lb ae/A Dicot:* Mustard NOAEC 0.0029 lb ae/A	MRID 435496-01
Terrestrial Plant: Seedling Emergence	Monocot: Sorghum EC_{25} 0.105 lb ae/A Dicot:* Mustard EC_{25} 0.0054 lb ae/A	Monocot: Sorghum NOAEC 0.045 lb ae/A Dicot:* Mustard NOAEC 0.0029 lb ae/A	Estimated value from vegetative vigor study MRID 435496-01

[1]For aquatic and terrestrial plants data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the terrestrial and runoff risk assessment.

*most sensitive species tested

Table 3.8: Summary of endpoints (LD_{50} or LC_{50} mg ae/kg) for Terrestrial Toxicity data used in RQ calculations for Mefluidide[1]			
TAXONOMIC GROUP	**Acute endpoint**	**Chronic endpoint**	
Acute Avian	>1500* Bobwhite quail		MRID 416019-01 Used this non-definitive endpoint as LD50
Chronic Avian		38	Estimated value acute to chronic ratio based on mammal data
Acute Dietary Avian	>3750*		
Acute mammal	829.8* mouse		MRID 00047116
Chronic mammal		102* rat	MRID 00082748

[1]For terrestrial plants data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the terrestrial risk assessment.

*most sensitive species tested

3.3.1.1 Aquatic Animals

Acute Toxicity to Freshwater Fish

There are no acute toxicity studies for mefluidide-K or mefluidide for bluegill sunfish (*Lepomis macrochirus*) (warm water species) or cold water species, rainbow trout (*Oncorhynchus mykiss*).

Mefluidide-DEA is practically non-toxic to the cold water species, rainbow trout (*Oncorhynchus mykiss*), with a non-definitive 96-hour LC_{50} of >68.47 mg ae/L and a NOAEC of 68.47 mg ae/L (MRID 418937-02). No mortalities or sublethal signs of toxicity in rainbow trout were observed with test material in any of the tested concentrations. The mean measured concentrations were 15.2, 12.5, 24.4, 45.2, and 91.3 mg ai /L. (11.4, 9.3, 18.3, 33.9 and 68.4 mg ae/L).

Mefluidide-DEA is practically non-toxic to the warm water species, bluegill sunfish (*Lepomis macrochirus)* with a non-definitive 96-hour LC_{50} of >70.80 mg ae/L and a NOAEC of 70.80 mg ae/L (MRID 418937-01). No mortalities or sublethal signs of toxicity in bluegill sunfish were observed with test material in any of the tested concentrations. The mean measured concentrations were 14.6, 19.7, 32.4, 58.3 and 94.4 mg ai /L(10.9, 14.7, 24.3, 43.7 and 70.8 mg ae/L).

The most conservative non-definitive LC_{50} of > 68.47 mg ae/L for mefluidide was determined from the rainbow trout fish study with mefluidide-DEA. Both studies were classified as acceptable based on guidelines §72-1(a) and §72-1(c) testing requirements. These results are summarized in Table E1.

The non-definitive LC50 of >68.47 mg ae/L was selected for evaluating freshwater fish for the runoff risk assessment of mefluidide-K, mefluidide-DEA and mefluidide.

Acute Toxicity to Estuarine/ Marine Fish

Mefluidide is practically non-toxic to sheepshead minnow (*Cyprinodon variegatus*), with a non-definitive 96-hour LC_{50} of >130 mg ae/L and a NOAEC of 130 mg ae/L (MRID 425624-03). No mortalities or sublethal signs of toxicity in sheephead minnow were observed with test material in any of the tested concentrations. The mean measured concentrations were 19, 28, 45, 80, and 130 mg ae /L**.**

Mefluidide-DEA is practically non-toxic to sheepshead minnow (*Cyprinodon variegatus*), with a non-definitive 96-hour LC_{50} of >84.75 mg ae/L and a NOAEC of 84.75 mg ae/L (MRID 425623-03). No mortalities or sublethal signs of toxicity in sheephead minnow were observed with test material in any of the tested concentrations. The mean measured concentrations were 16, 28, 34, 68, and 113 mg ai /L (12, 21, 25.5, 51 and 84.7 mg ae/L).

The non-definitive LC50 of >84.75 mg ae/L was selected for evaluating estuarine marine fish exposed to mefluidide-K, mefluidide-DEA and mefluidide for the runoff risk assessment .

Chronic Toxicity to Freshwater Fish and Estuarine/Marine Fish

No studies evaluating the chronic toxicity of mefluidide to freshwater or estuarine/marine fish have been submitted to the Agency. Due to lack of submitted chronic studies for freshwater fish estimated acute to chronic ratios (ACRs) were derived from the propanil analog. Therefore, the chronic NOAEC of > 0.267 mg ae/L value for freshwater fish was estimated from the propanil analog. Calculations and endpoints used to determine ACRs are summarized in Appendix E

Mefluidide is practically non-toxic to estuarine marine fish and slightly toxic to estuarine marine invertebrates on an acute basis. The lowest acute LC_{50} values reported for estuarine marine fish and invertebrates are >84.75 and (57.75 and 67 mg ae/L), respectively.

There are insufficient data to establish a definitive toxicity endpoint for estuarine/marine fish and invertebrate chronic effects for mefluidide and DEA salt acid equivalents for mefluidide. There is also little available data to compare to other anilide herbicides for this taxonomic group For the purposes of this risk assessment, it was assumed that estuarine marine fish were at least as sensitive as freshwater fish in terms of chronic toxicity. Therefore, the estimated endpoint for freshwater fish (NOAEC >0.267 mg ae/L) was used to estimate a chronic effects endpoint for estuarine/marine fish. The multiple assumptions involving extrapolations across species (fathead minnow and rainbow trout), data from a single analog

(propanil) and across freshwater and estuarine/marine conditions suggests that this estimate maybe highly uncertain. (For more information, please see source data in Appendix E for other anilide herbicide).

Acute Toxicity to Freshwater Invertebrates

Mefluidide-DEA is practically non-toxic to the waterflea (*Daphnia magna)*, with a non-definitive 48-hr EC_{50} >77.25mg ae/L and a NOAEC of 77.25mg ae/L (MRID 418937-03). Mean measured concentrations were 16.2, 28.0, 41.8, 68.0 and 103 mg ai/L. (12.1, 21, 31.3, 51 and 77.2 mg ae/L). One mortality for freshwater invertebrates occurred at the 51mg ae/L. This death was not considered treatment related due to 100% survival in the 77.2 mg ae/L concentration. This study is classified as acceptable according to the §72-2 guideline requirements.

The non-definitive LC_{50} of 77.25 mg ae/L was selected for evaluating freshwater invertebrates exposed to mefluidide-K, mefluidide-DEA, and mefluidide for the runoff risk assessment.

The results of these tests are summarized in Appendix E, Table E2.

Acute Toxicity to Estuarine/ Marine Invertebrates

Mefluidide is practically non-toxic to the estuarine marine mysid (*Mysidopsis bahia)*, with a 96-hr EC_{50} 133 mg ae/L and a NOAEC of 47 mg ae/L (MRID 425624-02). Mean measured concentrations were 16.2, 28.0, 47, 80 and 133 mg ae/L. One mortality for estuarine marine invertebrates occurred at the 28 mg ae/L treatment level. However, this death was not considered treatment related. By the end of the study 50% mortality had occurred in the 133 mg ae/L treatment group. This study is classified as acceptable according to the §72-3 guideline requirements.

Mefluidide-DEA is practically non-toxic to the estuarine marine mysid (*Mysidopsis bahia)*, with a 96-hr EC_{50} >94.5mg ae/L and a NOAEC of 31.5 mg ae/L (MRID 425623-02). Mean measured concentrations were 15, 26, 42, 75 and 126 mg ai/L (11.25, 19.5, 31.5, 56.2 and 94.5 mg ae/L). One mortality to estuarine marine mysid occurred at the 52.2 mg ae/L treatment level and 2 mortalities occurred in the 94.5 mg ae/L treatment level. No other mortalities or sublethal effects occurred during the test. This study is classified as acceptable according to the §72-3 guideline requirements.

Mefluidide is practically slightly toxic to the estuarine marine eastern oyster (*Crassostrea virginica)* for shell deposition, with a 96-hr EC_{50} 67 mg ae/L and a NOAEC of <12 mg ae/L (MRID 425624-01). Mean measured concentrations were 12, 21, 34, 55 and 99 mg ae/L. There were no mortalities or observations of sublethal effects during the test. The length measurements indicated shell growth inhibition ranging from 16.7% in the 12 mg ae/L

group to 73% in the 99 mg ae/L This study is classified as acceptable according to the §72-3 guideline requirements.

Mefluidide-DEA is slightly toxic to the estuarine marine eastern oyster (*Crassostrea virginica)* for shell deposition with a 96-hr EC_{50} 57.75 mg ae/L and a NOAEC of <10.5 mg ae/L (MRID 425623-01). Mean measured concentrations were 14, 23, 37, 61 and 98 mg ai/L.(10.5, 17.25, 27.75, 45.75 and 73.5 mg ae/L). The length measurements indicated shell growth inhibition ranging from 11% in the 10.5 mg ae/L group to 71% in the 73.5 mg ae/L. This study had 3 study deficiencies which results in a supplemental study. There was less than the recommended shell growth in the control animals, contamination was present in the control groups and the flow rate in the test chambers was less than recommended. However, adequate dose response occurred in the study. Contamination of the control solutions was evident, but this contamination was intermittent and well below the NOEC. Also the results of the study correlate well with the oyster shell deposition study done with TGAI (MRID 425624-01). This study is classified as supplemental according to the §72-3 guideline requirements.

The EC50 of 67 mg ae/L was selected for evaluating estuarine marine invertebrates exposed to mefluidide-K, mefluidide-DEA and mefluidide for the runoff risk assessment. The most sensitive endpoint EC50 57.75 mg ae/L was not selected due to study deficiencies as described above.

The results of these tests are summarized in Appendix E, **Table E2**.

Chronic Toxicity to Estuarine/Marine Invertebrates

No studies were submitted to the Agency evaluating the chronic toxicity of mefluidide-DEA, mefluidide-K and mefluidide to freshwater and estuarine marine invertebrates. Due to lack of submitted chronic studies for freshwater invertebrates estimated acute to chronic ratios (ACRs) were derived from the Propanil analog. Therefore, the chronic NOAEC of >5.54 mg ae/L value for freshwater invertebrates was estimated from the propanil analog. Calculations and endpoints used to determine ACRs are summarized in Appendix D

There are insufficient data to establish a definitive toxicity endpoint for estuarine/marine invertebrate chronic effects for the acid and DEA salt acid equivalents for mefluidide. There is also little available data to compare to other anilide herbicides for this taxonomic group For the purposes of this risk assessment, it was assumed that estuarine marine invertebrates were at least as sensitive as freshwater invertebrates in terms of chronic toxicity. Therefore, the estimated endpoint for freshwater invertebrates (NOAEC >5.54 mg ae/L) was used to estimate a chronic effects endpoint for estuarine/marine invertebrates. The multiple assumptions involving extrapolations with data from a single analog (Propanil) and across freshwater and estuarine/marine conditions suggests that this estimate maybe highly uncertain (see source data in Appendix E for other anilide herbicide).

Aquatic Plant Toxicity

No studies were submitted to the Agency evaluating the acute toxicity of mefluidide-K and mefluidide to aquatic plants. For mefluidide-DEA, the dosage tested for *Lemna gibba* (freshwater vascular plant) was 0.515 mg ae/L with stimulation of 8% frond growth for a Tier I study (MRID 435266-05). The dosage tested for *Selenastrum capricornutum* was 0.561 mg ae/L caused an 8% growth reduction in the exposed algal population for a Tier I study (MRID 435266-03). For the other two species of freshwater non-vascular plants (i.e., *Navicula pelliculosa* and *Anabaena flos-aquae*), Tier I studies resulted in (0.629 mg ae/L) 11.5% growth reduction and (0.543 mg ae/L) 4.3% growth reduction, respectively (MRIDs 435266-01 and 435266-04). For the estuarine/marine non-vascular plant (*Skeletonema costatum*), the dosage tested was 0.575 mg ae/L which resulted in no adverse effects for this Tier I study (MRID 4435266-02). All of the above Tier I studies are classified as acceptable according to the 122-2 guideline requirements.

The experimental procedures and dose calculation procedures for the range finding tests, for the above Tier I studies are basically the same as are those for the final or definitive studies. The results of the definitive or final aquatic plant tests are one order of magnitude more toxic than the range finding tests. The results for both sets of studies do not show any inhibition levels above 50%.

Due to lack of submitted aquatic plant studies for vascular and non-vascular plants, NOAEC or EC_{05} values were estimated acute to chronic ratios (ACRs) from the propanil analog. An EC_{05} was estimated at >0.029 value for vascular plants and >0.786 mg ae/L for non-vascular plants. The multiple assumptions involving extrapolations with data from a single analog (propanil) suggests that this estimate maybe highly uncertain. Calculations and endpoints used to determine ACRs are summarized in Appendix E.

Peak EECs from the PRZM/EXAMS turf modeled scenarios ranged from 0.003031 mg ae/L to 0.010573 mg ae/L. The Tier I study for *Navicula pelliculosa* resulted in (0.629 mg ae/L) 11.5% growth reduction. In contrast, the Tier I study for *Lemna gibba* resulted in (0.515 mg ae/L) 8% frond growth.

The results of the above studies and the range-finding tests are provided in **Table E4.**

3.3.1.2 Terrestrial Animals

Acute oral gavage bird

For mefluidide, an acute single-dose oral toxicity study was performed using the bobwhite quail (*Colinus virginianus*). The 58.2% ai compound was adjusted to 100% ai at dosing. Thirty birds were used at one dose level of 2000 mg ae/ kg. The LD_{50} value was >2000mg ae/kg-bw. The results of this study categorize mefluidide as practically non-toxic to birds on a acute oral basis. However, this study is classified as Supplemental for an avian dietary LD_{50} study because it is unclear what material (TGAI, formulated product, or

formulation intermediate) was tested. No statistics were performed due to lack of mortality and no signs of toxicity were observed. (MRID 416021-01)

For mefluidide-DEA, an acute single-dose oral toxicity study was performed using the bobwhite quail (*Colinus virginianus*). The 21.5% ai compound was adjusted to 100% ai at dosing. Thirty birds were used at one dose level of 1500 mg ae/ kg. The LD_{50} value was >1500mg ae/kg-bw. The results of this study categorize mefluidide-DEA as practically non-toxic to birds on an acute oral basis. However, this study does not fulfill the requirement in support of registration and is classified as Supplemental for an avian dietary LD_{50} study because it is unclear what material (TGAI, formulated product, or formulation intermediate) was tested. No statistics were performed due to lack of mortality and no signs of toxicity were observed (MRID 416019-01).

The above studies are summarized in **Table E5**.

Sub acute (dietary) Toxicity to Birds

For mefluidide, one dietary toxicity study was performed using the mallard duck (*Anas platyrhynchos*). The 58.2% ai compound was adjusted to 100% ai at dosing. Thirty birds were used at one dose level of 5000 mg ae/ kg diet. In the mallard duck study, the non-definitive LC_{50} was >5000 mg ae/kg diet. The results of this study categorize mefluidide as practically non-toxic to birds on a dietary basis. However, this study is classified as Supplemental for an avian dietary LC_{50} study because it is unclear what material (TGAI, formulated product, or formulation intermediate) was tested. No statistics were performed due to lack of mortality and no signs of toxicity were observed. (MRID416021-03)

For mefluidide, one dietary toxicity study was performed using the bobwhite quail (*Colinus virginianus*). The 58.2% ai compound was adjusted to 100% ai at dosing. Thirty birds were used at one dose level of 5000 mg ae/ kg diet. In the bobwhite quail study, the non-definitive LC_{50} was >5000 mg ae/kg diet. The results of this study categorize mefluidide as practically non-toxic to birds on a dietary basis. However, this study is classified as Supplemental for an avian dietary LC_{50} study because it is unclear what material (TGAI, formulated product, or formulation intermediate) was tested. No statistics were performed due to lack of mortality and no signs of toxicity were observed. (MRID 416021-02).

For mefluidide-DEA, one dietary toxicity study was performed using the mallard duck (*Anas platyrhynchos*). The 21.5% ai compound was adjusted to 100% ai at dosing. Thirty birds were used at one dose level of 3750mg ae/ kg diet. In the mallard duck study, the non-definitive LC_{50} was >3750 mg ae/ kg diet. The results of this study categorize mefluidide as practically non-toxic to birds on a dietary basis. However, this study is classified as Supplemental for an avian dietary LC_{50} study because it is unclear what material (TGAI, formulated product, or formulation intermediate) was tested. No statistics were performed due to lack of mortality and no signs of toxicity were observed. (MRID416019-03)

For mefluidide-DEA, one dietary toxicity study was performed using the bobwhite quail (*Colinus virginianus*). The 21.5% ai compound was adjusted to 100% ai at dosing. Thirty birds were used at one dose level of 3750 mg ae/ kg diet. In the bobwhite quail study, the non-definitive LC_{50} was >5000 mg ae/ kg diet. The results of this study categorize mefluidide-DEA as practically non-toxic to birds on a dietary basis. However, this study is classified as Supplemental for an avian dietary LC_{50} study because it is unclear what material (TGAI, formulated product, or formulation intermediate) was tested. No statistics were performed due to lack of mortality and no signs of toxicity were observed. (MRID416019-02)

The LC_{50} of 3750 mg ae/kg diet was selected for evaluating birds on a sub acute dietary basis exposed to mefluidide-K, mefluidide-DEA and mefluidide for the terrestrial risk assessment.

The above studies were classified as supplemental according to Guideline §71-2 requirement for subacute avian dietary testing and are summarized in Table E6.

Chronic Toxicity to Birds

No studies were submitted to the Agency evaluating the chronic toxicity of mefluidide-DEA, mefluidide-K and mefluidide to birds. There are insufficient data to establish a definitive toxicity endpoint for chronic effects to birds for the acid and DEA salt acid equivalents for mefluidide. There is also no available chronic avian data from other anilide herbicides for this taxonomic group to extrapolate acute to chronic ratios. For the purposes of this risk assessment, it was assumed that birds are similar in toxicity responses as mammals in terms of chronic toxicity. Therefore, acute to chronic ratios (ACRs) were derived from mefluidide laboratory rat and laboratory mouse data to determine the estimated chronic NOAEC of 38 mg ae/kg value for birds. Calculations and endpoints used to determine ACRs are summarized in Appendix E. The assumptions involving extrapolations with data from different terrestrial species suggests that this estimate maybe highly uncertain.

Acute Oral Toxicity to Mammals

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, rat or mouse toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing.

An acute oral toxicity study with the laboratory mouse for mefluidide resulted in a LD_{50} value of 829.8 ae mg/kg bw (MRID 00047116). This study is acceptable and satisfies guideline requirements for acute oral toxicity in rodents (81-1). Mefluidide is toxicity Category II. The data are summarized in **Table E9.**

Additional acute oral toxicity studies with the laboratory mouse and laboratory rat resulted in LD_{50} values based on mefluidide ranged from 1920.2 ae mg/kg bw to >4000 ae mg/kg bw. Mefluidide toxicity was classified as Category III .

The LD_{50} of 829.8 mg ae/kg bw was selected for evaluating mammals on a acute dietary basis exposed to mefluidide-K, mefluidide-DEA and mefluidide for the terrestrial risk assessment.

The data are summarized in **Table E9.**

Subchronic and Developmental/Chronic Toxicity to Mammals

Multi-Generation Reproduction Laboratory Rat Toxicity Study

In a three-generation reproduction study (MRID 00082748), MBR 12325 (Mefluidide; 93% a.i., Lot #25) was administered in the diet to 20 male and 40 female Charles River CD® rats/dose group at dose levels of 0, 600, 1800, or 6000 ppm (equivalent to Males/Females - 0/0, 34/60, 102/183, and 346/604 mg ae/kg bw/day)
There were no effects on food consumption, organ weights, gross pathology, or histopathology. Numerous absolute and relative (to bw) organ weights in the 6000 ppm parents were significantly ($p<0.05$) different from the controls, however, none of these differences were corroborated by any macroscopic or microscopic findings indicating these decreases were most likely not related to treatment. Thus, it is likely that they were attributable to decreased body weights at this dose.

The only deaths included one 6000 ppm F1 female, one 6000 ppm F2 male, and one 1800 ppm F2 female. It was stated that macroscopic and microscopic findings in these animals were unremarkable. Therefore, these deaths were considered incidental and were not treatment related. At 6000 ppm, body weights were decreased by 1-8% in males and 1-12% in females throughout the study in the P generation, attaining significance ($p<0.05$) at Week 18 in the males and Weeks 8, 18, 19, and 27 in the females. In the F1 generation at this dose, body weights were decreased throughout the study in the males (decr. 13-21%) and females (decr. 10-21%), attaining significance ($p<0.01$) at Weeks 27, 37, and 56 in both sexes. Similarly in the F2 generation, body weights were decreased throughout the study in the 6000 ppm males (decr. 14-21%) and females (decr. 11-23%), attaining significance ($p<0.01$) at Weeks 57, 66, and 85 in both sexes. At 1800 ppm, only minor and infrequent decreases in body weights were noted. There were no treatment-related findings at 600 ppm.

The parental systemic LOAEL is 6000 ppm (346/604 mg ae/kg bw/day in males/females), based on decreased body weights in both sexes in all generations. The parental systemic NOAEL is 1800 ppm (102/183 mg ae/kg bw/day in males/females). This study is acceptable/guideline and satisfies the guideline requirement for a three-generation reproductive study (OPPTS 870.3800; OECD 416) in rats.

Developmental Toxicity Study in Laboratory Rats:

In a developmental toxicity study (MRID 42026102), mefluidide-DEA (28.78% a.i. Lot # JB0624)) in distilled water was administered to pregnant Sprague Dawley Crl:CD BR VAF/Plus (25/dose) by gavage at dose levels of 0, 50, 200 or 400 mg/kg bw/day (adjusted doses for 100 % purity were 0, 14, 58, or 115 mg/kg/day, respectively) from days 6 through 15 of gestation. Animals were checked daily for clinical signs, mortality. Body weights were measured on gestation day 0, 6, 9, 12, 16 and 20. Unscheduled deaths, scheduled sacrifice and c-sections were subjected to gross necropsy examination. Each fetus was examined for external/visceral/skeletal anomalies, sexed and then weighed. Evidence of maternal toxicity included transient clinical signs (tremors, dark material around the nose, urine stain and reddish vaginal discharge), decreased body weight gain (11-61%), decreased food consumption and mortality (2/25 females) observed at the 400 mg ai/kg/day levels No external malformations or developmental variations were observed associated with any fetus. Fetal toxicity was manifested by increase in the number of early resorptions which resulted in increase in mean postimplantation loss at 400 mg ai/kg/day dose.

The maternal NOAEL was 200 mg ai/kg/day (adjusted to 58 mg/kg/day) and the LOAEL at 400 mg ai/kg/day (adjusted to 115 mg/kg/day) based on clinical signs (tremors, dark material around the nose, urine stain and reddish vaginal discharge), decreased body weight gain, decreased food consumption and mortality (2/25 females).

The developmental toxicity NOAEL was 200 mg/kg/day (adjusted to 58 mg/kg/day), the LOAEL was 400 mg ai/kg/day (adjusted to 115 mg/kg/day) based on increase in the number of early resorptions and increase in mean postimplantation loss.

The NOAEC of 102 mg ae/kg bw was selected for evaluating mammals on a chronic/reproductive basis exposed to mefluidide-K, mefluidide-DEA and mefluidide for the terrestrial risk assessment.

This developmental toxicity study is classified acceptable/Guideline and it does satisfy the guideline requirement for a developmental toxicity study (OPPTS 870.3700; OECD 414) in the rat.

Acute Toxicity to Non-target Insects (Honey Bee)

Acute contact toxicity of mefluidide-DEA on the honey bee (*Apis mellifera*) was tested and the data are summarized in Table E8. In the acute contact test, the non-definitive LD_{50} value was >18.75 µg ae/bee and the NOAEC was 9.37µg ae/bee. Mortality ranged between 6 and 14% with doses 1.6, 3.1, 6.3, 12.5 and 25 *ug* ai/bee (1.2, 2.3, 4.7, 9.3, and 18.75 *ug* ae /bee). Mortality at the four lowest test levels was determined to be non-treatment related. Mortality at the highest level was 14%. Mefluidide-DEA is categorized as practically non-toxic to honeybees on an acute contact basis. This study is classified as acceptable according to guideline 141-1 (MRID 425628-01).

Acute contact toxicity of mefluidide-K on the honey bee (*Apis mellifera*) was tested and the data are summarized in Table E8. In the acute contact test, the non-definitive LD_{50} value was >22.25µg ae/bee and the NOAEC was 22.25µg ae/bee. Mortality ranged between 6 and 14% with doses 1.6, 3.1, 6.3, 12.5, 25 *ug* ai/bee (1.4, 2.7, 5.6, 11.1 and 22.25 *ug* ae/bee). Mortality at all treatment levels was determined not to be treatment related since clinical observations were similar between control and treated bees and the surviving bees at the lowest dosage appeared normal throughout the test. Mefluidide-K is categorized as practically non-toxic to honeybees on an acute contact basis. This study is classified as acceptable according to guideline 141-1 (MRID 425628-02).

Terrestrial Plant

A Tier II vegetative vigor study was conducted for ten species using mefluidide-DEA and the data are summarized in Tables E12 and E13. For the vegetative vigor study, the most sensitive monocot was sorghum with an EC_{25} of 0.105 lbs ae/A and a NOAEC of 0.045 lbs ae/A, and the most sensitive dicot was mustard, with an EC_{25} of 0.00547 lbs ae/A and a NOAEC of 0.0029 lbs ae/acre. For both monocots and dicots, the most sensitive parameter was shoot fresh weight. Symptoms of toxicity included stunting, chlorosis, necrosis and distortion. This study was originally classified as acceptable, however this study will be reviewed for a possible classification of Supplemental because this study was based on fresh weight instead of dry weight which is required according to guideline 123-1 (MRID 435496-01).

Seedling emergence toxicity data was not available for a full review and data was not available from other anilide analogs to derive EC_{25} values. . A preliminary review on a recently submitted seedling emergence study (MRID 471907-01) was conducted. These results are uncertain until a full review of the study is performed. The results of the preliminary review are summarized in Appendix E. Therefore, to estimate possible effects measurement endpoints for seedling emergence, EFED assumed that EC_{25} toxicity values for vegetative vigor are equal to seedling emergence measurement endpoints for mefluidide, mefluidide-DEA and mefluidide-K. Therefore, the most sensitive seedling emergence EC_{25} estimated values are 0.105 and 0.0054 lb ae/acre for monocots and dicots, respectively. The NOEC estimated values for seedling emergence are 0.045 and 0.0029 lb ae/acre for monocots and dicots, respectively.

Earthworms

No earthworm studies were submitted to the Agency. However, Ecotox data indicates that mefluidide is non-toxic to earthworms (Ref #39542 Potter DA; Spicer PG;Redmond CT; Powell AJ (1994) Toxicity of Pesticides to Earthworms in Kentucky Bluegrass Turf). Two evaluations were conducted in the spring and the fall of 1992. Earthworm populations were sampled at 1 and 3 weeks after treatment. The application rate of mefluidide applied to the

plots were 0.56 ai/ha of Embark 2S which resulted in 0% and 17 % reduction of earthworms in the spring and fall respectively after the 3 week treatments.

Review of Incident Data

A review of the EIIS database for ecological incidents involving mefluidide**,** mefluidide-DEA and mefluidide-K was completed on December 28, 2006. There were no incidences reported for mefluidide**,** mefluidide-DEA and mefluidide-K in the EIIS database.

Incident reports submitted to EPA since approximately 1994 have been tracked by assignment of I #s in an Incident Data System (IDS), microfiched, and then entered to a second database (in EFED), the Ecological Incident Information System (EIIS). An effort has also been made to enter information to EIIS on incident reports received prior to establishment of current databases. Incident reports are often not received in a consistent format (e.g., states and various labs usually have their own formats), may involve multiple incidents involving multiple chemicals in one report, and may report on only part of a given incident investigation (e.g., residues).

It is believed that the EFED database contains reports of only a small portion of plant and animal wildlife incidents that actually occur as a result of pesticide use. Mortality incidents must be seen, reported, investigated, and had investigation reports submitted to EPA to have the potential to get entered into a database. Incidents often are not seen, especially if the affected organisms are inconspicuous or few people are systematically looking, for example. Incidents seen may not get reported to appropriate authorities capable of investigating the incident because the finder may not know of the importance of reporting incidents, may not know who to call, or may not feel they have the time or desire to call, for example. Incidents reported may not be investigated if resources are limited or may not get investigated thoroughly. Reports of investigated incidents often do not get submitted to EPA, since reporting by states is voluntary and some investigators may believe that they don't have the resources to submit incident reports to EPA.

Review of ECOTOX Data

A search of the ECOTOX from a Duluth review was completed on 7/ 5/06 for mefluidide. Six studies were reviewed with reference numbers 39542, 71019, 74741, 82489, 82719 and 82721. Studies with reference numbers 71019, 74741, 82489 were not incorporated in the assessment. The references to the above referenced studies and studies that were not accepted by OPP are posted in Appendix H.

Ecotox data indicates that mefluidide is non-toxic to earthworms (Ref #39542 Potter DA; Spicer PG; Redmond CT; Powell AJ (1994) Toxicity of Pesticides to Earthworms in Kentucky Bluegrass Turf). Two evaluations were conducted in the spring and the fall of 1992. Earthworm populations were sampled at 1 and 3 weeks after treatment. The application rate of mefluidide applied to the plots were 0.56 ai/ha of Embark 2S which resulted in 0% and 17

% reduction of earthworms in the spring and fall respectively after the 3 week treatments. (ref#39542)

Ecotox data indicates that mefluidide is non-toxic to grazing cattle based on weight gain. Twelve Hereford heifers were used in a grazing experiment to determine intake and digestibility of tall fescue forage treated with mefluidide. Additionally, steer and heifer performance were evaluated after grazing tall fescue pastures or consuming hay harvested from pastures treated with mefluidide. Two forage plots were sprayed with 0.28kg ai/ha when tall fescue herbage was 10 cm in height. Steers grazing mefluidide–treated herbage had greater total weight gains than untreated fields during a 168 d study (86 vs 69 kg). Heifers fed hay harvested from mefluidide treated pastures also exhibited similar improvements in gain (49 vs 38 kg) because of increased forage consumption (8.3 vs. 7.3 kg/d) greater forage OM digestibility (65 vs. 61%). Greater weight gains were attributed to a increased nitrogen content, lowered NDF neutral detergent fiber content (NDF) and increased OM digestibility from herbage available(ref#82719) A similar study (ref#82721) for effects of mefluidide on grazing cow–calf performance on smooth brome pastures also resulted in improved calf performance on treated mefluidide fields with 0.28kg ai/ha of mefluidide. Mefluidide sprayed on fields produced 26 kg/ha more cow gain than the controlled smooth brome pastures.

4 RISK CHARACTERIZATION

Risk characterization is the integration of exposure and effects characterization to determine the ecological risk from the use of mefluidide and the likelihood of effects on aquatic life, wildlife, and plants based on varying pesticide-use scenarios. The risk characterization provides a estimation and a description of the risk; articulates risk assessment assumptions, limitations, and uncertainties; synthesizes an overall conclusion; and provides the risk managers with information to support regulatory decision making.

4.1. Risk Estimation - Integration of Exposure and Effects Data

Results of the exposure and toxicity effects data are used to evaluate the likelihood of adverse ecological effects on non-target species. For the assessment of mefluidide risks, the risk quotient (RQ) method is used to compare exposure and toxicity values. Estimated environmental concentrations (EECs) are divided by acute and chronic toxicity values. The resulting RQs are compared to the Agency's levels of concern (LOCs). These LOCs are the Agency's interpretive policy and are used to analyze potential risk to non-target organisms and the need to consider regulatory action. These criteria are used to indicate when a pesticide's use as directed on the label has the potential to cause adverse effects on non-target organisms.

A summary of toxicity values used to calculate RQs is provided in **Table 4.1 and 4.2** and **4.3** more detailed discussion of mefluidide toxicity can be found in section **3.3 and Appendix D.**

Table 4.1: Summary of endpoints (LC_{50} or EC_{50}, mg ae/L) for Aquatic Toxicity used in RQ calculations for Mefluidide [1]			
TAXONOMIC GROUP	**Acute endpoint**	**Chronic endpoint**	**MRID/ Estimated value**
Acute freshwater fish	>68.47* Rainbow Trout		MRID 418937-02
Chronic freshwater fish		>0.267	Estimated value acute to chronic ratio
Acute freshwater inverts	>77.25* Daphnid		MRID 418937-03
Chronic freshwater inverts		>5.54	Estimated value acute to chronic ratio
Acute estuarine/marine fish	>84.75* Sheepshead minnow		MRID 425623-03
Chronic estuarine/marine fish		>0.267	Estimated value acute to chronic ratio
Acute estuarine/marine inverts	67* Eastern oyster		MRID 425624-01
Chronic estuarine/marine inverts		>5.54	Estimated value acute to chronic ratio

[1] For fish and invertebrates data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the runoff risk assessment.
*most sensitive species

Table 4.2: Summary of endpoints (LC_{50} or EC_{50}, mg ae/L) for Plant Toxicity used in RQ calculations for Mefluidide[1]			
TAXONOMIC GROUP	**Acute endpoint**	**NOAEC or EC_{05}**	
Acute vascular plant	0.515* Lemna		MRID 435266-01 Tier I(8% growth stimulation) Used this value as **EC_{50},**
Vascular plant (EC_{05})		>0.29	Estimated value acute to chronic ratio
Acute non-vascular plant	0.629* Navicula		MRID 435266-05 Tier I(11.5% growth reduction) Used this value as **EC_{50},**
Non-vascular plant (EC_{05}		>0.786	Estimated value acute to chronic ratio
Terrestrial Plant: Vegetative Vigor	Monocot:* Sorghum EC_{25} 0.105 lb ae/A Dicot:* Mustard EC_{25} 0.0054lb ae/A	Monocot:* Sorghum NOAEC 0.045 lb ae/A Dicot:* Mustard NOAEC 0.0029 lb ae/A	MRID 435496-01
Terrestrial Plant: Seedling Emergence	Monocot: Sorghum EC_{25} 0.105 lb ae/A Dicot:* Mustard EC_{25} 0.0054lb ae/A	Monocot: Sorghum NOAEC 0.045 lb ae/A Dicot:* Mustard NOAEC 0.0029 lb ae/A	Estimated value from vegetative vigor study MRID 435496-01

[1]For terrestrial plants data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the terrestrial risk assessment. *most sensitive species tested

Table 4.3: Summary of endpoints (LD_{50} or LC_{50} mg ae/kg) for Terrestrial Toxicity data used in RQ calculations for Mefluidide[1]			
TAXONOMIC GROUP	**Acute endpoint**	**Chronic endpoint**	
Acute Avian	>1500* Bobwhite quail		MRID 416019-01 Used this non-definitive endpoint as LD50
Chronic Avian		38	Estimated value acute to chronic ratio based on mammal data
Acute Dietary Avian	>3750*		
Acute mammal	829.8* mouse		MRID 00047116
Chronic mammal		102* rat	MRID 00082748

[1]For terrestrial plants data evaluating mefluidide-K, mefluidide-DEA and mefluidide have been bridged for the terrestrial risk assessment. *most sensitive species tested

4.1.1 Non-target Aquatic Animals and Plants

Routes of exposure evaluated in this risk assessment focused on runoff and/or spray drift for mefluidide–K, mefluidide-DEA and mefluidide. Tier II PRZM/EXAM modeling was used to estimate mefluidide acid concentrations in surface water. The runoff assessment considered the maximum label application rates. Because the mefluidide can be used on general turf areas including residential and agricultural areas, the runoff modeling was conducted using the PA turf and FL turf scenarios. More importantly, mefluidide labels allow broadcast applications as well as spot treatments. Application rates, therefore, were expressed on lbs ae/A regardless of the recommend application treatment. This approach is expected to be conservative because it assumes 100% of the watershed is treated with mefluidide. Concentrations of mefluidide are expressed in acid equivalence to address the bridging of mefluidide-K, mefluidide-DEA, mefluidide to mefluidide acid. Foliar dissipation half-lives were incorporated in the modeling to address mefluidide dissipation from the foliage of warm-season and cool season grasses. PRZM /EXAMS input parameters for mefluidide are shown in **Table 3.1**. Estimated environmental concentrations are shown in **Table 3.2.**

The 1-in-10 year peak EECs were compared to acute toxicity endpoints to derive acute RQs for mefluidide. For aquatic vascular and non-vascular plants, 1-in-10 year peak EECs were compared to acute EC_{50} values to derive acute non-listed species RQs. NOAEC values for vascular and non-vascular plants were estimated to derive listed species RQs for these

taxonomic groups. RQs for listed and non-listed aquatic vascular and non-vascular plants are summarized in **Table 4.2.**

4.1.1.1 *Freshwater Fish and Invertebrates*

Risk quotients for mefluidide-K, mefluidide-DEA and mefluidide were <0.0001 for acute freshwater fish and invertebrates based on the non-definitive EC_{50} of >68.47 mg ae/L for freshwater fish and >77.25 mg ae/L for freshwater invertebrates. Acute risk quotients for freshwater fish and invertebrates are summarized in **TABLE 4.4.**

Risk quotients for mefluidide-K, mefluidide-DEA and mefluidide were <0.001 for chronic freshwater fish and invertebrates based on the non-definitive estimated NOAEC values of >0.267 mg ae/L for freshwater fish and >5.54 mg ae/L for freshwater invertebrates. Chronic RQs for mefluidide freshwater fish and invertebrates were derived from estimated values due to lack of toxicity data and are summarized in **Appendix D.**

No LOC exceedances occurred for acute and chronic risks to freshwater fish and invertebrates for all application scenarios.

Table 4.4. Aquatic acute freshwater fish and Invertebrate RQs for Mefluidide-K, Mefluidide-DEA and Mefluidide applications by Ground (G) Spray and Granular(GR) for the aquatic runoff assessment[1,2,3]

Application Scenario			Fresh water Invertebrates	Freshwater Fish
		Acute EECs mg ae/L	Acute RQs (EC50 >77.25 mg ae/L)[2]	Acute RQs (EC50 >68.47 mg ae/L)[2]
Ornamental Turf (FLTurf PRISM scenario) 3 applications per season (interval of 6 weeks apart)	mefluidide (GR)	0.004835	0.0000625	0.0000706
	mefluidide-K and mefluidide-DEA (G)	0.010573	0.0001368	0.0001544
Ornamental Turf (PA Turf PRISM scenario) 3 applications per season (interval of 6 weeks apart) .	mefluidide (GR)	0.003031	0.0000392	0.0000442
	mefluidide-K and mefluidide-DEA (G)	0.007054	0.0000913	0.000103

[1] The below notation will be used to denote values that exceed the Levels of Concern (LOC)
* exceeds LOC for acute risk to listed fish or invertebrate species (RQ ≥ 0.05)
** exceeds LOCs for acute risk to listed fish or invertebrate species and restricted use (RQ ≥ 0.1)

4.1.1.2 *Estuarine/Marine Fish and Invertebrates*

Risk quotients for mefluidide-K, mefluidide-DEA and mefluidide were <0.0001 for acute estuarine marine fish aquatic-phase amphibians based on the non-definitive EC_{50} of

>84.75 mg ae/L. No LOC exceedances occurred for acute risks to estuarine/ marine invertebrates with an EC_{50} of 67 mg ae/L and RQs <0.0001 for all application scenarios. Acute risk quotients for estuarine marine fish and invertebrates are summarized in **TABLE 4.5.**

There are insufficient data to establish a definitive toxicity endpoint for estuarine/marine fish and invertebrate chronic effects for mefluidide and mefluidide-DEA. For the purposes of this risk assessment, it was assumed that estuarine marine fish were at least as sensitive as freshwater fish in terms of chronic toxicity. Therefore, the estimated endpoint for freshwater fish (NOAEC >0.267 mg ae/L) was used to estimate a chronic effects endpoint for estuarine/marine fish. Therefore, based on the estimated NOAEC of >0.267 mg ae/L no exceedances occurred for chronic estuarine marine fish and invertebrates. These estimated RQ values are summarized in **Appendix D.**

Table 4.5. Aquatic Estuarine Marine fish and Invertebrate RQs for Mefluidide-K, Mefluidide-DEA and Mefluidide applications by Ground (G) Spray and Granular(GR) for the aquatic runoff assessment[1,2,3]

Application Scenario			E/M Invertebrates	E/M Fish
		Acute EECs mg ae/L	Acute RQs (EC50 67 mg ae/L)[2]	Acute RQs (EC50 >84.75 mg ae/L)[2]
Ornamental Turf (FLTurf PRISM scenario) 3 applications per season (interval of 6 weeks apart)	mefluidide (GR)	0.004835	0.0000721	0.000057
	mefluidide-K and mefluidide-DEA (G)	0.010573	0.0001578	0.0001247
Ornamental Turf (PA Turf PRISM scenario) 3 applications per season (interval of 6 weeks apart)	mefluidide (GR)	0.003031	0.0000452	0.0000357
	mefluidide-K and mefluidide-DEA (G)	0.007054	0.0001052	0.0000832

[1] The below notation will be used to denote values that exceed the Levels of Concern (LOC)
* exceeds LOC for acute risk to listed fish or invertebrate species (RQ ≥ 0.05)
** exceeds LOCs for acute risk to listed fish or invertebrate species and restricted use (RQ ≥ 0.1)

4.1.1.3 *Aquatic Plants*

Although no EC_{50} values were available from aquatic plant studies, RQs were calculated for aquatic plants based on a EC_{50} values >0.515 mg ae/L for vascular plants and >0.629 mg ae/L for non-vascular plants. RQ values were <0.1 for all modeled scenarios.

Risk quotients for mefluidide-K, mefluidide-DEA and mefluidide were <0.1 for vascular and non-vascular plants based on the non-definitive estimated EC_{05} values of >0.029 mg ae/L for vascular plants and >0.786 mg ae/L for non-vascular plants.

No LOC exceedances occurred for acute listed and non-listed risks to vascular and non-vascular plants for all application scenarios.

Table 4.6 lists the RQs for aquatic vascular and non-vascular plants potentially exposed to mefluidide-K, mefluidide-DEA and mefluidide. No LOC exceedances (RQs <0.1) occurred for vascular and non-vascular plants.

Table 4.6. Aquatic Plant RQs for Mefluidide-K, Mefluidide-DEA and Mefluidide applications by Ground (G) Spray and Granular(GR) for the aquatic runoff assessment[1]

Application Scenario		EECs to calculate Acute RQs mg ae/L	Vascular Plants RQs (EC50 >0.515 mg ae/L)	Vascular Plants (listed) RQs (EC_{05}>0.29 mg ae/L)	Non-vascular Plants RQs EC_{50} (>0.629 mg ae/L)[2]	Non-vascular Plants RQs (EC_{05}>0.786 mg ae/L) [2]
Ornamental Turf (FLTurf PRZM scenario) 3 applications per season (interval of 6 weeks apart)	mefluidide (GR)	0.004835	0.0093883	0.0166724	0.0076868	0.0061513
	mefluidide-K and mefluidide-DEA (G)	0.010573	0.02053	0.0364586	0.0168092	0.0134516
Ornamental Turf (PA Turf PRZM scenario) 3 applications per season (interval of 6 weeks apart) .	mefluidide (GR)	0.003031	0.0058854	0.0104517	0.0048187	0.0038562
	mefluidide-K and mefluidide-DEA (G)	0.007054	0.013697	0.0243241	0.0112146	0.0089745

[1] The below notation will be used to denote values that exceed the Levels of Concern (LOC)
* exceeds LOC for acute risk to aquatic plant species (RQ ≥ 1.0, calculated as acute EEC /EC50)
**exceeds LOC for acute risk to listed aquatic plant species (RQ ≥ 1.0, calculated as acute EEC /NOAEC)
***exceeds LOC for acute risk to listed aquatic plant species (RQ ≥ 1.0, calculated as acute EEC /NOAEC), However, currently there are no listed non-vascular plants.
[2] EC_{50} or NOAEC estimated calculations are summarized in Appendix E

4.1.2 Non-target Terrestrial Animals

EECs were calculated for all ornamental turf labeled uses with application rates ranging from 0.5 to 1.0 lb ae/A. Risk quotients are based on the most sensitive studies that yielded the lowest toxicity values. For this assessment, the lowest LD_{50} and NOAEC values were used for birds and the lowest LD_{50} and NOAEL were used for mammals (based on lab rat and mouse studies).

4.1.2.1 Birds

Avian Risk

The EEC's for terrestrial exposure were derived from the Kenaga nomograph, as modified by Fletcher et al. (1994), based on a large set of field residue data. The EECs were calculated by the T-REX Version 1.3.1 model and corresponding avian acute and chronic risk quotients are based on the most sensitive subacute dietary LC_{50}, single oral dose LD_{50}, and NOAEC for birds.

Calculations for single-oral dose risk quotients are based on a Northern bobwhite quail oral acute LD_{50} of 1500 mg ae/kg-bw. RQs for oral dose-based scenarios are calculated by dividing the consumption-weighted equivalent dose by the body weight-adjusted LD_{50}. The avian LD_{50} is adjusted for body weight according to the following equation:

$$\text{Adjusted Avian } LD_{50}\,(\text{mg/kg bw}) = LD_{50}\,(\text{mg/kg bw}) * \left(\frac{\text{AW (g)}}{\text{TW (g)}}\right)^{1.15-1}$$

(USEPA, 2006)

The assessed weight (AW) is the body weight of the wildlife species of concern. An adjusted LD_{50} is calculated for three weight classes of birds (20, 100, and 1000 g). The test weight (TW) is the body weight of the species used in the toxicity study. In this case, the weight of the bobwhite quail is estimated to be 178 g. The adjusted LD_{50} is 1080, 1375, and 1943 mg ae/kg-bwt for the weight classes 20, 100, and 1000 g birds, respectively.

Foliar Summary for Mefluidide-K and Mefluidide-DEA

1. Acute RQs were calculated for birds based on the non-definitive LD_{50} value of >1500 mg ae/kg-bw. No mortality occurred at the single dose treatment level (1500 mg ae/kg-bw) for the Tier I Acute Toxicity to Bobwhite quail study MRID 416019-01. RQ values ranged 0 to 0.25 for the 1.0 lb ae/A ornamental turf modeled scenario. RQs are summarized in **Appendix D.** summarizes the avian dietary-based chronic RQs for foliar uses of mefluidide-K and mefluidide-DEA. Chronic RQs were estimated for birds based on the non-definitive LD_{50} value of 38 mg ae/kg. Chronic dietary-based exceedances occurred for birds for the 1.0 lb ae/A modeled scenario with risk quotients ranging from 2.9 to 6.32. Chronic estimated NOAEC values and calculations are summarized in **Appendix E.**

Table 4.7 summarizes the avian dose-based acute RQs for foliar uses of mefluidide-K and mefluidide-DEA.

For mefluidide-DEA and mefluidide-K, acute restricted use and/or listed species risk LOCs are exceeded for 20 g birds that consume short grass, tall grass, and broadleaf plants and small insects for the 1.0 ae/A application rate modeled scenario with acute RQs of <0.25.

For mefluidide-DEA and mefluidide-K, acute risk to listed species LOCs are exceeded for 20 g birds that consume short grass, tall grass, and broadleaf plants and small insects and 100 g birds that consume short grass for the 1.0 lb ae/A application rate modeled scenario with acute RQs ranging from <0.11 to <0.25.

Table 4.8 summarizes the avian dietary-based chronic RQs for foliar uses of mefluidide-K and mefluidide-DEA. Chronic dietary-based exceedances occurred for birds for the 1.0 lb ae/A modeled scenario with risk quotients ranging from 2.9 to 6.32. Risk quotients based on dietary exposure levels are provided for comparison purposes.

Table 4.7. Avian dose-based acute RQ values for proposed uses of Mefluidide-K, Mefluidide-DEA and Mefluidide based on a bobwhite quail LD_{50} > 1500 mg ae/kg -bw and upper-bound Kenaga values[1].

Use	Application Rate lbs. ae/A (# app / interval, days)	Body Weight, g	Mammalian Acute Risk Quotients (upper-bound Kenaga residues) Short Grass	Tall Grass	Broadleaf Plants/Small Insects	Fruits/pods/ seeds large insects
Ornamental Turf (mefluidide salts only) Ground spray	1.0 3 per season 42 day interval	20	<0.25**	<0.12*	<0.14*	<0.02
		100	<0.11*	<0.05	<0.06	<0.01
		1000	<0.04	<0.02	<0.02	<0.00

[1] For avian toxicity assessments, data evaluating Mefluidide-K, Mefluidide-DEA and Mefluidide toxicity have been bridged because toxicity is expected to come from the benzene ring of mefluidide. Therefore, the most sensitive Mefluidide endpoint was selected to represent avian for all application scenarios.

* exceeds LOC for acute risk to listed species (RQ ≥ 0.1)

** exceeds LOCs for acute risk to listed species and restricted use (RQ ≥ 0.2)

Table 4.8. Avian dietary-based chronic RQ values for Mefluidide-K and Mefluidide-DEA based on an estimated NOAEC of 38.0 mg/ ae kg and upper-bound Kenaga residues[1].

Use	Application Rate lbs. ai/A (# app / interval, days)	Food Items	Upper Bound EEC (mg/kg) [2]	Chronic RQ (EEC/ NOAEC)
Ornamental Turf (mefluidide salts only) Ground spray	1.0 3 per season 42 day interval	Short grass	240.17	6.32*
		Tall grass	110.08	2.90*
		Broadleaf plants/small insects	135.09	3.56*
		Fruits, pods, seeds, and large insects	15.01	0.40

[1] For avian toxicity assessments, data evaluating Mefluidide-K, Mefluidide-DEA and Mefluidide toxicity have been bridged because toxicity is expected to come from the benzene ring of mefluidide. Therefore, the most sensitive Mefluidide endpoint was selected to represent avian for all application scenarios.
* exceeds LOC for chronic risk to listed species (RQ ≥ 1.0)

LD_{50}/sq ft Summary

Mefluidide is the only proposed granular application. Based on one application of mefluidide at 0.5lbs ae/acre, LOC exceedances occurred for small-sized 20 g birds for acute restricted use and/or listed species (RQ=0.24). LD_{50}s/sq-ft can be interpreted as the number of lethal doses (LD_{50}s) that are available within one square foot immediately after application. EFED does not currently assess chronic risks to birds from granular applications. The acute RQs for LD_{50}/sq ft based on a single application of mefluidide are summarized in **Appendix D**

4.1.2.2 Mammals

Mammalian Risk

EECs and corresponding mammalian acute and chronic RQs for Mefluidide application were determined using the T-REX Version 1.3.1 model. Calculations for mammalian organisms oral dose-based risk quotients were based on an acute laboratory mouse LD_{50} value of 829.8 mg ae/kg bw and a chronic reproductive effect (NOAEC) observed at 102 mg ae/kg bw/day . Oral dose-based RQ values were calculated by dividing the consumption-weighted equivalent dose by the body weight-adjusted LD_{50}. The mammalian LD_{50} is adjusted for body weight according the following equation:

$$\text{Adjusted Mammalian } LD_{50}\,(\text{mg/kg bw}) = LD_{50} * \left(\frac{\text{TW (g)}}{\text{AW (g)}}\right)^{0.25}$$

(USEPA, 2006)

The assessed weight (AW) is the body weight of the wildlife species. An adjusted LD_{50} is calculated for each weight class of mammal (15, 35, and 1000 g). The test weight (TW) is the weight of the species used in the toxicity study. In this case, the average weight of the laboratory mouse was 20 g; however, T-REX assumes the average weight is 350 g. Therefore, the TW was adjusted to a mouse weighing 20 g in the model instead of 350 g rat weight. However, the assumed 350 g TW for the rat was used for the chronic oral dose-based RQ calculations, the NOAEC (102 mg ae/kg bw/day) was converted to a NOAEL (2040 mg ae/kg diet) based on a standard FDA lab rat conversion.

Foliar Summary for Mefluidide-K and Mefluidide-DEA

Table 4.9 summarizes the mammalian dose-based acute RQs for foliar uses of mefluidide-K and mefluidide-DEA.

For mefluidide-DEA and mefluidide-K, acute restricted use and/or listed species acute risk LOCs are exceeded for 15 g and 35 g mammals that consume short grass for the 1.0 lb ae/A application rate modeled scenario with acute RQs ranging from 0.22 to 0.26.

Acute risk to listed species are exceeded for 15 and 35 g sized mammals that consume short grass, tall grass, broadleaf plants and small insects and 1000 g mammals that consume short grass for the 1.0 lb ae/A application rate modeled scenario with acute RQs ranging from 0.10 to 0.26.

Table 4.10 summarizes the mammalian dose-based chronic RQs for foliar uses of mefluidide-K and mefluidide-DEA. The chronic LOC is exceeded for 15 g mammals that consume short grass with an RQ of 1.02 for the 1.0 lb ae/A modeled scenario.

Table 4.11 summarizes the mammalian dietary-based chronic RQs for foliar uses of mefluidide-K and mefluidide-DEA. No chronic dietary-based exceedances occurred for mammals for the1.0 lb ae/A modeled scenario. Risk quotients based on dietary exposure levels are provided for comparison purposes.

Table 4.9. Mammalian dose-based acute RQ values for proposed uses of Mefluidide-K and Mefluidide-DEA based on a mouse LD_{50} = 829.8 mg ae/kg -bw and upper-bound Kenaga values[1].

Use	Application Rate lbs. ae/A (# app / interval, days)	Body Weight, g	Mammalian Acute Risk Quotients (upper-bound Kenaga residues)				
			Short Grass	Tall Grass	Broadleaf Plants/Small Insects	Fruits/pods/ seeds large insects	Seeds (granivore)
Ornamental Turf (mefluidide salts only) Ground spray	1.0 3 per season 42 day interval	15	0.26**	0.12*	0.14*	0.02	0.00
		35	0.22**	0.10*	0.12*	0.01	0.00
		1000	0.12*	0.05	0.07	0.01	0.00

[1] For mammal toxicity assessments, data evaluating Mefluidide-K, Mefluidide-DEA and Mefluidide toxicity have been bridged because toxicity is expected to come from the benzene ring of mefluidide. Therefore, the most sensitive Mefluidide endpoint was selected to represent mammals for all application scenarios.
* exceeds LOC for acute risk to listed species (RQ ≥ 0.1)
** exceeds LOCs for acute risk to listed species and restricted use (RQ ≥ 0.2)

Table 4.10. Mammalian dose-based chronic RQ values for proposed uses of Mefluidide-K and Mefluidide-DEA based on a rat reproductive NOAEC of 102 mg ae/kg-bw/day and upper-bound Kenaga residues[1].

Use	Application Rate lbs. ae/A (# app / interval, days)	Body Weight, g	Mammalian Acute Risk Quotients (upper-bound Kenaga residues)				
			Short Grass	Tall Grass	Broadleaf Plants/Small Insects	Fruits/pods/seeds large insects	Seeds (granivore)
Ornamental Turf (mefluidide salts only) Ground spray	1.0 3 per season 42 day interval	15	1.02*	0.47	0.57	0.06	0.01
		35	0.87	0.40	0.49	0.05	0.01
		1000	0.47	0.21	0.26	0.03	0.01

[1] For mammal toxicity assessments, data evaluating Mefluidide-K, Mefluidide-DEA and Mefluidide toxicity have been bridged because toxicity is expected to come from the benzene ring of mefluidide. Therefore, the most sensitive Mefluidide endpoint was selected to represent mammals for all application scenarios.
*****exceeds the chronic risk LOC (RQ ≥ 1.0) for non-listed and listed species.

Table 4.11. Mammalian dietary-based chronic RQ values for Mefluidide-K and Mefluidide-DEA based on a rat reproductive NOAEC of 2040 mg/kg-diet and upper-bound Kenaga residues[1].

Use	Application Rate lbs. ai/A (# app / interval, days)	Food Items	Upper Bound EEC (mg/kg) [2]	Chronic RQ (EEC/ NOAEC)
Ornamental Turf (mefluidide salts only) Ground spray	1.0 3 per season 42 day interval	Short grass	240.17	0.12
		Tall grass	110.08	0.05
		Broadleaf plants/small insects	135.09	0.07
		Fruits, pods, seeds, and large insects	15.01	0.01

[1] For mammal toxicity assessments, data evaluating Mefluidide-K, Mefluidide-DEA and Mefluidide toxicity have been bridged because toxicity is expected to come from the benzene ring of mefluidide. Therefore, the most sensitive Mefluidide endpoint was selected to represent mammals for all application scenarios.
[2] estimated chronic diet concentration equivalent based on reported chronic dose
*****exceeds the chronic risk LOC (RQ $\geq$ 1.0) for non-listed and listed species.

LD_{50}/sq ft Summary

Mefluidide is the only proposed granular application. Based on one application of mefluidide at 0.5lbs ae/acre, acute restricted use and/or listed species acute risk LOC exceedances occurred for the LD_{50}s/sq-ft for small and medium-sized mammals. The RQs are 0.39 and 0.21 for small and medium mammals, respectively. LD_{50}s/sq-ft can be interpreted as the number of lethal doses (LD_{50}s) that are available within one square foot immediately after application. EFED does not currently assess chronic risks to mammals from granular applications. The acute RQs for LD_{50}/sq ft based on a single application of mefluidide are summarized in **Appendix D.** Calculations for LD_{50}/sq ft are based on the acute laboratory mouse LD_{50} value of 829.8 mg ae/kg bw, adjusted to an average weight of 20 g. The calculations for food intake for a 20 gram size class mouse are summarized in **Appendix D**. The LD50 approach is only applied to a single application.

4.1.2.3 Plants

Non-target Terrestrial Plants in Dryland and Semi-aquatic Areas

An analysis indicates exceedance of the Acute Risk LOC for listed and non-endangered monocots and dicots in dryland and semi-aquatic areas located adjacent to treated areas, both as a result of combined runoff and spray drift, and from spray drift alone for mefluidide-DEA and mefluidide-K.

For terrestrial plants, only one vegetative vigor toxicity study was submitted for plants based on fresh weight exposed to mefluidide-DEA. These data were bridged with mefluidide and mefluidide-K.

Risk to terrestrial plants from spray drift alone is evaluated by comparing the estimated exposure from drift to the most sensitive EC_{25} calculated from vegetative vigor laboratory tests. The most sensitive vegetative vigor EC_{25} values were 0.105 and 0.0054 lb ae/acre for monocots and dicots, respectively. The NOAEC values were 0.045 and 0.0029 lb ae/acre for monocots and dicots, respectively. Wet weight was the most sensitive endpoint for monocots and dicots in the vegetative vigor studies used to evaluate risk to terrestrial plants.

Seedling emergence toxicity data was not available for full review and data was not available from other anilide analogs to derive EC_{25} values. A preliminary review on a recently submitted seedling emergence study (MRID 471907-01) was conducted. These results are uncertain until a full review of the study is performed. The results of the preliminary review are summarized in Appendix E. Therefore, to estimate possible effects measurement endpoints for seedling emergence, EFED assumed that EC_{25} toxicity values for vegetative vigor are equal to seedling emergence measurement endpoints for mefluidide, mefluidide-DEA and mefluidide-K. Therefore, the most sensitive seedling emergence EC_{25} estimated values are 0.105 and 0.0054 lb ae/A for monocots and dicots, respectively. The NOEC estimated values for seedling emergence are 0.045 and 0.0029 lb ae/A for monocots and dicots, respectively. These values are used to calculate risk quotients for exposure from combined runoff and spray drift to adjacent fields.

Because RQs based on the EC_{25} values exceed the acute LOC, and exposure can be expected which would cause greater than a 25% effect, risk to listed plants is also a concern. Because RQs based on the NOAEC values exceed the acute LOC, and exposure can be expected which would cause potential risks to listed plants. Risk quotients with which to evaluate listed plant risks from a result of combined runoff and spray drift, and from spray drift alone for mefluidide, mefluidide-DEA and mefluidide-K were calculated with the above NOAEC values from the vegetative vigor studies.

Spray applications with 1.0lb ae/A demonstrated the highest RQ exceedances followed by granular applications with 0.5 lb ae/A. Dicots demonstrated more sensitivity than monocots in most application scenarios with exposure to mefluidide, mefluidide-DEA and mefluidide-K.

(**Table 4.12)** summarizes vegetative vigor and seedling emergence terrestrial plant RQs for foliar and granular uses of mefluidide-K, mefluidide-DEA and mefluidide from a result of combined runoff and spray drift, and from spray drift alone. Risk quotients were exceeded for ground spray (1.0 lb ae/A) and granular applications (0.5 lb ae/A) for monocots and dicots. Dicots demonstrated more sensitivity than monocots in all application scenarios with exposure to mefluidide-K and mefluidide-DEA with all TERR Plant modeled scenarios.

Table 4.12. Summarized Terrestrial Plant Risk Quotients for Mefluidide, Mefluidide-DEA and Mefluidide-K[a, b, c, d]						
	Acute Non-endangered RQs			Acute listed RQs		
Scenario	adjacent to treated sites	semi-aquatic areas	drift	adjacent to treated sites	semi-aquatic areas	drift
Ground spray application (1.0 lbs ae/acre)						
Monocot	0.571	4.86**	0.10	1.33*	11.33*	0.22
Dicot	11.11**	94.44**	1.85*	20.69*	175.86*	3.45*
Granular ground application (0.5 lbs ae/acre)[e]						
Monocot	0.24	2.38**	n/a	0.56	5.56*	n/a
Dicot	4.63**	46.3**	n/a	8.62*	86.21*	n/a

[1] For terrestrial plant (seedling emergence and vegetative vigor) toxicity assessments, data evaluating Mefluidide-K, Mefluidide-DEA and Mefluidide toxicity have been bridged. Therefore, the most sensitive Mefluidide endpoint was selected to represent terrestrial plants for all application scenarios.

[a] RQs for spray turf applications in this table were calculated for the maximum labeled application rates of (1.2 lbs ae/acre) and (1.0 lbs ae/acre) for mefluidide-DEA and mefluidide-K respectively..

[b] Acute non-endangered toxicity thresholds (EC_{25}) were (0.105, 0.0054, 0.105, 0.0054)ae/acre for seedling emergence monocot, seedling emergence dicot, vegetative vigor monocot, and vegetative vigor dicot, respectively. EFED assumed that EC_{25} toxicity values for terrestrial plants (vegetative vigor) are equal to (seedling emergence) measurement endpoints for Mefluidide, Mefluidide-DEA and Mefluidide-K due to lack of submitted data.

[c] Acute listed toxicity thresholds (NOAEC) were (0.045, 0.0029, 0.045, 0.0029) lb ai/acre for seedling emergence monocot, seedling emergence dicot, vegetative vigor monocot, and vegetative vigor dicot, respectively. EFED assumed that NOAEC toxicity values for terrestrial plants (vegetative vigor) are equal to (seedling emergence) measurement endpoints for Mefluidide, Mefluidide-DEA and Mefluidide-K due to lack of submitted data.

* indicates an exceedance of the listed Species Level of Concern (LOC).

**indicates an exceedance of the Acute Risk LOC.

[d]RQs for ground granular applications in this table were calculated for the maximum labeled application rate of 0.5lbs ae/acre. Drift RQs are not applicable for granular applications.

Spray drift is an important factor in characterizing the risk of Mefluidide to non-target plants. Spray drift exposure from ground application is assumed to be 1% of the application rate and the EECs and RQs were calculated using EFED's TerrPlant.xls model (Version 1.2.1). The AgDrift Tier 1 model (ground application, very fine to fine droplet size, medium to course droplet size and low boom height for turf application) was used to determine what conditions are represented by a 1% spray drift exposure from ground application. AgDrift provided 90th percentile estimates based on the distribution of field measurements at 10 to 900 feet distances from the edge of field (Table 3.5). The 90th percentile drift estimates from AgDrift for 1.0 lb ae/A ground application was 0.51% of applied at a distance of 200 ft from the edge of the field for turf applications (very fine to fine droplet size). The 90th percentile drift estimates from AgDrift for 1.0 lb ae/A ground application was 0.26% of applied at a distance of 200 ft from the edge of the field for turf

applications (medium to course droplet size). LOC exceedences did not occur with a 80 foot or above buffer size for both listed and non-listed dicots for the 1.0 lb ae/A application scenario with the medium to course droplet size. LOC exceedences did not occur with a 200 foot or above buffer size for both listed and non-listed dicots for the 1.0 lb ae/A application scenario with the very fine to fine droplet size. RQs were calculated for buffers from 10 to 900 feet are summarized in Appendix D.

4.1.3 RQs Based on Mean Kenaga Residues

For this risk assessment, the RQ that were compared to the LOCs were calculated using maximum EECs derived from the Kenaga nomograph. Risk quotients were also calculated using mean EECs to determine the extent of the risk to mammals. RQs were based on both single oral dose and dietary studies for mammals.

Birds

Acute RQs were calculated for birds based on the non-definitive LD_{50} value of >1500 mg ae/kg-bwt . No mortality occurred at the single dose treatment level (1500 mg ae/kg-bw) for the Tier I Acute Toxicity to Bobwhite quail study MRID 416019-01. When mean residues were assumed, RQ values ranged from 0 to <0.09 for the 1.0 lb ae/A ornamental turf modeled scenario. Based on the mean kenaga assessment, no acute LOC exceedances occurred for birds for the 1.0 lb ae/A application scenario.

Based on the chronic estimated value of NOAEC of 38 mg/ ae kg diet, when mean residues were assumed, RQ values ranged from 0.18 to 2.23 for the 1.0 lb ae/A ornamental turf modeled scenario. Based on the mean Kenaga assessment, chronic LOC exceedances for birds occurred for the1.0 lb ae/A ornamental turf modeled scenario. RQs are summarized in APPENDIX D.

Mammals

When mean residues were assumed:

- **Mammalian Acute listed** LOCs were no longer exceeded for the 1 lb ae/A modeled scenario.
- **Mammalian Acute Restricted Use** LOCs were no longer exceeded for 15 g and 35 g mammals for the 1.0 lb ae/A modeled scenario.
- **Mammalian Chronic** LOCs (dose-based) were no longer exceeded for the 15 g and 35 g size mammals for the 1.0 lb ae/A application scenario.

4.2. Risk Description – Interpretation of Direct Effects

4.2.1 *Risks to Aquatic Organisms and Plants*

Based on the risk hypothesis terrestrial organisms (birds, mammals, reptiles, terrestrial-phase amphibians and plants) and aquatic organisms (invertebrates, fish, amphibians and plants) in surface waters (freshwater or saltwater) are subject to adverse effects when exposed to mefluidide residues as a result of labeled use of the pesticide. Routes of exposure evaluated in this risk assessment focused on runoff and spray drift from ground spray with mefluidide applied at application rates of 1.0 lb ae/A (mefluidide-K and mefluidide-DEA) and runoff from granular applications with 0.5 lb ae/A mefluidide.

No LOCs were exceeded for acute effects on freshwater and estuarine marine fish, aquatic invertebrates, non-vascular and vascular aquatic plants in water bodies adjacent to ornamental turf in areas treated with mefluidide DEA, mefluidide K and mefluidide.

No LOC exceedances occurred for chronic freshwater fish, chronic estuarine marine fish, chronic estuarine marine invertebrates, chronic freshwater invertebrates, vascular plants and non-vascular plants.

4.2.2 *Risks to Terrestrial Organisms and Plants*

Direct application of mefluidide-K, mefluidide-DEA, and mefluidide to the field leads to the conclusion that exposure is likely to terrestrial organisms that are foraging or nesting in or near the treated field. Birds and mammals in treated fields may be exposed to spray and granular applications of pesticides by ingesting material directly with the diet. When pesticides are applied as a granular formulation, the exposure estimate is assumed to account for all methods of exposure. They may also be exposed by other routes, such as incidental ingestion of contaminated soil, dermal contact with treated plant surfaces and soil during activities in the treated areas, direct impingement of sprayed material on the body at the time of application, preening activities, inhalation of pesticide vapor and contaminated particulate, and ingestion of drinking water contaminated by the pesticide.

1. *Birds*

Six acute dietary studies were considered in determining the risk for birds following applications of mefluidide, mefluidide-K, and mefluidide-DEA to ornamental turf. Also, no mortality occurred at the highest levels for all six dietary studies. No toxic effects were identified for the above studies. Acute RQs were calculated for birds based on the non-definitive LD_{50} value of >1500 mg ae/kg-bw. RQ values ranged from 0 to <0.25 for the 1.0 ae/A ornamental turf modeled scenario. The available dietary toxicity studies on avian species failed to establishe definitive acute LD_{50} values (i.e., the lethality values exceed the highest dose tested). Therefore, use of this value adds uncertainty and may overestimate risk to avian species. Therefore, when the LD_{50} value of >1500 mg ae/kg-bw was applied to the TREX model it resulted in LOC exceedances for acute listed for 20 and 100g birds and restricted use

for 20 g birds for mefluidide-DEA and mefluidide-K (1.0 lb ae/A at 3 spray applications). The LD_{50} value of 5000 mg ae/bw if applied to the above modeled scenario would result in no acute LOC exceedances for birds. Based on the mean kenaga assessment, no acute LOC exceedances occurred for birds (1.0 lbae/A at 3 spray applications).

Chronic RQs were estimated for birds based on the non-definitive NOAEC value of 38 mg ae/kg. Chronic dietary-based exceedances occurred for birds for the 1.0 lb ae/A modeled scenario with risk quotient exceedances ranging from 2.90 to 6.32. Chronic estimated NOAEC values and calculations are summarized in **Appendix E.**

Due to the high degree of uncertainty based on the estimated NOAEC value 38 mg ae/kg and the non-definitive LD_{50} value of >1500 lb ae/A. Acute and chronic avian studies with definitive LD_{50} and NOAEC values would quantify the uncertainties of avian risk.

LD_{50}/sq ft Summary

Mefluidide is the only proposed granular application. Based on one application of mefluidide at 0.5lbs ae/acre, acute restricted use and/or listed species acute risk LOC exceedances occurred for the LD_{50}s/sq-ft for small and medium-sized mammals. The RQs are 0.39 and 0.21 for small and medium mammals, respectively. LD_{50}s/sq-ft can be interpreted as the number of lethal doses (LD_{50}s) that are available within one square foot immediately after application. EFED does not currently assess chronic risks to birds from granular applications. The acute RQs for LD_{50}/sq ft based on a single application of mefluidide are summarized in **Appendix D**

2. *Mammals*

Two dietary studies were considered in determining the risk for mammals following the application of mefluidide, mefluidide-K and mefluidide-DEA.

Based on this analysis, it is likely that listed and non-listed mammals that feed on grasses and broadleaf plants and small insects are at risk from acute exposure due to spray applications of mefluidide-K and mefluidide-DEA residues for turf modeled scenarios. Also, it is likely that listed and non-listed mammals that feed on grasses and broadleaf plants or small insects are at risk from chronic exposure due to mefluidide-DEA and mefluidide-K residues based on the ornamental turf (1.0 lb ae/A) modeled scenario.

Based on one granular application of mefluidide (0.5 lb ae/A) acute listed and restricted use LOCs were exceeded for small and medium sized mammals.

3. Non-Target Insects and Earthworms

EFED currently does not quantify risks to terrestrial non-target insects. Risk quotients, therefore, are not calculated for these organisms. Because mefluidide, mefluidide-K and mefluidide-DEA are practically non-toxic to honey bees (96-hr acute contact LD_{50} > 18.75 µg ae/bee, MRID 425628-01, LD_{50} > 22.25 µg ae/bee, MRID 425628-02), the risk are not likely to have adverse effects on pollinators and other beneficial insects.

Ecotox data indicates that mefluidide is non-toxic to earthworms (Ref #39542 Potter DA; Spicer PG; Redmond CT; Powell AJ (1994) Toxicity of Pesticides to Earthworms in Kentucky Bluegrass Turf). Two evaluations were conducted in the spring and the fall of 1992. Earthworm populations were sampled at 1 and 3 weeks after treatment. The application rate of mefluidide applied to the plots were 0.56 ai/ha of Embark 2S which resulted in 0% and 17 % reduction of earthworms in the spring and fall respectively after the 3 week treatments.

3. *Terrestrial Plants*

Ground spray and granular applications were modeled for both monocots and dicots from combined runoff and drift and drift only scenarios. Only one vegetative vigor toxicity study was submitted for terrestrial plants based on fresh weight basis exposed to mefluidide-DEA. These data were bridged with mefluidide and mefluidide-K. Seedling emergence toxicity data were not available for a full review to evaluate exposure of terrestrial plants to mefluidide from combined runoff and drift. In addition, data were not available from other anilide analogs to derive estimated EC_{25} values. To estimate possible effects measurement endpoints for seedling emergence, EFED assumed that EC_{25} toxicity values for vegetative vigor are equal to seedling emergence measurement endpoints for mefluidide, mefluidide-DEA and mefluidide-K.

Levels of concerns are exceeded for acute non-listed and listed monocots and dicots for ground applications for turf modeled scenarios. For the ornamental turf (1.0 lb ae/A) modeled scenario, RQs ranged from 0.10 to 175.86 (ground spray applications) for monocots and dicots from combined runoff and spray drift. For the ornamental turf (0.5 lb ae/A) modeled scenario, RQs ranged from 0.24 to 86.21 (granular applications) for monocots and dicots from runoff.

For the ornamental turf (1.0 lb ae/A) modeled scenario RQs ranged from 0.1 to 3.45 (ground spray applications) for monocots and dicots from spray drift only.

Levels of concerns are exceeded for acute non-listed and listed monocots and dicots from granular turf applications. For the ornamental turf (0.5 lb ae/A) modeled scenario, RQs were 46.3 for non-listed dicots, 86.2 for listed dicots, 2.38 for non-listed monocots and 5.56 for listed monocots.

An analysis of the results indicates exceedance of the Acute Risk LOC for listed and non-listed monocots and dicots in dryland and semi-aquatic areas located adjacent to treated

areas, both as a result of combined runoff and spray drift, and from spray drift alone for mefluidide, mefluidide-DEA and mefluidide-K.

Spray applications with 1.0 lb ae/acre demonstrated the highest RQ exceedances followed by granular applications with 0.5 lb ae/A. Dicots demonstrated more sensitivity than monocots in most application scenarios with exposure to mefluidide, mefluidide-DEA and mefluidide-K. A preliminary review on a recently submitted seedling emergence study (MRID 471907-01) was conducted. These results are uncertain until a full review of the study is performed. The results of the preliminary review are summarized in Appendix E.

5. Endocrine Disruption Assessment

No studies were submitted for mefluidide-K, mefluidide-DEA and mefluidide that indicated endocrine disruption.

The degradates of mefluidide-K, mefluidide-DEA and mefluidide have not been identified as possessing the potential for endocrine disruption. In addition, the registrant has not submitted, nor has the Agency requested, studies on the potential for endocrine disruption for any of these degradates resulting from the use of mefluidide. Until such time as the Agency determines that any of these degradates have the potential to be an endocrine disruptor, this risk assessment has not included an evaluation of the relative risk of mefluidide-K, mefluidide-DEA and mefluidide, degradates for endocrine disruption and as such is a source of uncertainty in this assessment.

EPA is required under the Federal Food, Drug, and Cosmetic Act (FFDCA), as amended by the Food Quality Protection Act (FQPA), to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) *"may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other such endocrine effects as the Administrator may designate."* Following the recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there were scientific bases for including, as part of the program, the androgen and thyroid hormone systems, in addition to the estrogen hormone system. EPA also adopted EDSTAC's recommendation that the Program include evaluations of potential effects in wildlife. For pesticide chemicals, EPA will use The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCA authority to require the wildlife evaluations. As the science develops and resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP). When the appropriate screening and/or testing protocols being considered under the Agency's EDSP have been developed, mefluidide-K, mefluidide-DEA and mefluidide may be subjected to additional screening and/or testing to better characterize effects related to endocrine disruption.

6. *Potential for Avian and Mammalian Exposure in Space and Time*

In order for chemical residues in potential wildlife food items to result in direct adverse effects in a mammalian population, the organisms must be exposed to those food items at locations and at times when the residues are present. There are a number of important questions that must be considered:

1. Are the residues present at locations where wildlife might feed?
2. Are the residues present in food items at times when wildlife might use the areas?
3. Are the residues likely to be around long enough to result in exposure sufficient to trigger the expected adverse responses?

Mefluidide formulations are for use on: agricultural/farm structures/buildings and equipment, agricultural/nonagricultural uncultivated areas/soils, airports/landing fields, commercial industrial lawns, commercial institutional/industrial premises/equipment (indoor/outdoor), golf course turf, hospitals/medical institutions premises (human veterinary), household domestic dwellings outdoor premises, industrial areas (outdoor), nonagricultural outdoor buildings/structures, nonagricultural rights-of-way/fencerows/hedgerows, ornamental and or shade trees, ornamental ground cover, ornamental herbaceous plants, ornamental lawns and turf, ornamental nonflowering plants, ornamental woody shrubs and vines, paths/patios, paved area (private roads/sidewalks), recreational areas, and residential lawns.

One category of ornamental turf that mefluidide is used on is golf courses. Golf courses are recognized as having strong potential for providing quality habitat to many wildlife species (Stangel and Distler 2002). For example, Audubon International has more than 2,200 golf courses enrolled in its Audubon Cooperative Sanctuary System Program for Golf Courses providing education and assistance to golf course managers promoting environmental stewardship, conservation of biological diversity, and sustainable resource management. Audubon International has also been awarded a grant from Wildlife Links to create a database for information on wildlife habitat on golf courses.

Across 24 golf courses in the northern coast of South Carolina, a total of 5,362 birds, 82 species, and 30 neotropical migratory birds species were recorded at 599 point count stations over a two year study (Crum et al. 2003). Crum et al. (2003) report that the majority of birds associated with less developed landscapes (i.e. golf courses with less habitat disturbance) were woodland breeding species, while urban breeding species were found primarily on golf courses in which the majority of native vegetation had either been removed or replaced with ornamental vegetation, or contained a high level of human disturbance including residential and non-residential structures. The large number of species observed on golf courses in this small geographic area of the US indicates that a wide variety of birds will utilize golf courses. Because of the large number of species represented, it is likely that some population of birds will be on the golf course year-round and that bird breeding seasons will be spread throughout much of the year. In another study, Merola-Zwartjes and DeLong (2005) compared a number

of golf courses in the Albuquerque, New Mexico, area with paired natural areas to see whether golf courses have the potential of acting as surrogate riparian habitats for Southwestern birds. They concluded that golf courses do have the potential to support riparian bird communities, but that their conservation potential can be enhanced through the addition of habitat complexity and structure utilizing native plants.

Sod farms are also registered for application with mefluidide-K, mefluidide-DEA, mefluidide. One example of a bird species that utilizes sod farms is the mountain plover who is attracted to manmade landscapes (e.g., sod farms and cultivated fields) that mimic their natural habitat associations, or sites with little vegetative cover (e.g., other agricultural lands and alkali flats) (http://www.epa.gov/fedrgstr/EPA-IMPACT/2002/December/Day-05/i30801.htm, accessed 01 October 2006). Land management practices on cultivated fields may include periods when fields are fallow, idle, or barren. If these fields remain fallow, idle, or barren during April and May, mountain plovers may choose these fields for nesting. Sod farms are often listed as popular sites for birding enthusiasts.
(e.g.,http://home.comcast.net/~ehoward24/localbirdingsites.html,
http://www.crbo.net/SpecialtyBirds.html, accessed on 01 October 2006).

An example of wildlife use of roadsides is provided by the Minnesota Department of Natural Resources (http://www.dnr.state.mn.us/roadsidesforwildlife/index.html, accessed on 01 October 2006). Researchers have found that over 40 species of birds and mammals utilize roadsides for shelter, nesting, and food. Roadsides receive almost continuous nesting use from April through August. Roadsides also provide the right combination of abundant food and cover for birds that nest in cavities or in trees near roads. Examples of birds and mammals documented to use roadsides in Minnesota are: cottontail rabbit, white-tailed jackrabbit, short-tailed shrew, woodchuck, meadow vole, meadow jumping mouse, ring-necked pheasant, gray (Hungarian) partridge, mallard, blue-winged teal, pintail, and upland sandpiper. Disturbance of roadside cover by early mowing, farm tillage, grazing, "blanket" spraying, or vehicle and tractor encroachment during the peak nesting months (May, June, July) will significantly lower production for species that use roadsides for nesting.

Based on a 4 day foliar half-life with LOC exceedances for mammals and birds for the 1.0 and 0.5 lb ae/A application scenarios, residues are likely to result in exposure sufficient to trigger the expected adverse responses.

This analysis suggests that the patterns of mefluidide uses are such that they coincide in time and space to areas frequented by mammalian wildlife. These areas have been of demonstrated use by wildlife as sources of food and cover. Finally, the potentially problematic wildlife food items suggested by the risk assessment of mefluidide are likely to be present in and around the treated areas.

4.2.4 Federally Threatened and Endangered (Listed) Species Concerns

4.2.4.1 Action Area

For listed species assessment purposes, the action area is considered to be the area affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. At the initial screening-level, the risk assessment considers broadly described taxonomic groups and so conservatively assumes that listed species within those broad groups are collocated with the pesticide treatment area. This means that terrestrial plants and wildlife are assumed to be located on or adjacent to the treated site and aquatic organisms are assumed to be located in a surface water body adjacent to the treated site. The assessment also assumes that the listed species are located within an assumed area which has the relatively highest potential exposure to the pesticide, and that exposures are likely to decrease with distance from the treatment area.

4.2.4.2 Taxonomic Groups Potentially at Risk

Based on available screening level information, the greatest concerns for direct Mefluidide ecological risks lie with effects to terrestrial and semi-aquatic plants as well as acute and chronic effects to birds and mammals. The screening-level risk assessment for Mefluidide has identified potential concerns for direct effects on the following listed species categories: birds, mammals, and terrestrial and semi-aquatic plants (both monocots and dicots). Since birds are used as a surrogate for reptiles and terrestrial phase amphibians, they are also considered to be of concern.

The LOCATES database was not used for this assessment to identify specific listed and threatened species at risk from exposure to Mefluidide. Because of its widespread use on non-crop areas and because it is used throughout the United States, the search of the database could not be restricted by crop or geographic area. Therefore, all species within each of the categories listed above would be identified as being at risk through the LOCATES database.

Probit Slope Analysis

Screening-level acute listed LOCs are exceeded for terrestrial organisms potentially exposed to residues by Mefluidide applications. The Agency uses the dose response relationship from the toxicity study used for calculating the RQ to estimate the probability of acute effects associated with an exposure equivalent to the EEC. This information serves as a guide to establish the need for and extent of additional analysis that may be performed using Services-provided "species profiles" as well as evaluations of the geographical and temporal nature of the exposure to ascertain if a "not likely to adversely affect" determination can be made. The degree to which additional analyses are performed is commensurate with the predicted probability of adverse effects from the comparison of the dose response information with the EECs. The greater the probability that exposures will produce effects on a taxa, the greater the concern for potential indirect effects for listed species dependant upon that taxa,

and therefore, the more intensive the analysis on the potential listed species of concern, their locations relative to the use site, and information regarding the use scenario (e.g., timing, frequency, and geographical extent of pesticide application).

The Agency uses the probit dose response relationship as a tool for providing additional information on the listed animal species acute levels of concern. The acute listed Species LOCs of 0.1 and 0.05 are used for terrestrial and aquatic animals, respectively. As part of the risk characterization, an interpretation of acute LOCs for listed species is discussed. This interpretation is presented in terms of the chance of an individual event (i.e., mortality or immobilization) should exposure at the estimated environmental concentration actually occur for a species with sensitivity to Mefluidide on par with the acute toxicity endpoint selected for RQ calculation. To accomplish this interpretation, the Agency uses the slope of the dose response relationship available from the toxicity study used to establish the acute toxicity measurement endpoints for each taxonomic group. The individual effects probability associated with the LOCs is based on the mean estimate of the slope and an assumption of a probit dose response relationship. In addition to a single effects probability estimate based on the mean, upper and lower estimates of the effects, probabilities are also provided to account for variance in the slope. The upper and lower bounds of the effects probability are based on available information on the 95% confidence interval of the slope. Confidence in the applicability of the assumed probit dose response relationship for predicting individual event probabilities is also relevant. Studies with good probit fit characteristics (i.e., statistically appropriate for the data set) are associated with a high degree of confidence. Conversely, a low degree of confidence is associated with data from studies that do not statistically support a probit dose response relationship. In addition, confidence in the data set may be reduced by high variance in the slope estimate (i.e., large 95% confidence intervals), despite good probit fit characteristics.

The individual effect probabilities for aquatic organisms were calculated based on an Excel spreadsheet tool IECV1.1 (Individual Effect Chance Model Version 1.1) The model allows for such calculations by entering the mean slope estimate (and the 95% confidence bounds of that estimate) as the slope parameter for the spreadsheet. For all species event probability was calculated for the exceeded LOC based on a default slope assumption of 4.5 due to studies that do not statistically support a probit dose response relationship with confidence intervals of 2 and 9 as per original Agency assumptions of typical slope cited in Urban and Cook (1986).

The corresponding estimated chance of individual mortality associated with the terrestrial listed Species LOC 0.10 for terrestrial species located near ornamental turf (1.0 lb ae/A) areas exposed to mefluidide is approximately **1 in 2.94E+05 for mammals.** Probit analysis was not conducted for birds because the LD_{50} was greater than 1500 mg ae/kg-bw in the Bobwhite quail study (MRID 416019-01) and there were no mortalities reported.

However, based on the screening level assessment, the acute risk quotients for mammals are as high as 0.26, above the acute listed LOC of 0.05. The probability of individual mortality based on the calculated RQs is 1 in 236 for potentially exposed mammals (based on the LD_{50}

study). Table 4.7 summarizes information on the Probability of Individual Mortality for Mammals and Birds.

Table 4.7 Probability of Individual Mortality for Birds and Mammals at the Highest RQs and Application Rate (1.0lb ae/A) Mefluidide

Species	Type of application	EC50 LD50	RQ	Probit Slope	95% Confidence Interval	Probability of Individual Mortality at the RQ in this Assessment	MRID Source of Probit Slope
Bobwhite quail LD_{50}	Ornamental Turf	>1500		n/a			416019-01
Lab mouse LD_{50}	Ornamental Turf	829.8	0.26**	default = 4.5	default 2-9	1 in 236 (95% confidence interval 1 in 8.27 and 1 in 1.43 E+ 07)	00047116

[1] For terrestrial avian toxicity assessments, data evaluating toxicity data have been bridged. Therefore, the most sensitive mefluidide endpoint for birds was selected to represent all three Mefluidide formulations for birds for all application scenarios For terrestrial mammal toxicity assessments, data evaluating toxicity data have been bridged. Also the most sensitive mefluidide endpoint for mammals was selected to represent all three Mefluidide formulations for mammals for all application scenarios.
* exceeds LOC for acute risk to listed species (aquatic LOC = 0.05, terrestrial LOC = 0.10)
** exceeds LOCs for acute risk to listed species and restricted use (aquatic LOC = 0.1, terrestrial LOC = 0.20)
*** exceeds LOCs for acute risk, acute risk to listed species, and restricted use (LOC = 0.5)

The corresponding estimated chance of individual mortality associated with the aquatic species listed Species LOC of 0.05 for potentially exposed **estuarine marine invertebrates** located near ornamental turf (1.0 lb ae/A) is approximately **1 in 4.18E*8.** Probit analysis was not conducted for freshwater fish because the LC_{50} was greater than 68.47 mg ae/L in the rainbow trout study (MRID 418937-02) and there were no mortalities reported. Probit analysis was not conducted for freshwater invertebrates because the LC_{50} was greater than 77.25 mg ae/L in the Daphnia study (MRID 418937-03) and there were no mortalities reported.
Based on the screening level assessment, the highest acute risk quotient for estuarine marine invertebrates is 0.0001, two orders of magnitude below the acute listed LOC of 0.05. The probability of individual mortality based on the calculated RQs is 1 in 1.03E+72 for potentially exposed invertebrates (based on the LC_{50} study) Table 4.8 summarizes information on the Probability of Individual Mortality for fish and aquatic invertebrates.

Table 4.8 Probability of Individual Mortality for fish and aquatic invertebrates at the Highest RQs and Application Rate (1.0 ae/A) Mefluidide							
Species	**Type of Application**	**LC50 LD50 EC50**	**RQ**	**Probit Slope**	**95% Confidence Interval**	**Probability of Individual Mortality at the RQ in this Assessment**	**MRID Source of Probit Slope**
FW Rainbow trout	Ornamental turf	>68.47		n/a			418937-02
FW Daphnid	Ornamental turf	>77.25		n/a			418937-03
EM Sheepshead minnow	Ornamental turf	>84.75		n/a			425623-03
EM Eastern oyster	Ornamental turf	67	0.0001	default = 4.5	default 2-9	1 in 1.03E+72 (95% confidence interval 1 in 1.61E+15 and 1 in 2.39E+283)	425624-01

[1] For terrestrial avian toxicity assessments, data evaluating toxicity data have been bridged. Therefore, the most sensitive mefluidide endpoint for birds was selected to represent all three Mefluidide formulations for birds for all application scenarios For terrestrial mammal toxicity assessments, data evaluating toxicity data have been bridged. Also the most sensitive mefluidide endpoint for mammals was selected to represent all three Mefluidide formulations for mammals for all application scenarios.

* exceeds LOC for acute risk to listed species (aquatic LOC = 0.05, terrestrial LOC = 0.10)

** exceeds LOCs for acute risk to listed species and restricted use (aquatic LOC = 0.1, terrestrial LOC = 0.20)

*** exceeds LOCs for acute risk, acute risk to listed species, and restricted use (LOC = 0.5)

Indirect Effects Analysis

The Agency acknowledges that pesticides have the potential to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering the extent of nesting habitat, etc. In conducting a screen for indirect effects, direct effect LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms in these taxonomic groups as resources critical to their life cycle. There are acute and chronic direct effects for mammals, birds and acute direct effects for terrestrial plants (monocot and dicot).

Indirect effects are possible for terrestrial animals that are dependent on terrestrial monocots and dicot plants for food and/or shelter. Therefore, there is potential for adverse effects to those species that rely either on a specific plant species or multiple plant species. Also, plant indirect effects may be limited to general habitat modification, host plant loss, and competition. If the available plant material is impacted due to the effects of mefluidide, this may have negative effects not only on the herbivorous animals, but throughout the food chain. Also, depending on the severity of impact to the plant communities (edge and riparian vegetation), community assemblages and ecosystem stability may be altered (i.e. reduced bird

and mammal populations in edge habitats; reduced riparian vegetation resulting in increased light penetration and temperature in aquatic habitats).

Acute listed LOCs were exceeded for 20 g and 100 g birds and acute restricted use LOCs were exceeded for 20 g birds that were exposed to and consumed various feed items. Consequently, there may be a concern for potential indirect effects to listed species dependent upon birds that consume feed items (short and tall grasses, broadleaf plants, and small insects) contaminated with mefluidide residues; such as predatory birds and mammals.

Acute listed and acute restricted use LOCs were exceeded for mammals (15 g and 35 g) and acute listed LOCs were exceeded for 1000 g mammals that consumed various feed items. The results of the probit dose analysis for mouse indicated a **1 in 236 for mammals** chance of mortality based on the maximum use scenario and RQ of 0.26 for small mammals consuming mefluidide. Consequently, there may be a concern for potential indirect effects to listed species dependent upon mammals that consume feed items (short and tall grasses, broadleaf plants, and small insects) contaminated with mefluidide residues; such as predatory birds and mammals.

There are potential concerns for indirect effects on aquatic organisms (fish, invertebrates, and plants) due to the potential for changes in the habitat adjacent to water bodies. Shading of water bodies that provides temperature regulation of the water could be reduced, thus altering the habitat by increasing water temperature. This change in temperature could affect the abundance and/or diversity of aquatic plants and organisms in the adjacent water bodies. Furthermore, the reduction of upstream riparian vegetation that would otherwise supply downstream habitats could result not only in a loss of a significant component of food for aquatic herbivores and detritivores, but also of habitat (i.e. leaf packs, materials for case-building for invertebrates). These concerns are not only for freshwater systems, but also for estuarine/marine systems. As an example, many golf courses are located on or near coastal areas.

Again, the LOCATES database was not used for this assessment to identify specific listed and threatened species at risk from indirect effects to Mefluidide-K, mefluidide-DEA and mefluidide. Because of its widespread use on non-crop areas and because it is used throughout the United States, the search of the database could not be restricted by crop or geographic area. Therefore, further co-location analysis is recommended once the locations of mefluidide use can be identified.

Critical Habitat for Listed Species

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

screening-level taxonomic analysis (RQs) and listed species levels of concern (LOCs) that are used to evaluate direct and indirect effects to listed organisms.

The screening-level risk assessment for mefluidide has identified potential concerns for direct effects on the following listed species categories: small and medium birds, small, medium and large mammals, and terrestrial and semi-aquatic plants (both monocots and dicots). Since birds are used as a surrogate for reptiles and terrestrial phase amphibians, they are also considered to be of concern. In light of the potential for both direct effects, the next step for EPA and the Service(s) is to identify which listed species and critical habitat are potentially implicated.

Analytically, the identification of such species and critical habitat can occur in either of two ways. First, the Agencies could determine whether the action area overlaps critical habitat or the occupied range of any listed species. If so, EPA would examine whether the pesticide's potential impacts on non-endangered species would affect the listed species indirectly or directly affect a constituent element of the critical habitat. Alternatively, the Agencies could determine which listed species depend on biological resources, or have constituent elements that fall into the taxa that may be directly or indirectly impacted by a pesticide. Then EPA would determine whether or not use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA is not sufficient to permit use of either analytical approach to make a definitive identification of species that are potentially impacted indirectly or critical habitats that are potentially impacted directly by the use of pesticides. EPA and the Service(s) are working together to conduct the necessary analysis.

Because of the large number of species that are potentially impacted, critical habitats will not be analyzed in this assessment. Therefore, it is the continued responsibility of the EPA and the Service(s) to make these assessments before final regulatory decisions are made.

Species with identified critical habitats are listed at:
http://ecos.fws.gov/tess_public/CriticalHabitat.do?listings=0&nmfs=1
(Fish and Wildlife Service)
http://ecos.fws.gov/tess_public/CriticalHabitat.do?listings=0&nmfs=2
(National Oceanic and Atmospheric Administration). A critical habitat mapper for a subset of listed species is available at: http://ecos.fws.gov/imf/imf.jsp?site=ecos.

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

1. Uncertainties and data gaps associated with the environmental fate and toxicity data

Exposure estimates for this screening level risk assessment focused on the mefluidide, mefluidide-K and mefluidide-DEA. Degradation products were not considered in the exposure assessment. There are no environmental fate data on the degradation products of mefluidide, mefluidide-K and mefluidide-DEA. More importantly, 5-amino-2,4-dimethyltrifluoromethane-sulfonilide is a minor degradation product of mefluidide. Diethanolamine (DEA) degrades rapidly ($t_{1/2}$= 1.7 to 5.8 days) in aerobic soil and water environments (MRID 43685901, 43685902, 44439401). In contrast, DEA is persistent ($t_{1/2}$= 990 days) in anaerobic aquatic environments (MRID 43882901). Degradation products of diethanolamine are glycine, ethanolamine, and CO_2. Therefore, the potential mechanisms of transformation (i.e., which degradates may form in the environment, in which media, and how much) must be known, especially for a chemical whose metabolites/degradates such as DEA are of greater toxicological concern.

Additional uncertainty results from the lack of information and/or data in several components of this ecological risk assessment as follows:

Ecotoxicity data for chronic risks to freshwater fish and freshwater invertebrates exposed to mefluidide were not available. However, estimated values were derived from only one anilide (propanil) herbicide to obtain effects measurement endpoints. A range of anilide herbicides was not available to extrapolate endpoints.

- Although propanil has a similar chemical structure as mefluidide, the anilide (propanil) has a different mode of action for plants. Propanil is a photosynthesis inhibitor in contrast to mefluidide which inhibits plant cell division, stem elongation and seed head development. Also propanil has reported sublethal effects in fish and aquatic invertebrates where mefluidide does not at similar or lower concentrations such as; surfacing, loss of equilibrium, quiescent, labored respiration, fish lying on their side, hypersensitivity to disturbances and fish lying on the bottom of test vessel. Even though propanil effects may not be good predictors of mefluidide effects, in the absence of mefluidide data, EFED believes propanil data could be used to estimate the acute to chronic ratio for mefluidide. Note that uncertainties exist with these extrapolated endpoints and propanil data are not considered complete substitutes for missing effects data for mefluidide. Other anilide herbicides such as Chloranocryl, Monalide and Pentanochlor were also considered, however no information was available for these chemicals. Additional information on these estimated values are provided in Appendix E. However, EFED concluded that resulting estimated risk quotients, had they been based on definitive effects measurement endpoints, would not trigger concerns for chronic risks to these taxonomic groups.

- Ecotoxicity data for chronic risks to estuarine marine fish and estuarine marine invertebrates exposed to mefluidide were not available. However, assuming ACRs from the freshwater fish and invertebrates are similar to the estuarine marine species. No chronic exceedances would occur for estuarine marine fish or invertebrates with RQs <0.01. These extrapolated endpoints are uncertain and are not considered complete substitutes for missing effects data. RQ calculations for chronic risks to

estuarine marine fish and estuarine marine invertebrates are summarized in Appendix E. However, EFED concluded that resulting estimated risk quotients, had they been based on definitive effects measurement endpoints, would not trigger concerns for chronic risks to these taxonomic groups.

- Ecotoxicity data for chronic risks to birds exposed to mefluidide were not available. Therefore, EFED calculated estimates for measurement endpoints for chronic toxicity to birds by evaluating the available data from mammal toxicity data (acute and chronic) and extrapolating the findings to available data for mefluidide, mefluidide-DEA and mefluidide-K to estimate possible effects measurement endpoints. These extrapolated endpoints are uncertain and are not considered complete substitutes for missing effects data. Additional information on these estimated values are provided in Appendix E. Submission of a chronic bird study would quantify risks associated with exposure of mefluidide to birds.

- The magnitude of toxicity to terrestrial plants is uncertain because only one terrestrial vegetative vigor plant study was available and conducted on fresh weight and not dry weight as required by EPA guidelines. A preliminary review on a recently submitted seedling emergence study (MRID 471907-01) was conducted. These results are uncertain until a full review of the study is performed. The results of the preliminary review are summarized in Appendix E. Ecotoxicity data for terrestrial plants (seedling emergence) exposed to mefluidide were not available Therefore, to estimate possible effects measurement endpoints for seedling emergence, EFED assumed that EC_{25} toxicity values for terrestrial plants (vegetative vigor) are equivalent to (seedling emergence) measurement endpoints for mefluidide, mefluidide-DEA and mefluidide-K. These estimated endpoints are uncertain and are not considered complete substitutes for missing effects data. Additional information on these estimated values are provided in Appendix E.

- NOAEC or EC_{05} values were not available to calculate (listed) aquatic vascular plants exposed to mefluidide. However, estimated values were derived from only one anilide herbicide to obtain effects measurement endpoints. A range of anilide herbicides was not available to extrapolate endpoints. Although propanil has a similar chemical structure as mefluidide, the anilide (propanil) has a different mode of action for plants. Propanil is a photosynthesis inhibitor in contrast to mefluidide which inhibits plant cell division, stem elongation and seed head development. Therefore, these extrapolated endpoints are uncertain and are not considered complete substitutes for missing effects data. Additional information on these estimated values are provided in Appendix E. However, EFED concluded that resulting estimated risk quotients, had they been based on definitive effects measurement endpoints, would not trigger concerns for chronic risks to these taxonomic groups

- The available dietary toxicity studies on avian species failed to established definitive acute LD_{50} values (i.e., the lethality values exceed the highest dose tested). Therefore,

use of this value adds uncertainty and may overestimate risk to avian species. Therefore, when the LD_{50} value of >1500 mg ae/kg-bw was applied to the TREX model it resulted in LOC exceedances for Acute listed (20 and 100 g birds) and Restricted Use (100 g birds) for mefluidide-DEA and mefluidide-K (1.0 lb ae/A at 3 applications). The LD_{50} value of 5000 mg ae/bw if applied to the above modeled scenario would result in no acute LOC exceedances for birds.

4.3.1 Assumptions and Limitations Related to Exposure to All Taxa

There are a number of areas of uncertainty in the aquatic and terrestrial risk assessments. The toxicity assessment for terrestrial and aquatic animals is limited by the number of species tested in the available toxicity studies. Use of toxicity data on representative species does not provide information on the potential variability in susceptibility to acute and chronic exposures.

4.3.2. Assumptions and Limitations Related to Exposure to Aquatic Species

PRZM/EXAMS standard runoff model

Although there are uncertainties and limitations with the use of the PRZM/EXAMS standard runoff scenario for a regional aquatic exposure assessment, it is designed to represent pesticide exposure from an agricultural watershed impacting a vulnerable aquatic environment. Extrapolating the risk conclusions from this standard small water body scenario may either underestimate or overestimate the potential risks.

Major uncertainties with the standard runoff scenario are associated with the physical construct of the watershed and representation of vulnerable aquatic environments for different geographic regions. The phyisco-chemical properties (pH, redox conditions, etc.) of the standard small water body are based on a Georgia farm pond. These properties are likely to be regionally specific because of local hydrogeological conditions. Any alteration in water quality parameters may impact the environmental behavior of the pesticide. The small water body represents a well mixed, static water body. Because the small water body is a static water body (no flow through); it does not account for pesticide removal through flow through or accidental water releases. However, the lack of water flow in the small water body provides an environmental condition for accumulation of persistent pesticides. The assumption of uniform mixing does not account for stratification due to thermoclines (e.g., seasonal stratification in deep water bodies). Additionally, the physical construct of the standard runoff scenario assumes a watershed water body area ratio of 10. This ratio is recommended to maintain a sustainable pond in the Southeastern United States. The use of higher watershed water body ratios (as recommended for sustainable ponds in drier regions of the United States) may lead to higher pesticide concentrations when compared to the standard watershed water body ratio.

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

Currently, crop sites for PRZM/EXAMS modeling are chosen to represent sites which produce high-end, but not unrealistic or worst-case, EECs for that crop. The EECs in this analysis are accurate only to the extent that the site represents a hypothetical high-end exposure site. It should be remembered that while the standard pond would be expected to generate lower EECs than shallow water bodies near agricultural fields that receive most of their water as runoff from use sites that have been treated with mefluidide.

4.3.3 Assumptions and Limitations Related to Exposure to Terrestrial Species

Residue concentration

The data available to support the exposure assessment for mefluidide is substantially complete, with the exception of a chronic bird study, which is an input variable for Tier 1 modeling of risks to birds and mammals (i.e., T-REX Model). EFED is confident that the estimated foliar half-life of 4 days derived from the two field dissipation studies on warm and cool season turf soil are acceptable (MRID 43276802 and 43276801). Therefore, EFED used the 4 day half-life for aquatic and terrestrial modeling in this assessment.

EFED also identified alternative foliar half lives and applications to identify LOC exceedances. To assess risks to terrestrial animals, the Tier I terrestrial model, T-REX, was used with maximum application rates (1 and 3 applications), foliar half-lives (4 day and 35 day) and values derived from upper bound and mean kenaga assessments.

To obtain an upper and lower bound estimates, both the estimated foliar half-life (4 days) and the default foliar half-life (35 days) with 1 and 3 applications resulted in acute LOC exceedances for both mammals and birds from both the upperbound and mean kenaga assessments. Chronic dose based exceedances for mammals did not exceed from the mean kenaga assessment for the 1.0 lb ae/A application scenario. The 35 day foliar half life with 3 applications resulted in RQ values approximately 61% higher than the single application rates for mammals. EFED is confident that the estimated foliar half-life of 4 days derived from the two field dissipation studies on warm and cool season turf soil is acceptable (MRID 43276802 and 43276801). Therefore, EFED will use the 4 day half-life for aquatic and terrestrial

modeling in this assessment. Based on acute RQ values for the upper bound kenaga values for mammals, LOC exceedances for acute mammals would occur for the 1.0 lb ae/A modeled scenario. However, acute exceedences for mammals did not exceed from the mean kenaga assessment for the 1.0 lb ae/A application scenario. These RQ values are summarized in Appendix D.

Variation in habitat and dietary requirements

For screening terrestrial risk assessments, a generic bird or mammal is assumed to occupy either the treated field or adjacent areas receiving pesticide at a rate commensurate with the treatment rate on the field. The habitat and feeding requirements of the modeled species and the wildlife species may be different. It is assumed that species occupy, exclusively and permanently, the treated area being modeled. This assumption leads to a maximum level of exposure in the risk assessment.

The acute studies have a fixed exposure period, not allowing for the differences in response of individuals to different durations of exposure. Further, for the acute oral study, Mefluidide is administered in a single dose which does not mimic wild birds' exposure through multiple feedings. Also, it does not account for the effect of different environmental matrices on the absorption rate of the chemical into the animal. Because exposure occurs over several days, both the accumulated dose and elimination of the chemical from the body for the duration of the exposure determine the exact exposure to wildlife, however they are not taken into account in the screening assessment. There was also no assumption of an effect of repeated doses that change the tolerance of an individual to successive doses. EFED is confident based on the acceptable bird and mammal toxicity studies and conservative modeling procedures that the above assumptions pertaining to variations in habitat and dietary requirements do not effect the certainty of the risk conclusions.

Variation in diet composition

The risk assessment and calculated RQs assume 100% of the diet is relegated to single food types foraged only from treated fields. The assumption of 100% diet from a single food type may be realistic for acute exposures based on this assessment, but diets are likely to be more variable over longer periods of time. This assumption is likely to be conservative and will tend to overestimate potential risks for chronic exposure. These large animals (e.g., deer and geese) will tend to forage from a variety of areas and move on and off of treated fields. Small animals (e.g., mice, voles, and small birds) may have home ranges smaller than the size of a treated area and will have little or no opportunity to obtain foodstuffs that have not been treated with mefluidide. Even if their home range does cover area outside the treated field, mefluidide may have drifted or runoff to areas adjacent to the treated area.

Exposure routes other than dietary

Screening-level risk assessments for spray applications of pesticides consider dietary exposure to terrestrial organisms. Other exposure routes are possible for animals residing in or moving through treated areas. These routes include ingestion of contaminated drinking water, ingestion of contaminated soils, preening/grooming, and dermal contact. Preening exposures, involving the oral ingestion of material from the feathers remains an unquantified, but potentially important, exposure route. If toxicity is expected through any of these other routes of exposure, then the risks of a toxic response to mefluidide is underestimated in this risk assessment. Other routes of exposure, not considered in this assessment, are discussed below:

Incidental soil ingestion exposure

This risk assessment does not consider incidental soil ingestion. Available data suggests that up to 15% of the diet can consist of incidentally ingested soil depending on the species and feeding strategy (Beyer et al, 1994). Because mefluidide is moderately persistent in soils, incidental soil ingestion is a possible exposure pathway.

Inhalation exposure

The screening risk assessment does not consider inhalation exposure however, due to the low Henrys Constant of mefluidide (2.27E-7 atm m^3/mole) inhalation is not likely to be an important exposure pathway. Also, mammalian toxicity studies for inhalation exposure to mefluidide indicate low acute toxicity Appendix E.

Based on the acceptable mammal toxicity studies and low Henrys Constant of mefluidide the above assumptions pertaining to inhalation exposure do not effect the certainty of the risk conclusions.

Dermal Exposure

The screening assessment does not consider dermal exposure. Dermal exposure may occur through three potential sources: (1) direct application of spray to terrestrial wildlife in the treated area or within the drift footprint, (2) incidental contact with contaminated vegetation, or (3) contact with contaminated water or soil.

The low octanol/water partitioning coefficient with a Kow value of (log Kow=1.97; Kow=94.5 indicates the potential for mefluidide to be absorbed via dermal exposure is not likely to be an important exposure pathway. Also, mammalian toxicity studies for mefluidide indicate low acute toxicity by dermal exposure routes Appendix E.

The available measured data related to wildlife dermal contact with pesticides are extremely limited. The Agency is actively pursuing modeling techniques to account for

dermal exposure via direct application of spray and by incidental contact with vegetation. EFED is confident based on the acceptable mammal toxicity studies and low octanol/water partitioning coefficient of mefluidide that the above assumptions pertaining to dermal exposure do not effect the certainty of the risk conclusions.

Drinking Water Exposure

Drinking water exposure to a pesticide active ingredient may be the result of consumption of surface water or consumption of the pesticide in dew or other water on the surfaces of treated vegetation. Given that Mefluidide is soluble in water there exists the potential to dissolve in runoff and puddles on the treated field may contain the chemical. Consumption of drinking water would appear to be inconsequential if water concentrations were equivalent to the concentrations from PRZM/EXAMS; however, concentrations in puddled water sources on treated fields may be higher than concentrations in modeled small water body. Given that this exposure route is not included in the assessment, overall risk may be underestimated.

Dietary Intake - Differences between Laboratory and Field Conditions

There are several aspects of the dietary test that introduce uncertainty into calculation of the LC_{50} value (Mineau, Jobin, and Baril, 1996; ECOFRAM, 1999). The endpoint of this test is reported as the concentration mixed with food that produces a response rather than as the dose ingested. Although food consumption sometimes allows for the estimate of a dose, calculations of the mg/kg/day are confounded by undocumented spillage of feed and how consumption is measured over the duration of the test. Usually, if measured at all, food consumption is estimated once at the end of the five-day exposure period. Further, group housing of birds undergoing testing only allows for a measure of the average consumption per day for a group; consumption estimates can be further confounded if birds die within a treatment group. The exponential growth of young birds also complicates the estimate of the dose; controls often nearly double in size over the duration of the test. Since weights are only taken at the initiation of the exposure period and at the end, the dose per body weight (mg/kg) is difficult to estimate with any precision. The interpretation of this test is also confounded because the response of birds is not only a function of the intrinsic toxicity of the pesticide, but also the willingness of the birds to consume treated food.

Further, the acute and chronic characterization of risk rely on comparisons of wildlife dietary residues with LC_{50} or NOAEC values expressed in concentrations of pesticides in laboratory feed. These comparisons assume that ingestion of food items in the field occurs at rates commensurate with those in the laboratory. Although the screening assessment process adjusts dry-weight estimates of food intake to reflect the increased mass in fresh-weight

wildlife food intake estimates, it does not allow for gross energy and assimilative efficiency differences between wildlife food items and laboratory feed. On gross energy content alone, direct comparison of a laboratory dietary concentration- based effects threshold to a fresh-weight pesticide residue estimate would result in an underestimation of field exposure by food consumption by a factor of 1.25 - 2.5 for most food items. Only for seeds would the direct comparison of dietary threshold to residue estimate lead to an overestimate of exposure.

Differences in assimilative efficiency between laboratory and wild diets suggest that current screening assessment methods do not account for a potentially important aspect of food requirements. Depending upon species and dietary matrix, bird assimilation of wild diet energy ranges from 23 - 80%, and mammal's assimilation ranges from 41 - 85% (U.S. Environmental Protection Agency, 1993). If it is assumed that laboratory chow is formulated to maximize assimilative efficiency (e.g., a value of 85%), a potential for underestimation of exposure may exist by assuming that consumption of food in the wild is comparable with consumption during laboratory testing. In the screening process, exposure may be underestimated because metabolic rates are not related to food consumption.

Finally, the screening procedure does not account for situations where the feeding rate may be above or below requirements to meet free living metabolic requirements. Gorging behavior is a possibility under some specific wildlife scenarios (e.g., bird migration) where the food intake rate may be greatly increased. Kirkwood (1983) has suggested that an upper-bound limit to this behavior might be the typical intake rate multiplied by a factor of 5. In contrast is the potential for avoidance, operationally defined as animals responding to the presence of noxious chemicals in their food by reducing consumption of treated dietary elements. This response is seen in nature where herbivores avoid plant secondary compounds.

In the absence of additional information, the acute oral LD_{50} test provides the best estimate of acute effects for chemicals where exposure can be considered to occur over relative short feeding periods, such as the diurnal feeding peaks common to avian species (ECOFRAM, 1999**).** EFED is confident based on the acceptable bird and mammal toxicity studies that the above assumptions pertaining laboratory and field conditions do not effect the certainty of the risk conclusions.

Assumptions and Limitations Related to Effects Assessment

EFED has identified gaps in the effects dataset for mefluidide, mefluidide-DEA and mefluidide-K. These data gaps prevent the establishment of definitive effects measurement endpoints for the following taxonomic groups for mefluidide, mefluidide-DEA and mefluidide-K: Chronic freshwater fish, chronic estuarine marine fish, chronic estuarine marine invertebrates, chronic freshwater invertebrates, vascular plants (EC_{05} or NOAEC) and

non-vascular plants (EC_{05} or NOAEC). Therefore, EFED calculated estimates for measurement endpoints for these taxonomic groups by evaluating the available data from other anilide herbicides (Propanil) and extrapolating the findings to available data for mefluidide, mefluidide-DEA and mefluidide-K to estimate possible effects measurement endpoints. Other anilide herbicides that were considered for data were Chloranocryl, Monalide and Pentanochlor, however no information was available for these chemicals. Therefore, Propanil was used to estimate acute to chronic ratios for mefluidide. EFED then compared estimated environmental concentrations for surface waters with these endpoints. In all cases, EFED concluded that resulting estimated risk quotients, had they been based on definitive effects measurement endpoints, would not trigger concerns for acute or chronic risks to these taxonomic groups. In fact, the RQ estimates are multiple orders of magnitude below Agency LOCs. However, estimated values were derived from only one anilide herbicides to obtain effects measurement endpoints. A range of anilide herbicides was not available to extrapolate endpoints. Although propanil has a similar chemical structure as mefluidide, the anilide (propanil) has a different mode of action for plants. Propanil is a photosynthesis inhibitor in contrast to mefluidide which inhibits plant cell division, stem elongation and seed head development. Also propanil has reported sublethal effects in fish and aquatic invertebrates where mefluidide does not at similar or lower concentrations such as; surfacing (fish and invertebrates), erratic movement(invertebrates), loss of equilibrium (fish), quiescent (fish), labored respiration (fish), lying on side (fish), hypersensitivity to disturbances (fish) and lying on the bottom of test vessel (fish and invertebrates). Therefore, these extrapolated endpoints are uncertain and are not considered complete substitutes for missing effects data.

EFED has identified gaps in the effects dataset for mefluidide, mefluidide-DEA and mefluidide-K. These data gaps prevent the establishment of definitive effects measurement endpoints for the following taxonomic groups for mefluidide, mefluidide-DEA and mefluidide-K: birds (chronic) and terrestrial plants (seedling emergence). Therefore, EFED calculated estimates for measurement endpoints for chronic toxicity to birds by evaluating the available data from mammal toxicity data (acute and chronic) and extrapolating the findings to available data for mefluidide, mefluidide-DEA and mefluidide-K to estimate possible effects measurement endpoints.

To estimate possible effects measurement endpoints for seedling emergence, EFED assumed that EC_{25} toxicity values for terrestrial plants (vegetative vigor) are equivalent to (seedling emergence) measurement endpoints for mefluidide, mefluidide-DEA and mefluidide-K. Therefore, these estimated endpoints are uncertain and are not considered complete substitutes for missing effects data.

Age class and sensitivity of effects thresholds

It is generally recognized that test organism age may have a significant impact on the observed sensitivity to a toxicant. The screening risk assessment acute toxicity data for fish are collected on juvenile fish between 0.1 and 5 grams. Aquatic invertebrate acute testing is

performed on recommended immature age classes (e.g., first instar for daphnids, second instar for amphipods, stoneflies and mayflies, and third instar for midges). Similarly, acute dietary testing with birds is also performed on juveniles, with mallard being 5-10 days old and quail 10-14 days old.

Testing of juveniles may overestimate toxicity of older age classes for pesticidal active ingredients, such as Mefluidide, that act directly (without metabolic transformation) because younger age classes may not have the enzymatic systems associated with detoxifying xenobiotics. The screening risk assessment has no current provisions for a generally applied method that accounts for this uncertainty. In so far as the available toxicity data may provide ranges of sensitivity information with respect to age class, the risk assessment uses the most sensitive life-stage information as the conservative screening endpoint. However, EFED is confident based on all the acceptable aquatic and terrestrial toxicity studies that the above assumptions pertaining to age sensitivity does not effect the certainty of the risk conclusions.

Use of the Most Sensitive Species Tested

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

The Agency is not limited to a base set of surrogate toxicity information in establishing risk assessment conclusions. The Agency also considers toxicity data on non-standard test species when available. EFED is confident based on the acceptable aquatic and terrestrial toxicity studies that the above assumptions pertaining to the most sensitive species tested does not effect the certainty of the risk conclusions.

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Appendix A Ecological Data Requirements

Ecological Effects Data Requirements for Mefluidide[1]				
Guideline #		**Data Requirement**	**Species / MRID**	**Study Classification**
71-1	850.2100	Avian Oral LD_{50}	Northern Bobwhite Quail (416019-01) Mallard duck Not submitted	Supplemental
71-2	850.2200	Avian Dietary LC_{50}	Northern Bobwhite Quail (416019-02)	Supplemental
			Mallard duck (416019-03)	Supplemental
71-4	850.2300	Avian Reproduction	Not submitted	Estimated values
81-1		Acute Mammal	Laboratory mouse (00047116)	Acceptable
83-4		Chronic Mammal	Laboratory rat (00082748)	Acceptable
72-1	850.1075	Freshwater Fish LC_{50}	Rainbow Trout Coldwater species Freshwater fish (418937-02)	Acceptable
			Bluegill sunfish Warmwater species Freshwater fish (418937-01)	Acceptable
72-2	850.1010	Freshwater Invertebrate Acute LC_{50}	Water flea Freshwater Invertebrate (418937-03)	Acceptable
72-3(a)	850.1075	Estuarine/Marine Fish LC_{50}	Sheepshead minnow (425623-03)	Acceptable
72-3(b)	850.1025	Estuarine/Marine Invertebrates EC_{50}	Eastern Oyster (425624-01)	Acceptable
72-4(a)	850.1400	Fish Early Life-Stage	Not submitted	Estimated values
72-4(b)	850.1300 850.1350	Aquatic Invertebrate Life-Cycle	Not submitted	Estimated values
72-5	850.1500	Freshwater Fish Full Life-Cycle	Not submitted	Estimated values
123-1(a)	850.4225	Seedling Emergence	Not submitted	Estimated values
123-1(b)	850.4250	Vegetative Vigor (Tier II)	Most sensitive monocot: Onion Most sensitive dicot: cabbage, lettuce (435496-01)	Supplemental
123-2	850.4400	Aquatic Plant Growth (Tier II)	*Navicula pelliculosa* Tier I Nonvascular Plant(435266-05)	Acceptable
123-2	850.4400	Aquatic Plant Growth (Tier II)	*Lemna gibba* Tier I Vascular Plant(435266-01)	Acceptable
141-1	850.3020	Honey Bee Acute Contact LD_{50}	Honeybee (425628-01)	Acceptable

Appendix B Bibliography for Environmental Fate and Selected Chemical Structures

Bibliography

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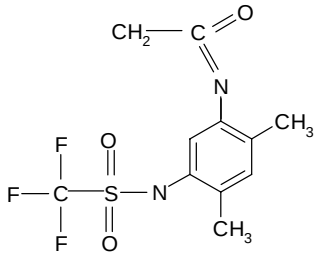
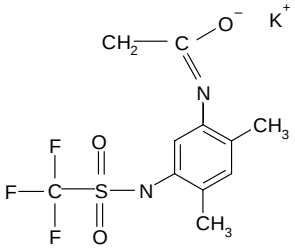
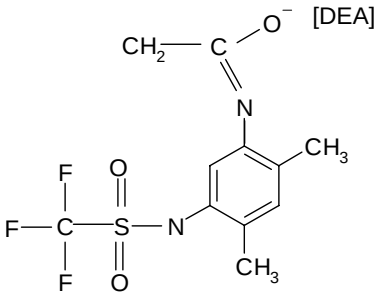
Chemical Stuctures for Mefluidide



Mefluidide a.i



Mefluidide-K a.i



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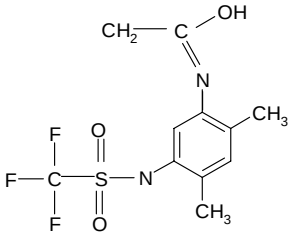
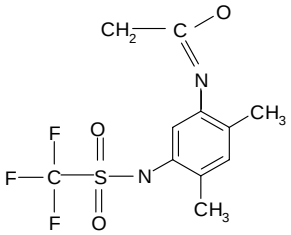
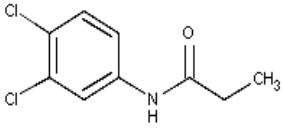


Mefluidide acid (Enol form)



Mefluidide (Keto form)



Propanil analog

Appendix C Aquatic Exposure Modeling Assessment PRZM-EXAMS model outputs

PRZM-EXAMS SIMULATIONS

FL TURF mefluidide-DEA

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

Year    Peak    96 hr   21 Day  60 Day  90 Day  Yearly
1961    6.522   6.393   5.844   4.781   4.142   1.629
1962    2.048   2.006   1.904   1.621   1.473   1.009
1963    10.33   10.1    9.353   7.649   6.617   2.702
1964    3.237   3.164   3.003   2.477   2.159   1.513
1965    1.479   1.45    1.332   1.139   1.112   0.679
1966    16.06   15.7    14.25   11.58   10.03   4.671
1967    3.069   3.035   2.896   2.614   2.409   1.701
1968    8.56    8.38    7.675   6.287   5.45    2.273
1969    5.46    5.357   5.124   4.396   3.892   1.956
1970    2.4     2.345   2.128   1.816   1.765   1.048
1971    6.952   6.81    6.223   5.131   4.881   2.576
1972    2.756   2.706   2.502   2.233   2.031   1.15
1973    2.109   2.069   1.968   1.866   1.792   0.9159
1974    5.179   5.102   4.72    3.909   3.396   1.445
1975    3.035   2.971   2.726   2.251   2.01    1.233
1976    12.62   12.39   11.53   9.825   8.995   4.192
1977    1.88    1.837   1.714   1.619   1.523   1.118
1978    1.602   1.565   1.421   1.337   1.278   0.6743
1979    1.461   1.427   1.304   1.145   1.04    0.5849
1980    5.023   4.929   4.5     3.632   3.132   1.623
1981    1.565   1.529   1.387   1.276   1.222   0.7967
1982    5.846   5.753   5.376   4.844   4.576   2.162
1983    2.743   2.703   2.492   2.398   2.317   1.295
1984    10.6    10.42   9.653   8.537   8.545   3.988
1985    1.841   1.806   1.697   1.559   1.529   1.038
1986    1.867   1.84    1.679   1.404   1.239   0.6823
1987    2.407   2.354   2.14    1.739   1.515   0.7955
1988    1.338   1.309   1.194   1.038   1.003   0.5808
1989    1.267   1.239   1.126   0.9689  0.9342  0.4958
1990    1.281   1.251   1.198   0.9955  0.953   0.5079

Sorted results
Prob.   Peak    96 hr   21 Day  60 Day  90 Day  Yearly
0.032258064516129       16.06   15.7    14.25   11.58   10.03   4.671
0.0645161290322581      12.62   12.39   11.53   9.825   8.995   4.192
0.0967741935483871      10.6    10.42   9.653   8.537   8.545   3.988
0.129032258064516       10.33   10.1    9.353   7.649   6.617   2.702
0.161290322580645       8.56    8.38    7.675   6.287   5.45    2.576
0.193548387096774       6.952   6.81    6.223   5.131   4.881   2.273
0.225806451612903       6.522   6.393   5.844   4.844   4.576   2.162
0.258064516129032       5.846   5.753   5.376   4.781   4.142   1.956
0.290322580645161       5.46    5.357   5.124   4.396   3.892   1.701
0.32258064516129        5.179   5.102   4.72    3.909   3.396   1.629
0.354838709677419       5.023   4.929   4.5     3.632   3.132   1.623
0.387096774193548       3.237   3.164   3.003   2.614   2.409   1.513
```

```
0.419354838709677      3.069   3.035   2.896   2.477   2.317   1.445
0.451612903225806      3.035   2.971   2.726   2.398   2.159   1.295
0.483870967741936      2.756   2.706   2.502   2.251   2.031   1.233
0.516129032258065      2.743   2.703   2.492   2.233   2.01    1.15
0.548387096774194      2.407   2.354   2.14    1.866   1.792   1.118
0.580645161290323      2.4     2.345   2.128   1.816   1.765   1.048
0.612903225806452      2.109   2.069   1.968   1.739   1.529   1.038
0.645161290322581      2.048   2.006   1.904   1.621   1.523   1.009
0.67741935483871       1.88    1.84    1.714   1.619   1.515   0.9159
0.709677419354839      1.867   1.837   1.697   1.559   1.473   0.7967
0.741935483870968      1.841   1.806   1.679   1.404   1.278   0.7955
0.774193548387097      1.602   1.565   1.421   1.337   1.239   0.6823
0.806451612903226      1.565   1.529   1.387   1.276   1.222   0.679
0.838709677419355      1.479   1.45    1.332   1.145   1.112   0.6743
0.870967741935484      1.461   1.427   1.304   1.139   1.04    0.5849
0.903225806451613      1.338   1.309   1.198   1.038   1.003   0.5808
0.935483870967742      1.281   1.251   1.194   0.9955  0.953   0.5079
0.967741935483871      1.267   1.239   1.126   0.9689  0.9342  0.4958

0.1     10.573  10.388  9.623   8.4482  8.3522  3.8594
                                Average of yearly averages:   1.56783666666667

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

Data used for this run:
Output File: MefluDEA
Metfile:       w12834.dvf
PRZM scenario: FLturfC.txt
EXAMS environment file:       pond298.exv
Chemical Name: Mefluidide
Description    Variable Name  Value   Units   Comments
Molecular weight       mwt     310.6   g/mol
Henry's Law Const.     henry   2.27E-7 atm-m^3/mol
Vapor Pressure vapr    1E-4    torr
Solubility     sol     180     mg/L
Kd      Kd      0.073   mg/L
Koc     Koc             mg/L
Photolysis half-life   kdp             days    Half-life
Aerobic Aquatic Metabolism     kbacw   72      days    Halfife
Anaerobic Aquatic Metabolism   kbacs           days    Halfife
Aerobic Soil Metabolism        asm     36      days    Halfife
Hydrolysis:    pH 7            days    Half-life
Method: CAM    2       integer See PRZM manual
Incorporation Depth:   DEPI            cm
Application Rate:      TAPP    1.12    kg/ha
Application Efficiency:        APPEFF  0.99    fraction
Spray Drift    DRFT    0.01    fraction of application rate applied to pond
Application Date       Date    1-4     dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1     interval        42      days    Set to 0 or delete line for single app.
Interval 2     interval        42      days    Set to 0 or delete line for single app.
Record 17:     FILTRA
       IPSCND  1
       UPTKF
Record 18:     PLVKRT
       PLDKRT  0.1715
       FEXTRC  0.5
Flag for Index Res. Run        IR      Pond
Flag for runoff calc.  RUNOFF  none    none, monthly or total(average of entire run)
```

FL TURF mefluidide-K

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

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1975	3.035	2.971	2.726	2.251	2.01	1.233
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1978	1.602	1.565	1.421	1.337	1.278	0.6743
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1982	5.846	5.753	5.376	4.844	4.576	2.162
1983	2.743	2.703	2.492	2.398	2.317	1.295
1984	10.6	10.42	9.653	8.537	8.545	3.988
1985	1.841	1.806	1.697	1.559	1.529	1.038
1986	1.867	1.84	1.679	1.404	1.239	0.6823
1987	2.407	2.354	2.14	1.739	1.515	0.7955
1988	1.338	1.309	1.194	1.038	1.003	0.5808
1989	1.267	1.239	1.126	0.9689	0.9342	0.4958
1990	1.281	1.251	1.198	0.9955	0.953	0.5079

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	16.06	15.7	14.25	11.58	10.03	4.671
0.0645161290322581	12.62	12.39	11.53	9.825	8.995	4.192
0.0967741935483871	10.6	10.42	9.653	8.537	8.545	3.988
0.129032258064516	10.33	10.1	9.353	7.649	6.617	2.702
0.161290322580645	8.56	8.38	7.675	6.287	5.45	2.576
0.193548387096774	6.952	6.81	6.223	5.131	4.881	2.273
0.225806451612903	6.522	6.393	5.844	4.844	4.576	2.162
0.258064516129032	5.846	5.753	5.376	4.781	4.142	1.956
0.290322580645161	5.46	5.357	5.124	4.396	3.892	1.701
0.32258064516129	5.179	5.102	4.72	3.909	3.396	1.629
0.354838709677419	5.023	4.929	4.5	3.632	3.132	1.623
0.387096774193548	3.237	3.164	3.003	2.614	2.409	1.513
0.419354838709677	3.069	3.035	2.896	2.477	2.317	1.445
0.451612903225806	3.035	2.971	2.726	2.398	2.159	1.295
0.483870967741936	2.756	2.706	2.502	2.251	2.031	1.233
0.516129032258065	2.743	2.703	2.492	2.233	2.01	1.15
0.548387096774194	2.407	2.354	2.14	1.866	1.792	1.118
0.580645161290323	2.4	2.345	2.128	1.816	1.765	1.048
0.612903225806452	2.109	2.069	1.968	1.739	1.529	1.038
0.645161290322581	2.048	2.006	1.904	1.621	1.523	1.009
0.67741935483871	1.88	1.84	1.714	1.619	1.515	0.9159
0.709677419354839	1.867	1.837	1.697	1.559	1.473	0.7967
0.741935483870968	1.841	1.806	1.679	1.404	1.278	0.7955
0.774193548387097	1.602	1.565	1.421	1.337	1.239	0.6823

```
0.806451612903226      1.565   1.529   1.387   1.276   1.222   0.679
0.838709677419355      1.479   1.45    1.332   1.145   1.112   0.6743
0.870967741935484      1.461   1.427   1.304   1.139   1.04    0.5849
0.903225806451613      1.338   1.309   1.198   1.038   1.003   0.5808
0.935483870967742      1.281   1.251   1.194   0.9955  0.953   0.5079
0.967741935483871      1.267   1.239   1.126   0.9689  0.9342  0.4958

0.1     10.573  10.388  9.623   8.4482  8.3522  3.8594
                                        Average of yearly averages:   1.56783666666667

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

Data used for this run:
Output File: MefluK
Metfile:       w12834.dvf
PRZM scenario: FLturfC.txt
EXAMS environment file:       pond298.exv
Chemical Name: Mefluidide
Description    Variable Name  Value   Units   Comments
Molecular weight       mwt    310.6   g/mol
Henry's Law Const.     henry  2.27E-7 atm-m^3/mol
Vapor Pressure vapr    1E-4    torr
Solubility     sol     180     mg/L
Kd      Kd     0.073   mg/L
Koc     Koc            mg/L
Photolysis half-life   kdp             days    Half-life
Aerobic Aquatic Metabolism    kbacw   72      days    Halfife
Anaerobic Aquatic Metabolism  kbacs           days    Halfife
Aerobic Soil Metabolism       asm     36      days    Halfife
Hydrolysis:    pH 7           days    Half-life
Method: CAM    2       integer See PRZM manual
Incorporation Depth:   DEPI           cm
Application Rate:      TAPP    1.12    kg/ha
Application Efficiency:       APPEFF  0.99    fraction
Spray Drift    DRFT    0.01    fraction of application rate applied to pond
Application Date       Date    1-4     dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1     interval       42      days    Set to 0 or delete line for single app.
Interval 2     interval       42      days    Set to 0 or delete line for single app.
Record 17:     FILTRA
       IPSCND  1
       UPTKF
Record 18:     PLVKRT
       PLDKRT  0.1715
       FEXTRC  0.5
Flag for Index Res. Run       IR      Pond
Flag for runoff calc.  RUNOFF  none    none, monthly or total(average of entire run)
```

FL TURF mefluidide

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

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	2.705	2.623	2.395	1.959	1.697	0.6036
1962	0.4867	0.4819	0.4621	0.4172	0.3845	0.2598
1963	4.628	4.521	4.186	3.424	2.962	1.119
1964	1.063	1.039	0.9768	0.8114	0.7087	0.5198
1965	0.2023	0.2004	0.1923	0.1746	0.1613	0.0877
1966	7.509	7.344	6.666	5.416	4.692	2.106
1967	1.435	1.419	1.354	1.222	1.126	0.6051
1968	3.711	3.633	3.324	2.724	2.361	0.8962
1969	2.254	2.212	2.11	1.748	1.51	0.7417
1970	0.6738	0.6621	0.6153	0.5286	0.4994	0.2943
1971	2.902	2.842	2.597	2.132	1.999	1.053
1972	0.8825	0.8664	0.8012	0.6593	0.5722	0.3381
1973	0.7281	0.7167	0.6819	0.5861	0.5181	0.2195
1974	1.999	1.973	1.825	1.513	1.314	0.4854
1975	0.9183	0.8987	0.8271	0.6841	0.5946	0.3775
1976	5.849	5.746	5.348	4.478	4.143	1.863
1977	0.7792	0.773	0.7472	0.6889	0.6377	0.3198
1978	0.3362	0.3306	0.3074	0.2628	0.2355	0.1042
1979	0.209	0.2042	0.1856	0.1521	0.1322	0.05641
1980	1.927	1.886	1.725	1.393	1.199	0.5759
1981	0.3447	0.3422	0.3319	0.306	0.2846	0.157
1982	2.621	2.58	2.411	2.08	1.908	0.8387
1983	0.9113	0.8994	0.8361	0.7669	0.7557	0.396
1984	4.858	4.774	4.423	3.942	3.914	1.755
1985	0.6437	0.6381	0.615	0.5619	0.5184	0.2808
1986	0.3765	0.3696	0.3383	0.2763	0.2394	0.09841
1987	0.6123	0.5988	0.544	0.4412	0.3805	0.1559
1988	0.1109	0.1099	0.1057	0.09663	0.08981	0.04412
1989	0.02912	0.02866	0.02658	0.02215	0.01923	0.009001
1990	0.08553	0.08355	0.07587	0.0616	0.05313	0.01983

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	7.509	7.344	6.666	5.416	4.692	2.106
0.0645161290322581	5.849	5.746	5.348	4.478	4.143	1.863
0.0967741935483871	4.858	4.774	4.423	3.942	3.914	1.755
0.129032258064516	4.628	4.521	4.186	3.424	2.962	1.119
0.161290322580645	3.711	3.633	3.324	2.724	2.361	1.053
0.193548387096774	2.902	2.842	2.597	2.132	1.999	0.8962
0.225806451612903	2.705	2.623	2.411	2.08	1.908	0.8387
0.258064516129032	2.621	2.58	2.395	1.959	1.697	0.7417
0.290322580645161	2.254	2.212	2.11	1.748	1.51	0.6051
0.32258064516129	1.999	1.973	1.825	1.513	1.314	0.6036
0.354838709677419	1.927	1.886	1.725	1.393	1.199	0.5759
0.387096774193548	1.435	1.419	1.354	1.222	1.126	0.5198
0.419354838709677	1.063	1.039	0.9768	0.8114	0.7557	0.4854
0.451612903225806	0.9183	0.8994	0.8361	0.7669	0.7087	0.396
0.483870967741936	0.9113	0.8987	0.8271	0.6889	0.6377	0.3775
0.516129032258065	0.8825	0.8664	0.8012	0.6841	0.5946	0.3381
0.548387096774194	0.7792	0.773	0.7472	0.6593	0.5722	0.3198
0.580645161290323	0.7281	0.7167	0.6819	0.5861	0.5184	0.2943
0.612903225806452	0.6738	0.6621	0.6153	0.5619	0.5181	0.2808
0.645161290322581	0.6437	0.6381	0.615	0.5286	0.4994	0.2598
0.67741935483871	0.6123	0.5988	0.544	0.4412	0.3845	0.2195
0.709677419354839	0.4867	0.4819	0.4621	0.4172	0.3805	0.157
0.741935483870968	0.3765	0.3696	0.3383	0.306	0.2846	0.1559
0.774193548387097	0.3447	0.3422	0.3319	0.2763	0.2394	0.1042
0.806451612903226	0.3362	0.3306	0.3074	0.2628	0.2355	0.09841

```
0.838709677419355      0.209   0.2042  0.1923  0.1746  0.1613  0.0877
0.870967741935484      0.2023  0.2004  0.1856  0.1521  0.1322  0.05641
0.903225806451613      0.1109  0.1099  0.1057  0.09663 0.08981 0.04412
0.935483870967742      0.08553 0.08355 0.07587 0.0616  0.05313 0.01983
0.967741935483871      0.02912 0.02866 0.02658 0.02215 0.01923 0.009001

0.1     4.835   4.7487  4.3993  3.8902  3.8188  1.6914
                                        Average of yearly averages:   0.5460257

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

Data used for this run:
Output File: Mefluacidi
Metfile:       w12834.dvf
PRZM scenario: FLturfC.txt
EXAMS environment file:       pond298.exv
Chemical Name: Mefluidide
Description    Variable Name  Value   Units   Comments
Molecular weight       mwt     310.6   g/mol
Henry's Law Const.     henry   2.27E-7 atm-m^3/mol
Vapor Pressure vapr    1E-4    torr
Solubility     sol     180     mg/L
Kd      Kd      0.073   mg/L
Koc     Koc             mg/L
Photolysis half-life   kdp             days    Half-life
Aerobic Aquatic Metabolism    kbacw   72      days    Halfife
Anaerobic Aquatic Metabolism  kbacs           days    Halfife
Aerobic Soil Metabolism       asm     36      days    Halfife
Hydrolysis:    pH 7           days    Half-life
Method: CAM     2       integer See PRZM manual
Incorporation Depth:   DEPI            cm
Application Rate:      TAPP    0.56    kg/ha
Application Efficiency:       APPEFF  1.00    fraction
Spray Drift    DRFT    0.0     fraction of application rate applied to pond
Application Date       Date    1-4     dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1     interval        42      days    Set to 0 or delete line for single app.
Interval 2     interval        42      days    Set to 0 or delete line for single app.
Record 17:     FILTRA
       IPSCND  1
       UPTKF
Record 18:     PLVKRT
       PLDKRT  0.1715
       FEXTRC  0.5
Flag for Index Res. Run       IR      Pond
Flag for runoff calc.  RUNOFF  none    none, monthly or total(average of entire run)
```

PA TURF mefluidide-DEA

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

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.508	1.481	1.375	1.288	1.184	0.6653
1962	1.894	1.864	1.74	1.627	1.567	1.027
1963	1.689	1.663	1.549	1.395	1.353	0.9127
1964	1.64	1.616	1.507	1.342	1.309	0.861
1965	1.606	1.582	1.477	1.306	1.277	0.8369
1966	1.618	1.591	1.472	1.321	1.274	0.8173
1967	2.52	2.478	2.31	2.014	1.848	1.149
1968	3.188	3.157	3.052	2.893	2.82	1.641
1969	1.823	1.795	1.677	1.549	1.499	1.083
1970	10.34	10.26	9.907	9.204	8.608	4.205
1971	5.302	5.247	5.022	4.55	4.182	2.656
1972	2.679	2.641	2.464	2.311	2.18	1.537
1973	10.43	10.25	9.455	7.943	7.066	3.655
1974	4.838	4.792	4.605	4.369	4.183	2.896
1975	7.102	7.045	6.814	6.374	5.981	3.199
1976	5.928	5.872	5.64	5.283	4.982	2.834
1977	2.329	2.298	2.172	2.051	2.021	1.455
1978	5.93	5.872	5.592	5.087	4.753	2.412
1979	2.673	2.634	2.47	2.386	2.27	1.662
1980	1.753	1.726	1.601	1.465	1.403	0.9518
1981	2.388	2.359	2.239	2.1	1.963	1.108
1982	2.107	2.078	1.943	1.781	1.701	1.123
1983	1.87	1.84	1.719	1.599	1.527	0.9895
1984	6.622	6.507	6.052	5.134	4.63	2.621
1985	2.641	2.607	2.468	2.323	2.243	1.695
1986	2.182	2.148	2.018	1.904	1.816	1.182
1987	3.103	3.066	2.944	2.855	2.755	1.587
1988	2.9	2.866	2.718	2.551	2.358	1.403
1989	3.313	3.275	3.116	2.887	2.683	1.541
1990	2.244	2.208	2.074	1.949	1.867	1.252

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	10.43	10.26	9.907	9.204	8.608	4.205
0.0645161290322581	10.34	10.25	9.455	7.943	7.066	3.655
0.0967741935483871	7.102	7.045	6.814	6.374	5.981	3.199
0.129032258064516	6.622	6.507	6.052	5.283	4.982	2.896
0.161290322580645	5.93	5.872	5.64	5.134	4.753	2.834
0.193548387096774	5.928	5.872	5.592	5.087	4.63	2.656
0.225806451612903	5.302	5.247	5.022	4.55	4.183	2.621
0.258064516129032	4.838	4.792	4.605	4.369	4.182	2.412
0.290322580645161	3.313	3.275	3.116	2.893	2.82	1.695
0.32258064516129	3.188	3.157	3.052	2.887	2.755	1.662
0.354838709677419	3.103	3.066	2.944	2.855	2.683	1.641
0.387096774193548	2.9	2.866	2.718	2.551	2.358	1.587
0.419354838709677	2.679	2.641	2.47	2.386	2.27	1.541
0.451612903225806	2.673	2.634	2.468	2.323	2.243	1.537
0.483870967741936	2.641	2.607	2.464	2.311	2.18	1.455
0.516129032258065	2.52	2.478	2.31	2.1	2.021	1.403
0.548387096774194	2.388	2.359	2.239	2.051	1.963	1.252
0.580645161290323	2.329	2.298	2.172	2.014	1.867	1.182
0.612903225806452	2.244	2.208	2.074	1.949	1.848	1.149
0.645161290322581	2.182	2.148	2.018	1.904	1.816	1.123
0.67741935483871	2.107	2.078	1.943	1.781	1.701	1.108
0.709677419354839	1.894	1.864	1.74	1.627	1.567	1.083
0.741935483870968	1.87	1.84	1.719	1.599	1.527	1.027
0.774193548387097	1.823	1.795	1.677	1.549	1.499	0.9895

```
0.806451612903226      1.753   1.726   1.601   1.465   1.403   0.9518
0.838709677419355      1.689   1.663   1.549   1.395   1.353   0.9127
0.870967741935484      1.64    1.616   1.507   1.342   1.309   0.861
0.903225806451613      1.618   1.591   1.477   1.321   1.277   0.8369
0.935483870967742      1.606   1.582   1.472   1.306   1.274   0.8173
0.967741935483871      1.508   1.481   1.375   1.288   1.184   0.6653

0.1     7.054   6.9912  6.7378  6.2649  5.8811  3.1687
                                        Average of yearly averages:   1.69858333333333

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

Data used for this run:
Output File: MefluDEA
Metfile:       w14737.dvf
PRZM scenario: PAturfC.txt
EXAMS environment file:       pond298.exv
Chemical Name: Mefluidide
Description    Variable Name  Value   Units   Comments
Molecular weight       mwt    310.6   g/mol
Henry's Law Const.     henry  2.27E-7 atm-m^3/mol
Vapor Pressure vapr    1E-4    torr
Solubility     sol     180     mg/L
Kd      Kd      0.073   mg/L
Koc     Koc             mg/L
Photolysis half-life   kdp             days    Half-life
Aerobic Aquatic Metabolism    kbacw   72      days    Halfife
Anaerobic Aquatic Metabolism  kbacs           days    Halfife
Aerobic Soil Metabolism       asm     36      days    Halfife
Hydrolysis:    pH 7           days    Half-life
Method: CAM     2       integer See PRZM manual
Incorporation Depth:   DEPI            cm
Application Rate:      TAPP    1.12    kg/ha
Application Efficiency:        APPEFF  0.99    fraction
Spray Drift    DRFT    0.01    fraction of application rate applied to pond
Application Date       Date    1-4     dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1     interval        42      days    Set to 0 or delete line for single app.
Interval 2     interval        42      days    Set to 0 or delete line for single app.
Record 17:     FILTRA
        IPSCND  1
        UPTKF
Record 18:     PLVKRT
        PLDKRT  0.1715
        FEXTRC  0.5
Flag for Index Res. Run        IR      Pond
Flag for runoff calc.  RUNOFF  none    none, monthly or total(average of entire run)
```

PA TURF mefluidide-K

stored as MefluK.out
Chemical: Mefluidide
PRZM environment: PAturfC.txt modified Satday, 12 October 2002 at 15:27:02
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 15:33:30
Metfile: w14737.dvf modified Wedday, 3 July 2002 at 08:06:12
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.508	1.481	1.375	1.288	1.184	0.6653
1962	1.894	1.864	1.74	1.627	1.567	1.027
1963	1.689	1.663	1.549	1.395	1.353	0.9127
1964	1.64	1.616	1.507	1.342	1.309	0.861
1965	1.606	1.582	1.477	1.306	1.277	0.8369
1966	1.618	1.591	1.472	1.321	1.274	0.8173
1967	2.52	2.478	2.31	2.014	1.848	1.149
1968	3.188	3.157	3.052	2.893	2.82	1.641
1969	1.823	1.795	1.677	1.549	1.499	1.083
1970	10.34	10.26	9.907	9.204	8.608	4.205
1971	5.302	5.247	5.022	4.55	4.182	2.656
1972	2.679	2.641	2.464	2.311	2.18	1.537
1973	10.43	10.25	9.455	7.943	7.066	3.655
1974	4.838	4.792	4.605	4.369	4.183	2.896
1975	7.102	7.045	6.814	6.374	5.981	3.199
1976	5.928	5.872	5.64	5.283	4.982	2.834
1977	2.329	2.298	2.172	2.051	2.021	1.455
1978	5.93	5.872	5.592	5.087	4.753	2.412
1979	2.673	2.634	2.47	2.386	2.27	1.662
1980	1.753	1.726	1.601	1.465	1.403	0.9518
1981	2.388	2.359	2.239	2.1	1.963	1.108
1982	2.107	2.078	1.943	1.781	1.701	1.123
1983	1.87	1.84	1.719	1.599	1.527	0.9895
1984	6.622	6.507	6.052	5.134	4.63	2.621
1985	2.641	2.607	2.468	2.323	2.243	1.695
1986	2.182	2.148	2.018	1.904	1.816	1.182
1987	3.103	3.066	2.944	2.855	2.755	1.587
1988	2.9	2.866	2.718	2.551	2.358	1.403
1989	3.313	3.275	3.116	2.887	2.683	1.541
1990	2.244	2.208	2.074	1.949	1.867	1.252

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	10.43	10.26	9.907	9.204	8.608	4.205
0.0645161290322581	10.34	10.25	9.455	7.943	7.066	3.655
0.0967741935483871	7.102	7.045	6.814	6.374	5.981	3.199
0.129032258064516	6.622	6.507	6.052	5.283	4.982	2.896
0.161290322580645	5.93	5.872	5.64	5.134	4.753	2.834
0.193548387096774	5.928	5.872	5.592	5.087	4.63	2.656
0.225806451612903	5.302	5.247	5.022	4.55	4.183	2.621
0.258064516129032	4.838	4.792	4.605	4.369	4.182	2.412
0.290322580645161	3.313	3.275	3.116	2.893	2.82	1.695
0.32258064516129	3.188	3.157	3.052	2.887	2.755	1.662
0.354838709677419	3.103	3.066	2.944	2.855	2.683	1.641
0.387096774193548	2.9	2.866	2.718	2.551	2.358	1.587
0.419354838709677	2.679	2.641	2.47	2.386	2.27	1.541
0.451612903225806	2.673	2.634	2.468	2.323	2.243	1.537
0.483870967741936	2.641	2.607	2.464	2.311	2.18	1.455
0.516129032258065	2.52	2.478	2.31	2.1	2.021	1.403
0.548387096774194	2.388	2.359	2.239	2.051	1.963	1.252
0.580645161290323	2.329	2.298	2.172	2.014	1.867	1.182
0.612903225806452	2.244	2.208	2.074	1.949	1.848	1.149
0.645161290322581	2.182	2.148	2.018	1.904	1.816	1.123
0.67741935483871	2.107	2.078	1.943	1.781	1.701	1.108
0.709677419354839	1.894	1.864	1.74	1.627	1.567	1.083
0.741935483870968	1.87	1.84	1.719	1.599	1.527	1.027
0.774193548387097	1.823	1.795	1.677	1.549	1.499	0.9895
0.806451612903226	1.753	1.726	1.601	1.465	1.403	0.9518

```
0.838709677419355      1.689   1.663   1.549   1.395   1.353   0.9127
0.870967741935484      1.64    1.616   1.507   1.342   1.309   0.861
0.903225806451613      1.618   1.591   1.477   1.321   1.277   0.8369
0.935483870967742      1.606   1.582   1.472   1.306   1.274   0.8173
0.967741935483871      1.508   1.481   1.375   1.288   1.184   0.6653

0.1     7.054   6.9912  6.7378  6.2649  5.8811  3.1687
                                        Average of yearly averages:   1.69858333333333

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

Data used for this run:
Output File: MefluK
Metfile:       w14737.dvf
PRZM scenario: PAturfC.txt
EXAMS environment file:       pond298.exv
Chemical Name: Mefluidide
Description    Variable Name  Value   Units   Comments
Molecular weight       mwt     310.6   g/mol
Henry's Law Const.     henry   2.27E-7 atm-m^3/mol
Vapor Pressure vapr    1E-4    torr
Solubility     sol     180     mg/L
Kd      Kd      0.073   mg/L
Koc     Koc             mg/L
Photolysis half-life   kdp             days    Half-life
Aerobic Aquatic Metabolism    kbacw   72      days    Halfife
Anaerobic Aquatic Metabolism  kbacs           days    Halfife
Aerobic Soil Metabolism       asm     36      days    Halfife
Hydrolysis:    pH 7           days    Half-life
Method: CAM     2       integer See PRZM manual
Incorporation Depth:   DEPI            cm
Application Rate:      TAPP    1.12    kg/ha
Application Efficiency:        APPEFF  0.99    fraction
Spray Drift    DRFT    0.01    fraction of application rate applied to pond
Application Date       Date    1-4     dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1     interval        42      days    Set to 0 or delete line for single app.
Interval 2     interval        42      days    Set to 0 or delete line for single app.
Record 17:     FILTRA
        IPSCND  1
        UPTKF
Record 18:     PLVKRT
        PLDKRT  0.1715
        FEXTRC  0.5
Flag for Index Res. Run        IR      Pond
Flag for runoff calc.  RUNOFF  none    none, monthly or total(average of entire run)
```

PA TURF mefluidide

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

Year    Peak    96 hr   21 Day  60 Day  90 Day  Yearly
1961    0.2013  0.1977  0.1837  0.1572  0.141   0.06874
1962    0.3033  0.3007  0.291   0.265   0.243   0.1292
1963    0.06957 0.06934 0.06838 0.06625 0.06425 0.03723
1964    0.02459 0.0244  0.02365 0.02181 0.0201  0.01287
1965    0.006556        0.006535        0.006445        0.006245        0.006063        0.003507
1966    0.001198        0.001194        0.001178        0.001142        0.001107        0.0007252
1967    0.5128  0.5042  0.4697  0.4045  0.3667  0.1522
1968    0.9759  0.9672  0.9291  0.8587  0.7887  0.3996
1969    0.2438  0.243   0.2397  0.2322  0.2251  0.1299
1970    4.701   4.666   4.505   4.108   3.775   1.704
1971    1.972   1.952   1.868   1.635   1.465   0.9264
1972    0.6406  0.6321  0.5955  0.5166  0.4622  0.3636
1973    4.493   4.414   4.073   3.421   3.043   1.441
1974    1.962   1.943   1.868   1.697   1.565   1.058
1975    3.083   3.059   2.958   2.691   2.461   1.205
1976    2.504   2.481   2.382   2.164   1.981   1.031
1977    0.5919  0.5865  0.5663  0.5151  0.5046  0.333
1978    2.308   2.287   2.179   1.926   1.775   0.8143
1979    0.6768  0.6705  0.6519  0.6315  0.6109  0.4296
1980    0.184   0.1834  0.1809  0.1753  0.17    0.09462
1981    0.5482  0.5415  0.5138  0.4424  0.3929  0.1747
1982    0.3024  0.2988  0.2824  0.246   0.2211  0.149
1983    0.21    0.2082  0.2015  0.1855  0.1727  0.09921
1984    2.558   2.513   2.339   1.984   1.768   0.9311
1985    0.8114  0.8088  0.7976  0.7681  0.7392  0.4633
1986    0.4099  0.4043  0.3805  0.3328  0.2998  0.1956
1987    1.062   1.053   1.014   0.9196  0.8384  0.3995
1988    0.7952  0.7858  0.7451  0.6441  0.5769  0.3123
1989    0.9959  0.9843  0.9364  0.8137  0.7298  0.3742
1990    0.4174  0.4126  0.3863  0.3501  0.3269  0.2328

Sorted results
Prob.   Peak    96 hr   21 Day  60 Day  90 Day  Yearly
0.032258064516129       4.701   4.666   4.505   4.108   3.775   1.704
0.0645161290322581      4.493   4.414   4.073   3.421   3.043   1.441
0.0967741935483871      3.083   3.059   2.958   2.691   2.461   1.205
0.129032258064516       2.558   2.513   2.382   2.164   1.981   1.058
0.161290322580645       2.504   2.481   2.339   1.984   1.775   1.031
0.193548387096774       2.308   2.287   2.179   1.926   1.768   0.9311
0.225806451612903       1.972   1.952   1.868   1.697   1.565   0.9264
0.258064516129032       1.962   1.943   1.868   1.635   1.465   0.8143
0.290322580645161       1.062   1.053   1.014   0.9196  0.8384  0.4633
0.32258064516129        0.9959  0.9843  0.9364  0.8587  0.7887  0.4296
0.354838709677419       0.9759  0.9672  0.9291  0.8137  0.7392  0.3996
0.387096774193548       0.8114  0.8088  0.7976  0.7681  0.7298  0.3995
0.419354838709677       0.7952  0.7858  0.7451  0.6441  0.6109  0.3742
0.451612903225806       0.6768  0.6705  0.6519  0.6315  0.5769  0.3636
0.483870967741936       0.6406  0.6321  0.5955  0.5166  0.5046  0.333
0.516129032258065       0.5919  0.5865  0.5663  0.5151  0.4622  0.3123
0.548387096774194       0.5482  0.5415  0.5138  0.4424  0.3929  0.2328
0.580645161290323       0.5128  0.5042  0.4697  0.4045  0.3667  0.1956
0.612903225806452       0.4174  0.4126  0.3863  0.3501  0.3269  0.1747
0.645161290322581       0.4099  0.4043  0.3805  0.3328  0.2998  0.1522
0.67741935483871        0.3033  0.3007  0.291   0.265   0.243   0.149
0.709677419354839       0.3024  0.2988  0.2824  0.246   0.2251  0.1299
0.741935483870968       0.2438  0.243   0.2397  0.2322  0.2211  0.1292
0.774193548387097       0.21    0.2082  0.2015  0.1855  0.1727  0.09921
0.806451612903226       0.2013  0.1977  0.1837  0.1753  0.17    0.09462
```

```
0.838709677419355      0.184   0.1834  0.1809  0.1572  0.141   0.06874
0.870967741935484      0.06957 0.06934 0.06838 0.06625 0.06425 0.03723
0.903225806451613      0.02459 0.0244  0.02365 0.02181 0.0201  0.01287
0.935483870967742      0.006556        0.006535        0.006445        0.006245        0.006063
        0.003507
0.967741935483871      0.001198        0.001194        0.001178        0.001142        0.001107
        0.0007252

0.1     3.0305  3.0044  2.9004  2.6383  2.413   1.1903
                                        Average of yearly averages:   0.455540073333333

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

Data used for this run:
Output File: Mefluacid
Metfile:        w14737.dvf
PRZM scenario: PAturfC.txt
EXAMS environment file:         pond298.exv
Chemical Name: Mefluidide
Description     Variable Name   Value   Units   Comments
Molecular weight        mwt     310.6   g/mol
Henry's Law Const.      henry   2.27E-7 atm-m^3/mol
Vapor Pressure vapr     1E-4    torr
Solubility      sol     180     mg/L
Kd      Kd      0.073   mg/L
Koc     Koc             mg/L
Photolysis half-life    kdp             days    Half-life
Aerobic Aquatic Metabolism      kbacw   72      days    Halfife
Anaerobic Aquatic Metabolism    kbacs           days    Halfife
Aerobic Soil Metabolism         asm     36      days    Halfife
Hydrolysis:     pH 7            days    Half-life
Method: CAM     2       integer See PRZM manual
Incorporation Depth:    DEPI            cm
Application Rate:       TAPP    0.56    kg/ha
Application Efficiency:         APPEFF  1.00    fraction
Spray Drift     DRFT    0.00    fraction of application rate applied to pond
Application Date        Date    1-4     dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1      interval        42      days    Set to 0 or delete line for single app.
Interval 2      interval        42      days    Set to 0 or delete line for single app.
Record 17:      FILTRA
        IPSCND  1
        UPTKF
Record 18:      PLVKRT
        PLDKRT  0.1715
        FEXTRC  0.5
Flag for Index Res. Run         IR      Pond
Flag for runoff calc.   RUNOFF  none    none, monthly or total(average of entire run)
```

Appendix D Terrestrial Exposure Modeling TREX and Terrplant

TREX MODEL OUTPUTS

TREX (Version 1.3.1)

2006

As part of the terrestrial assessment, EFED modeled exposure concentrations of Mefluidide, Mefluidide-K and Mefluidide-DEA to non-target animals following the proposed application rates provided by the registrant. For terrestrial birds and mammals, estimates of initial levels of Mefluidide, Mefluidide-K and Mefluidide-DEA residues on various food items, which may be contacted or consumed by wildlife, were determined using the Kenega-Fletcher nomogram followed by a first order decline model TREX 1.3.1. Upper bound and Mean Kenega-Fletcher values were used for RQ calculations.

T-REX Calculations and Results

Risk Estimation Based on Dietary Residue Concentrations (Foliar Spray)

The methods used by T-REX to estimate risk from consumption of selected contaminated food items is described below. For this analysis, T-REX calculates EECs and risk quotients based on both the upper bound and mean residue concentrations as presented by Hoerger and Kenaga (1972) and modified by Fletcher *et al*. (1994). These concentrations are determined using nomograms that relate application rate of a pesticide to residues remaining on dietary items of terrestrial organisms. The results of the upper bound and mean residue levels are presented in separate tabs ("upper bound Kenaga" and "mean Kenaga"); however, the methods used to calculate EECs and risk quotients are equivalent. Based on the estimated dietary residue concentrations from the upper bound and mean Kenaga values, T-REX calculates the associated doses for various size classes of birds and mammals.

T-REX estimates the following: (1) residue concentrations on selected food items (mg/kg-dietary item); (2) dose-based EECs (mg/kg-bw) from dietary concentrations on selected food items; (3) adjusted toxicity values; and (4) risk quotients.

Calculation of dietary concentrations on selected food items

The spreadsheet calculates the pesticide residue concentrations on each selected food item on a daily interval for one year. When multiple applications are modeled, residue concentrations resulting from the final application and remaining residue from previous applications are summed. The maximum concentration calculated out of the 365 days is returned as the EEC used to estimate potential risk to birds and mammals as described below. Dissipation of a chemical applied to foliar surfaces for single or multiple applications is calculated assuming a first order decay rate from the following first order rate equation:

$C_t = C_0 e^{-kt}$

or in log form:

$\ln(C_t) = \ln(C_0)(-kT)$
Where:

C_t = concentration, parts per million (ppm), at time T.

C_0 = concentration (ppm), present initially (on day zero) on the surface of selected food items. C_0 is calculated by multiplying the application rate, in pounds active ingredient per acre, by 240 for short grass, 110 for tall grass, and 135 for broad-leafed plants/small insects and 15 for fruits/pods/large insects for upper bound residue levels. Mean residue levels are derived by multiplying the application rate by 85 for short grass, 36 for tall grass, and 45 for broad-leafed plants/small insects and 7 for fruits/pods/seeds/large insects. Residue levels are based on work by Hoerger and Kenaga (1972) as modified by Fletcher *et al*. (1994). Additional applications are converted from pounds active ingredient per acre to ppm on the plant surface and the additional mass added to the mass of the chemical still present on the surfaces on the day of application.

k = Exponential rate constant = ln 2 ÷ foliar dissipation half-life. This value is in cell Q16 of the upper bound and mean Kenaga worksheets of TREX. If the foliar dissipation data submitted to EFED are found scientifically valid and statistically robust for a specific pesticide, the 90% upper confidence limit of the mean half-lives should be used. When scientifically valid, statistically robust data are not available, EFED recommends the using a default foliar dissipation half-life value of 35 days. The use of the 35-day half-life is based on the highest reported value (36.9 days), as reported by Willis and McDowell (1987). However in this assessment a 4 day foliar half life was used.

t = time, in days, since the start of the simulation. The initial application is on day 0. The simulation is designed to run for 365 days.

The dietary concentrations estimated using the above methodology may be used directly to calculate risk quotients, but may also be used to calculate dose-based EECs (mg/kg-bw) for various size classes of mammals and birds .

Calculating EEC Equivalent Doses based on Estimated Dietary Concentrations on Selected Bird and Mammal Food Items

EECs (mg/kg-bw) for various size classes of mammals and birds may be calculated based on the dietary residue concentrations derived using the equations presented above. To allow for this type of analysis, the EECs and toxicity values are adjusted based on food intake and body weight differences so that they are comparable for a given weight class of animal. The size classes assessed are small (20-gram), medium (100-gram), and large (1000-gram) birds, and small (15-gram), medium (35-gram), and large (1000-gram) mammals. Equations used to calculate food intake (grams/day) and to adjust toxicity values for dose-based risk quotients are presented below.

Calculating Food Intake for Different Size Classes of Birds and Mammals:

Daily food intake (g/day) is assumed to correlate with body weight using the following empirically derived equation (U.S. EPA, 1993):

Avian consumption

$$F = \frac{0.648 * BW^{0.651}}{(1 - W)}$$

where:
F = food intake in grams of fresh weight per day (g/day)
BW = body mass of animal (g)
W = mass fraction of water in the food (EFED value = 0.8 for birds and herbivorous mammals, 0.1 for granivorous mammals)
Based on this equation, a 20-gram bird would consume 22.8 grams of food daily (114% of its body weight), a 100-gram bird would consume 65 grams of food daily (65% of its body weight daily), and 1000-gram bird would consume 290 grams of food daily (29% of its body weight). These data, together with the residue concentrations (mg/kg-food item) on selected food items calculated from the Kenaga nomogram, are used to estimate the dose (mg/kg-bw) of residue consumed by the three size classes of birds as discussed below. Using a small (20-gram) bird as an example, a dietary concentration of 100 mg/kg-diet (ppm) x 1.14 kg diet/kg bw (114%) would result in an equivalent dose-based EEC of 114 mg/kg-bw. T-REX calculates food intake based on dry weight and wet weight of food items. The dose-based assessment uses the wet weight food consumption values by assuming that dietary items are 80% water by weight. However, if dietary items of a species being assessed are known, then a refined dose-based EEC can be calculated using appropriate water fractions of the food items.

A similar relationship between body weight and food intake has been derived for mammals (U.S. EPA 1993):
Mammalian food consumption (g/day)

$$F = \frac{0.621 * BW^{0.564}}{(1 - W)}$$

where:
F = food intake in grams of fresh weight per day (g/day)
BW = body mass of animal (g)
W = mass fraction of water in the food (EFED value = 0.8 for birds and herbivorous mammals, 0.1 for granivorous mammals)

The scaling factors result in a percent body weight consumed presented in the following table for each weight class of mammal. These values are used in the same manner described for birds to calculate dose-based EECs (mg/kg-bw). Note the difference in food intake of grainivores compared with herbivores and insectivores. This is caused by the difference in the assumed mass fraction of water in their diets.

Organism and body weight	Food intake (g day^{-1})[a]	Percent body weight consumed (day^{-1})[a]
15 g	14.3 / 3.2	95 / 21
35 g	23 / 5.1	66 / 15
1000 g	150 / 34	15 / 3

[a] The first number in this column is specific to herbivores/insectivores. The second number is for granivores. These groups have markedly different consumption requirements.

T-REX calculates food intake based on dry weight and wet weight of food items (wet weight is used for RQ calculations). The dose-based assessment uses the wet weight food consumption values by assuming that dietary items are 80% water by weight (10% for granivores). However, if dietary items of a species being assessed are known, then a refined dose-based EEC can be calculated using appropriate water fractions of the food items.

Calculating Adjusted Toxicity Values

The dose-based EECs (mg/kg-bw) derived above are compared with LD_{50} or NOAEL (mg/kg-bw) values from acceptable or supplemental toxicity studies that are adjusted for the size of the animal tested compared with the size of the animal being assessed (e.g., 20-gram bird). These exposure values are presented as mass of pesticide consumed per kg body weight of the animal being assessed (mg/kg-bw). EECs and toxicity values are relative to the animal's body weight (mg residue/kg bw) because consumption of the same mass of pesticide residue results in a higher body burden in smaller animals compared with larger animals. For birds, only acute values (LD_{50}s) are adjusted because dose-based risk quotients are not calculated for the chronic risk estimation. Adjusted mammalian LD_{50}s and reproduction NOAELs (mg/kg-bw) are used to calculate dose-based acute and chronic risk quotients for 15-, 35-, and 1000-gram mammals. The following equations are used for the adjustment (U.S. EPA 1993):

Adjusted avian LD_{50}: $$Adj.LD_{50} = LD_{50}\left(\frac{AW}{TW}\right)^{(x-1)}$$

where:
Adj. LD_{50} = adjusted LD_{50} (mg/kg-bw) calculated by the equation
LD_{50} = endpoint reported from bird study (mg/kg-bw)
TW = body weight of tested animal (178g bobwhite; 1580g mallard; 350g rat)
AW = body weight of assessed animal (*avian*: 20g, 100g, and 1000g)
x = Mineau scaling factor for birds; EFED default 1.15

Adjusted mammalian NOAELs and LD_{50}s (note that the same equation is used to adjust the NOAEL):

$$Adj.NOAEL\ or\ LD_{50} = NOAEL\ or\ LD_{50}\left(\frac{TW}{AW}\right)^{(0.25)}$$

where:
Adj. NOAEL or LD_{50} = adjusted NOAEL or LD_{50} (mg/kg-bw)
NOAEL or LD_{50} = endpoint reported from animal study (mg/kg-bw)
TW = body weight of tested animal (350g for chronic mammal based on the rat) TREX does not incorporate in the model different mammal TW. Therefore, the above calculation was used and incorporated in model (replaced the 350 g to 20 g in the formula equations) with the TW of 20 g for acute mammal based on the laboratory mouse with 829.8mg ae/kg bw LD_{50} to derive the adjusted toxicity values for acute mammals for each body weight class.
AW = body weight of assessed animal (15g, 35g, 1000g)

Calculating Risk Quotients

Two types of risk quotients are calculated by T-REX based on the estimated dietary residue concentrations determined from the Kenaga nomogram: (1) dietary based RQs; and (2) dose based RQs. These RQs are not equivalent. Dietary risk quotients are calculated by directly comparing the concentration of a pesticide administered (or estimated to be administered) to experimental animals in the diet in a toxicity study to the concentration estimated to be on selected food items. These risk quotients do not account for the fact that smaller-sized animals need to consume more food relative to their body weight than larger animals or that differential amounts of food are consumed depending on the water content and nutritive value of the food. The dose-based risk quotients do account for these factors. The dose-based RQs incorporate the ingestion rate-adjusted exposure from the various food items to the different weight classes of birds and the weight class-scaled toxicity endpoints. Formulas presented in Table 1 are used to calculate dose-based and dietary based risk quotients:

Table 1. Formulas used to calculate dose- and dietary-based risk quotients.			
Duration	**Dose or Dietary RQ**	**Surrogate Organism**	**Equation**
Acute	Dose-based	Birds and mammals	Acute Daily Exposure (mg/kg-bw) / adjusted LD_{50} (mg/kg-bw)
	Dietary-based	Birds	*Kenaga* EEC (mg/kg-food item) / LC_{50} (mg/kg-diet)
Chronic	Dietary-based	Birds and mammals	EEC (mg/kg-food item) / NOAEC (mg/kg-diet)
	Dose-based	Mammals only	EEC (mg/kg-bw) / Adjusted NOAEL (mg/kg-bw)

These risk quotients are compared to the Agency's LOCs to determine if risk is greater than EFED's concern level.

Granular LD50 per square foot

Mammalian LD50 per Square Foot 0.5 lbs ae A Based on acute mouse LD_{50} 829.8 mg /kg bw, 4 day half life, 42 day interval and 3 applications per season	
Size Class (grams)	**Broadcast LD50 per Square Foot**
15	0.39
35	0.21
1000	0.02

Upper Bound and Mean Kenaga 1.0 lbs ae/A application Rate based on acute mouse LD_{50} 829.8 mg/kg bw, 4 day half life, 42 day interval and 3 applications per season

Upper 90th Percentile Kenaga, Acute Mammalian Dose-Based Risk Quotients 1.0 Lbs ae/A Based on acute mouse LD_{50} 829.8, 4 day half life, 42 day interval and 3 applications per season											
Size Class (grams)	**Adjusted LD50**	**EECs and RQs**									
		Short Grass		**Tall Grass**		**Broadleaf Plants/ Small Insects**		**Fruits/Pods/ Seeds/ Large Insects**		**Granivore**	
		EEC	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**
15	891.68	228.98	0.26	104.95	0.12	128.80	0.14	14.31	0.02	3.18	0.00
35	721.46	158.26	0.22	72.53	0.10	89.02	0.12	9.89	0.01	2.20	0.00
1000	312.05	36.69	0.12	16.82	0.05	20.64	0.07	2.29	0.01	0.51	0.00

Mean Kenaga, Acute Mammalian Dose-Based Risk Quotients 1.0 Lbs ae/A Based on acute mouse LD_{50} 829.8, 4 day half life, 42 day interval and 3 applications per season											
Size Class (grams)	**Adjusted LD50**	**EECs and RQs**									
		Short Grass		**Tall Grass**		**Broadleaf Plants/ Small Insects**		**Fruits/Pods/ Seeds/ Large Insects**		**Granivore**	
		EEC	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**
15	891.68	80.81	0.091	34.22	0.038	42.78	0.048	6.65	0.007	1.47	0.00
35	721.46	56.14	0.078	23.78	0.033	29.72	0.041	4.62	0.006	1.05	0.00
1000	312.05	12.76	0.041	5.40	0.017	6.75	0.022	1.05	0.003	0.21	0.00

Upper Bound and Mean Kenaga 1.0 lbs ae/A application Rate based on Chronic rat NOAEL 102 mg ae/A, 4 day half life, 42 day interval and 3 applications per season

Upper 90th Percentile Kenega, Chronic Mammalian Dietary Based Risk Quotients 1.0 lbs ae/A application Rate based on Chronic rat NOAEL 102 mg ae/A, 4 day half life, 42 day interval and 3 applications per season								
NOAEC (ppm)	**EECs and RQs**							
	Short Grass		**Tall Grass**		**Broadleaf Plants/ Small Insects**		**Fruits/Pods/ Seeds/ Large Insects**	
	EEC	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**
2040	240.17	0.12	110.08	0.05	135.09	0.07	15.01	0.01

Size class not used for dietary risk quotients

Upper 90th Percentile Kenega, Chronic Mammalian Dose-Based Risk Quotients 1.0 lbs ae/A application Rate based on Chronic rat NOAEL 102 mg ae/A, 4 day half life, 42 day interval and 3 applications per season											
Size Class (grams)	**Adjusted NOAEL**	**EECs and RQs**									
		Short Grass		**Tall Grass**		**Broadleaf Plants/ Small Insects**		**Fruits/Pods/ Seeds/ Large Insects**		**Granivore**	
		EEC	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**
15	224.18	228.98	1.02	104.95	0.47	128.80	0.57	14.31	0.06	3.18	0.01
35	181.38	158.26	0.87	72.53	0.40	89.02	0.49	9.89	0.05	2.20	0.01
1000	78.45	36.69	0.47	16.82	0.21	20.64	0.26	2.29	0.03	0.51	0.01

Mean Kenega, Chronic Mammalian Dietary Based Risk Quotients 1.0 lbs ae/A application Rate based on Chronic rat NOAEL 102 mg ae/A, 4 day half life, 42 day interval and 3 applications per season								
NOAEC (ppm)	**EECs and RQs**							
	Short Grass		**Tall Grass**		**Broadleaf Plants/ Small Insects**		**Fruits/Pods/ Seeds/ Large Insects**	
	EEC	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**
2040	85.06	0.04	36.02	0.018	45.03	0.022	7.00	0.003

Size class not used for dietary risk quotients

Mean Kenega, Chronic Mammalian Dose-Based Risk Quotients 1.0 lbs ae/A application Rate based on Chronic rat NOAEL 102 mg ae/A, 4 day half life, 42 day interval and 3 applications per season											
Size Class (grams)	**Adjusted NOAEL**	**EECs and RQs**									
		Short Grass		**Tall Grass**		**Broadleaf Plants/ Small Insects**		**Fruits/Pods/ Seeds/ Large Insects**		**Granivore**	
		EEC	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**	**EEC**	**RQ**
15	224.18	80.81	0.36	34.22	0.153	42.78	0.191	6.65	0.030	1.47	0.01
35	181.38	56.14	0.31	23.78	0.131	29.72	0.164	4.62	0.025	1.05	0.01
1000	78.45	12.76	0.163	5.40	0.069	6.75	0.086	1.05	0.013	0.21	0.00

Avian Granular LD50 per square foot

Avian LD50 per Square Foot 0.5 lbs ae A Based on acute bird LD_{50} >1500 mg ae /kg bw, 4 day half life, 42 day interval and 3 applications per season		
Size Class (grams)	**Adjusted LD50**	**Broadcast LD50 per Square Foot**
20	1080.64	0.24
100	1375.71	0.04
1000	1943.25	0.00

Upper Bound and Mean Kenaga 1.0 lbs ae/A application Rate based on acute avian LD_{50} >1500 mg/kg bw, 4 day half life, 42 day interval and 3 applications per season

Upper 90th Percentile Kenaga, Acute Avian Dose-Based Risk Quotients 1.0 lbs ae/A application Rate based on acute bird LD50 >1500 mg ae/kg bw, 4 day half life, 42 day interval and 3 applications per season									
Size Class (grams)	Adjusted LD50	EECs and RQs							
		Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
20	1080.64	273.52	0.25	125.37	0.12	153.86	0.14	17.10	0.02
100	1375.71	155.98	0.11	71.49	0.05	87.74	0.06	9.75	0.01
1000	1943.25	69.83	0.04	32.01	0.02	39.28	0.02	4.36	0.00

Upper 90th Percentile Kenega, Subacute Avian Dietary Based Risk Quotients 1.0 lbs ae/A application								
	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
LC50	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
3750	240.17	0.06	110.08	0.03	135.09	0.04	15.01	0.00

Mean Kenaga, Acute Avian Dose-Based Risk Quotients 1.0 lbs ae/A application Rate based on acute bird >1500 mg ae/kg bw, 4 day half life, 42 day interval and 3 applications per season									
Size Class (grams)	Adjusted LD50	EECs and RQs							
		Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
20	1080.64	96.97	0.090	41.07	0.038	51.34	0.048	7.99	0.007
100	1375.71	55.29	0.040	23.42	0.017	29.27	0.021	4.55	0.003
1000	1943.25	24.67	0.013	10.45	0.005	13.06	0.007	2.03	0.001

Mean Kenega, Subacute Avian Dietary Based Risk Quotients 1.0 lbs ae/A application								
	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
LC50	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
3750	85.06	0.023	36.02	0.010	45.03	0.012	7.00	0.002

Upper Bound and Mean Kenaga 1.0 lbs ae/A application Rate based on Chronic bird NOAEL= 38 mg ae/kg, 4 day half life, 42 day interval and 3 applications per season

Upper 90th Percentile Kenega, Chronic Avian Dietary Based Risk Quotients 1.0 lbs ae/A application Rate based on chronic bird = 38 mg ae/kg , 4 day half life, 42 day interval and 3 applications per season								
	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
NOAEC (ppm)	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
38	240.17	6.32	110.08	2.90	135.09	3.56	15.01	0.40

Mean Kenega, Chronic Avian Dietary Based Risk Quotients 1.0 lbs ae/A application Rate based on Chronic bird = 38 mg ae/A, 4 day half life, 42 day interval and 3 applications per season								
	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/ Large Insects	
NOAEC (ppm)	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
38	85.06	2.238	36.02	0.948	45.03	1.185	7.00	0.184

TERRPLANT MODEL

(November 9, 2005; version 1.2.1)

Terrestrial plant exposure characterization employs runoff and spray drift scenarios contained in OPP's Terrplant model. Exposure calculations are based on a pesticide's water solubility and the amount of pesticide present on the surface soil within the first inch of depth. For dry areas, the loading of pesticide active ingredient or acid equivalent from runoff to an adjacent non-target area is assumed to occur from one acre of treatment to one acre of non-target area. For terrestrial plants inhabiting semi-aquatic (wetland) areas, runoff is considered to occur from a larger source area with active ingredient loading originating from 10 acres of treated area to a single acre of non-target wetland. Default spray drift assumptions are 1% for ground applications and 5% for aerial, forced air (i.e., air pressure within a spray tank that forces the spray liquid through the boom nozzles), and chemigation applications. Predicted EECs resulting from spray drift and aerial applications are derived for non-granular applications only.

TERRPLANT
MEFLUIDIDE-K, MEFLUIDIDE-DEA (1.0 lbs ae/A) GROUND SPRAY ONLY

Terrestrial Plant EECs and Acute Non Endangered RQs (November 9, 2005; version 1.2.1)

	Input Values										
Application Rate (lb a.e./acre)	**1.0**	**Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)**				**Risk Quotients (RQs) for NON-GRANULAR formulation applications**					
Runoff Value (0.01, 0.02, or 0.05 if chemical solubility <10, 10-100, or >100 ppm, respectively)	**0.05**	**Application Method**	**Total Loading to Adjacent Areas (EEC = Sheet Runoff +Drift)**	**Total Loading to Semi-aquatic Areas (EEC = Channelized Runoff + Drift)**	**DRIFT EEC***	**Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC25**		**Emergence RQs, Semi-aquatic Areas RQ = EEC/Seedling Emergence EC25**		**Drift RQs RQ = Drift EEC/ Vegetative Vigor EC25**	
Minimum Incorporation Depth (cm)	**0**					**Monocot**	**Dicot**	**Monocot**	**Dicot**	**Monocot**	**Dicot**
		Ground Unincorp.	**0.600**	**0.5100**	**0.100**	**0.571**	**11.11**	**4.86**	**94.44**	**0.10**	**1.85**
Seed Emerg Monocot EC25 (lb a.e./acre)	**0.105**	**Ground Incorp**	**0.600**	**0.5100**	**0.100**	**0.571**	**11.11**	**4.86**	**94.44**	**0.10**	**1.85**
Seed Emerg Dicot EC25 (lb a.e./acre)	**0.0054**										
Veg Vigor Monocot EC25 (lb a.e./acre)	**0.105**										
Veg Vigor Dicot EC25 (lb a.e./acre)	**0.0054**										

TERRPLANT
MEFLUIDIDE-K, MEFLUIDIDE-DEA (1.0 lbs ae/A) GROUND SPRAY ONLY

Terrestrial Plant EECs and Acute Endangered RQs (November 9, 2005; version 1.2.1)

	Input Values											
Application Rate (lb a.e./acre)	**1.0**	**Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)**				**Risk Quotients (RQs) for NON-GRANULAR formulation applications**					
Runoff Value (0.01, 0.02, or 0.05 if chemical solubility <10, 10-100, or >100 ppm, respectively)	**0.05**	**Application Method**	**Total Loading to Adjacent Areas (EEC = Sheet Runoff +Drift)**	**Total Loading to Semi-aquatic Areas (EEC = Channelized Runoff + Drift)**	**DRIFT EEC***	**Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC05 or NOAEC**		**Emergence RQs, Semi-aquatic areas RQ = EEC/Seedling Emergence EC05 or NOAEC**		**Drift RQs RQ = EEC/ Vegetative Vigor EC05 or NOAEC**	
Minimum Incorporation Depth (cm)	**0**					**Monocot**	**Dicot**	**Monocot**	**Dicot**	**Monocot**	**Dicot**
		Ground Unincorp.	**0.600**	**0.5100**	**0.100**	**1.333**	**20.69**	**11.33**	**175.86**	**0.22**	**3.45**
Seed Emerg Monocot EC05 or NOAEC (lb a.e./acre)	**0.105**	**Ground Incorp**	**0.600**	**0.5100**	**0.100**	**1.333**	**20.69**	**11.33**	**175.86**	**0.22**	**3.45**
Seed Emerg Dicot EC05 or NOAEC (lb a.e./acre)	**0.0054**										
Veg Vigor Monocot EC05 or NOAEC (lbs a.e./acre)	**0.105**										
Veg Vigor Dicot EC05 or NOAEC (lb a.e./acre)	**0.0029**										

TERRPLANT
MEFLUIDIDE (0.5 lbs ae/A) GRANULAR APPLICATION ONLY

Terrestrial Plant EECs and Acute Non Endangered RQs (November 9, 2005; version 1.2.1)

	Input Values											
Application Rate (lb a.e./acre)	**0.5**	**Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)**				**Risk Quotients (RQs) for NON-GRANULAR formulation applications**					
Runoff Value (0.01, 0.02, or 0.05 if chemical solubility <10, 10-100, or >100 ppm, respectively)	**0.05**	**Application Method**	**Total Loading to Adjacent Areas (EEC = Sheet Runoff)**	**Total Loading to Semi-aquatic Areas (EEC = Channelized Runoff)**	**DRIFT EEC***	**Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC25**		**Emergence RQs, Semi-aquatic Areas RQ = EEC/Seedling Emergence EC25**		**Drift RQs RQ = Drift EEC/ Vegetative Vigor EC25**	
Minimum Incorporation Depth (cm)	**0**					**Monocot**	**Dicot**	**Monocot**	**Dicot**	**Monocot**	**Dicot**
		Ground Unincorp.	**0.0250**	**0.2500**	**N/A**	**0.24**	**4.63**	**2.38**	**46.30**	**N/A**	**N/A**
Seed Emerg Monocot EC25 (lb a.e./acre)	**0.105**										
Seed Emerg Dicot EC25 (lb a.e./acre)	**0.0054**										
Veg Vigor Monocot EC25 (lb a.e./acre)	**0.105**										
Veg Vigor Dicot EC25 (lb a.e./acre)	**0.0054**										

TERRPLANT
MEFLUIDIDE (0.5 lbs ae/A) GRANULAR APPLICATION ONLY

Terrestrial Plant EECs and Acute Endangered RQs (November 9, 2005; version 1.2.1)

	Input Values	Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)				Risk Quotients (RQs) for NON-GRANULAR formulation applications					
Application Rate (lb a.e./acre)	0.5										
Runoff Value (0.01, 0.02, or 0.05 if chemical solubility <10, 10-100, or >100 ppm, respectively)	0.05	Application Method	Total Loading to Adjacent Areas (EEC = Sheet Runoff)	Total Loading to Semi-aquatic Areas (EEC = Channelized Runoff)	DRIFT EEC*	Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC05 or NOAEC		Emergence RQs, Semi-aquatic areas RQ = EEC/Seedling Emergence EC05 or NOAEC		Drift RQs RQ = EEC/ Vegetative Vigor EC05 or NOAEC	
Minimum Incorporation Depth (cm)	0					Monocot	Dicot	Monocot	Dicot	Monocot	Dicot
		Ground Unincorp.	0.0250	0.2500	N/A	0.56	8.62	5.56	86.21	N/A	N/A
Seed Emerg Monocot EC05 or NOAEC (lb a.e./acre)	0.105										
Seed Emerg Dicot EC05 or NOAEC (lb a.e./acre)	0.0054										
Veg Vigor Monocot EC05 or NOAEC (lbs a.e./acre)	0.105										
Veg Vigor Dicot EC05 or NOAEC (lb a.e./acre)	0.0029										

DRIFT RQs for Buffers from 10 to 900 ft RQs= (EEC/EC_{25}) EECs derived from AGDRIFT Table 3.5 for very fine to fine droplet size*			
Buffer distance	**1.0 lb ae/A**	**RQs Monocot (EC25 0.105)**	**RQs Dicot (EC25 0.0054)**
10	0.0923	0.879	17.093
20	0.0437	0.416	8.093
40	0.0218	0.208	4.037
60	0.0149	0.142	2.759
80	0.0115	0.110	2.130
100	0.0095	0.905	1.759
140	0.007	0.067	1.296
180*	0.0056	0.053	1.037
200	0.0051	0.049	0.944
250	0.0042	0.040	0.778
500	0.0021	0.020	0.389
900	0.0011	0.011	0.204
* dicots exceed LOCs for spray drift (very fine to fine droplet size)			

DRIFT RQs for Buffers from 10 to 900 ft RQs= (EEC/EC_{25}) EECs derived from AGDRIFT Table 3.5 for medium to course droplet size*			
Buffer distance	**1.0 lb ae/A**	**RQs Monocot (EC25 0.105)**	**RQs Dicot (EC25 0.0054)**
10	0.0275	0.262	4.8
20	0.0149	0.142	2.8
40	0.0087	0.083	1.61
60*	0.0064	0.061	1.18
80	0.0052	0.05	0.96
100	0.0044	0.042	0.82
140	0.0035	0.033	0.65
180	0.0029	0.028	0.54
200	0.0026	0.025	0.481
250	0.0022	0.021	0.41
500	0.0012	0.011	0.22
900	0.0007	0.006	0.13
* dicots exceed LOCs for spray drift (medium to course droplet size)			

Appendix E

APPENDIX E. Ecological Effects Characterization for Mefluidide, Mefluidide-DEA and Mefluidide-K

310=Molecular Weight of Mefluidide acid
415.24 = Molecular Weight of Mefluidide-DEA
348.29=Molecular Weight of Mefluidide-K

The following tables present measures of effect both in terms of active ingredient and acid equivalents. Conversion from active ingredient to acid equivalents was made in accordance with molecular weight differences (MW acid/ MW salt = AE). One gram mole of Mefluidide acid has a mass of 310.0 and one gram mole of **Mefluidide-DEA** has a mass of 415.24 grams; therefore one unit of salt would be equivalent to 0.75 units of the acid. Hence, the LC50 values from the toxicity tests with **Mefluidide-DEA** were converted to acid equivalents by multiplying the values by 0.75. The same conversion scenario was made Mefluidide-K with one gram mole of Mefluidide-K equal to 348.29. Therefore, 310 MW acid/348.29MW potassium salt is equivalent to 0.89. Hence, the LC50 values from the toxicity tests with Mefluidide-K were converted to acid equivalents by multiplying the values by 0.89.

Table E-1: Acute Toxicity of Mefluidide to Freshwater Fish

Species	% a.i. / %ae	96-hr LC_{50}, mg/L (confid. int.) a.i.	96-hr LC_{50}, mg/L (confid. int.) a.e.	NOEC (mg/L) a.i.	NOEC (mg/L) a.e.	Study Properties[a]	Toxicity Classification (based on a.e.)	MRID	Status
Freshwater fish studies were submitted for 114001-Mefluidide and are in review MRIDs 73635, 80027, 80028 , 87475, 41893801 and 41893802 with LC50s ranging from > 96.4 mg/L to 1720 mg/L No freshwater fish studies were submitted for 114003 -Mefluidide potassium salt									
114002- Mefluidide-DEA									
Rainbow trout	28.8	>91.3	>68.47	91.3	68.47	F-T, M	Slightly-toxic	418937-02	Acceptable
Bluegill sunfish	28.8	>94.4	>70.80	94.4	70.80	F-T, M	Slightly-toxic	418937-01	Acceptable

Table E-2: Acute Toxicity of Mefluidide to Freshwater Invertebrates									
		48-hr EC_{50}, mg/L (confid. int.)		NOEC (mg/L)					
Species	% a.i.	a.i.	a.e.	a.i.	a.e.	Study Properties[a]	Toxicity Classification (based on a.e.)	MRID	Status
Freshwater invertebrate study was submitted for 114001-Mefluidide and is in review with MRID 41893803 with and EC_{50} of >111 **No freshwater invertebrate studies were submitted for114003 -Mefluidide potassium salt**									
114002- Mefluidide-DEA									
Daphnia	28.8%	>103	>77.25	103	77.25	F-T, M	Slightly-toxic	418937-03	Acceptable

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static.

Table E-3: Chronic (Early-life) Toxicity of Mefluidide to Invertebrates									
		NOEC (mg/L)		LOEC (mg/L)					Status
Species	% a.i.	a.i.	a.e.	a.i.	a.e.	Study Properties[a]	Most sensitive parameter	MRID	
No Chronic invertebrate studies were submitted for 114001-Mefluidide , 114002 Mefluidide-DEA and 114003 - Mefluidide-K									

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static.

Table E-1: Acute Toxicity of Mefluidide to Estuarine marine Fish

Species	% a.i. / %ae	96-hr LC_{50}, mg/L (confid. int.) a.i.	96-hr LC_{50}, mg/L (confid. int.) a.e.	NOEC (mg/L) a.i.	NOEC (mg/L) a.e.	Study Properties[a]	Toxicity Classification (based on a.e.)	MRID	Status
114001-Mefluidide									
Sheepshead minnow	58.2	>130	>130	130	130	F-T, M	Practically non-toxic	425624-03	Acceptable
114002- Mefluidide-DEA									
Sheepshead minnow	28.8	>113	>84.75	113	84.75	F-T, M	Slightly-toxic	425623-03	Acceptable

Table E-2: Acute Toxicity of Mefluidide to Estuarine marine Invertebrates

Species	% a.i.	EC_{50}, mg/L (confid. int.) a.i.	EC_{50}, mg/L (confid. int.) a.e.	NOEC (mg/L) a.i.	NOEC (mg/L) a.e.	Study Properties[a]	Toxicity Classification (based on a.e.)	MRID	Status
114001-Mefluidide									
Mysid *(Mysidopsis bahia) (96 HR)*	58.2	133 (113- 204)	133	47	47	F-T, M	Practically non-toxic	425624-02	Acceptable
Eastern Oyster *(Crassostrea virginica)(96 HR)*	58.2	67	67	<12	<12	F-T, M	Slightly toxic	425624-01	Acceptable
114002- Mefluidide-DEA									
Mysid *(Mysidopsis bahia) (96 HR)*	28.8	>126	>94.5	42	31.5	F-T, M	Practically non-toxic	425623-02	Acceptable

Table E-2: Acute Toxicity of Mefluidide to Estuarine marine Invertebrates									
		EC_{50}, mg/L (confid. int.)		NOEC (mg/L)					
Species	**% a.i.**	**a.i.**	**a.e.**	**a.i.**	**a.e.**	**Study Properties[a]**	**Toxicity Classification (based on a.e.)**	**MRID**	**Status**
Eastern Oyster *(Crassostrea virginica) (96 HR)*	28.8	77	57.75	<14	<10.5	F-T, M	Slightly toxic	425623-01	Supplemental

[a] M=mean-measured chemical concentrations, N=nominal chemical concentrations; F-T=flow-through; S=static.

Table E-3: Acute Toxicity of Mefluidide to Aquatic Plants

Species	%a.i.	Definitive test a.i.	Definitive test a.e.	Most sensitive parameter	Initial/mean measured concentrations	MRID	Status
114002- Mefluidide-DEA							
Navicula pelliculosa *Tier I (120 Hr)*	28.8	831 ug ai/L	.629mg ae/L	11.5% growth reduction	mean	435266-01	Acceptable
Skeletonema costatum *Tier1(120Hr)*	28.8	767ug ai/L	.575 mg ae/L	no adverse effects	mean	435266-02	Acceptable
Lemna gibba *TierI (14day)*	28.8	687 ug ai/L (8% growth stimulation)	0.515 mg ae/L	8% growth stimulation	mean	435266-05	Acceptable
Anabaena flos-aquae *Tier1(120 Hr)*	28.8	725 ug ai/L	0.543 mg ae/L	4.3% growth reduction	mean	435266-04	Acceptable
Selenastrum capricornutum *Tier I (120 Hr)*	28.8	749 ug ai/L	0.561 mg ae/L	8% growth reduction	mean	435266-03	Acceptable

Table E-4: Acute Toxicity of Mefluidide to Aquatic Plants			
Species			**MRID**
	Endpoints definitive tests	**Endpoints range finding tests**	
114002- Mefluidide-DEA Definitive and Range finding Tessts for Tier I studies for aquatic plants			
Navicula pelliculosa *Tier I (120 Hr)*	831 ug ai/L 11.5% growth reduction	1131 ug ai/L 5.10%growth stimulation	435266-01
Skeletonema costatum *Tier1(120Hr)*	767ug ai/L no adverse effects	1117 ugai/L 2.5% growth stimulation	435266-02
Lemna gibba *TierI (14day)*	687 ug ai/L8% growth stimulation	1084 ug ai/L 2.6% growth reduction	435266-05
Anabaena flos-aquae *Tier1(120 Hr)*	725 ug ai/L 4.3% growth reduction	1077 ug ai/L 26.5%growth stimulation	435266-04
Selenastrum capricornutum *Tier I (120 Hr)*	749 ug ai/L 4.3% growth reduction	1117 ug ai/L 8.5% growth stimulation	435266-03

Table E-5: Acute Toxicity of Mefluidide to Birds (oral administration)									
		LD_{50}, mg ai/kg-bw (conf. interval)		NOEC, mg ai/kg-diet					
Species	**% a.i.**	**a.i.**	**a.e.**	**a.i.**	**a.e.**	**Effects**	**Toxicity Classification (based on a.e.)**	**MRID**	**Status**
114001-Mefluidide*									
Bobwhite quail Tier I	58.2	>2000	>2000	>2000	>2000		Practically non-toxic	416021-01	Supplemental
114002- Mefluidide_DEA									
Bobwhite quail Tier I	28.8	>2000	>1500	>2000	>1500		Practically non-toxic	416019-01	Supplemental

***Avian acute oral studies were submitted for 114001-Mefluidide and are in review MRIDs 7362 with LD_{50} 4640 mg/kg bw**

Table E-6: Acute Toxicity of Mefluidide to Birds (dietary administration)

Species	% a.i.	LC_{50}, mg ai/kg-diet (conf. interval)		NOEC, mg ai/kg-diet		Effects	Toxicity Classification (based on a.e.)	MRID	Status
		a.i.	a.e.	a.i.	a.e.				
114001-Mefluidide*									
Mallard duck (Tier I or limit test)	58.2% (adjusted to 100%ai)	>5000	>5000	>5000	>5000	No mortality	Practically non- toxic	416021-03	Supplemental
Bobwhite quail (Tier I or limit test)	58.2% (adjusted to 100%ai)	>5000	>5000	>5000	>5000	No mortality	Practically non- toxic	416021-02	Supplemental
114002- Mefluidide Diethanolamine salt									
Mallard duck (Tier I or limit test)	28.8% (adjusted to 100%ai)	>5000	>3750	>5000	>3750	No mortality	Practically non- toxic	416019-03	Supplemental
Bobwhite quail (Tier I or limit test)	28.8% (adjusted to 100%ai)	>5000	>3750	>5000	>3750	No mortality	Practically non- toxic	416019-02	Supplemental

***Avian acute dietary studies were submitted for 114001-Mefluidide and are in review MRIDs, 7633 and 7634 with LC_{50}s of >10,000 mg/kg diet**

Table E-7: Chronic Toxicity of Mefluidide to Birds

Species	% a.i.	NOEC (mg ai/kg-diet) a.i.	NOEC (mg ai/kg-diet) a.e.	LOEC (mg ai/kg-diet) a.i.	LOEC (mg ai/kg-diet) a.e.	Effects	MRID	Status
No Chronic bird studies were submitted for 114001-Mefluidide , 114002 Diethanolamine salt and 114003 - Mefluidide potassium salt								

Table E-8: Acute Contact Toxicity of Mefluidide to Non-target Insects

Species	% a.i.	Toxicity endpoint a.i.	Toxicity endpoint a.e.	NOEL	Toxicity classification (based on a.e.)	MRID	Status
114002- Mefluidide Diethanolamine salt							
Honey bee	28.8	>25	>18.75	12.5	Practically non-toxic	425628-01	Acceptable
114003- Mefluidide Potassium salt							
Honey bee	28.8	>25	>22.25	25	Practically non-toxic	425628-02	Acceptable

Table E 9 Acute Toxicity of Mefluidide [a]

Guideline No.	Study Type	MRID	Results (LD_{50}/LC_{50})	Toxicity Category
870.1100 (81-1)	Acute Oral (female rat) Mefluidide tech	>4000 mg/kg MRID 00047118		III
870.1100 (81-1)	Acute Oral (mouse) Mefluidide tech	1920.2 mg/kg MRID 00047117		III
870.1100 (81-1)	Acute Oral (mouse) Mefluidide tech	829.8 mg/kg MRID 00047116		III

[a] Status (acceptability) based on HEDs guidelines.

Table E 10 Toxicity Profile of Mefluidide sub chronic and developmental toxicity and its salts (114001, 114002, 114003) [a]		
Guideline No./ Study type	**MRID No.(year)/Doses/ classification**	**Results**
870.3200 82-2 21-Day Dermal toxicity - rabbit	00082073, (1977) 0, 1, 3, 10 ml of 2S formulation/kg/day (Formulation containing 24% a.i., equivalent to 0, 240, 720, or 2400 mg mefluidide/kg/day) (4 rabbits/sex/dose) **Acceptable/Non-guideline** (NOAEL was not observed) Note: This study assessed the dermal toxicity of 24 % formulation mefluidide	**Dermal LOAEL** = 240 mg/kg/day, based on irritation, inflammation and necrosis at test sites. **Dermal a NOAELs** were not established.
870.3700a 83-3(a) Developmental Toxicity Gavage [rat]	42097201 (range finding) 42097701 (teratology), 1991 Range finding: 0, 100, 200, 400, 600 or 800 mg a.i./kg/d Teratology study: 0, 50, 200 or 400 mg a.i./kg/d Mefluidide technical 58.2% a.i. **Acceptable/Guideline**	**Maternal LOAEL** = 400 mg/kg/d based on reduced gain and food consumption. Higher dose in the range finding study of 600 mg/kg/day produced excessive mortality. **Maternal NOAEL** = 200 mg/kg/d **Developmental LOAEL** = 400 mg/kg/d based on slight fetal toxicity as indicated by a slight nonstatistical increase in 14th rib. **Developmental NOAEL** = 200 mg/kg/d
870.3700a 83-3(a) Developmental Toxicity, gavage [rat]	42026102, (1991) 0, 50, 200 400 mg **diethanolamine salt of mefluidide** (28.78%)/kg/d (25 females/dose) Doses adjusted for 100 % purity were 0, 14, 58, or 115 mg/kg/day. **Acceptable/guideline**	**Maternal LOAEL** = 115 mg a.i./kg/day based on mortality, clinical signs (tremors, stained nose, urine and vaginal discharge), decreased body weight and weight gain. **Maternal NOAEL** = 58 mg a.i./kg/day), **Developmental LOAEL** = 115 mg a.i./kg/day based on increased number of early resorptions and mean post-implantation loss. **Developmental NOAEL**: 200 mg/kg/day (adjusted to 58 mg/kg/day),
Non-guideline 14-Day Oral gavage [rabbit]	00047138, (1975) 0, 100, 200, 400, 800 mg/kg/d Vistar tech, 93% a.i. 4 females/dose range finding **Acceptable/non-guideline**	**LOAEL** = < 100 mg/kg/day (females), based on mortality (1/3 deaths) at 100 mg/kg/d. Tremors and 100% mortality were noted at the levels of 200 mg/kg/d and above. Histopathology not reported. **NOAEL**: not established,
870.3700b 83-3(b) Developmental Toxicity, gavage [rabbit]	00047139, (1975) 0, 15, 30, 60 mg technical MBR 12325/kg/d Unacceptable by itself, however, if combined with the 14-day oral study (00047138), it is acceptable.	**Maternal LOAEL** = not established. **Maternal NOAEL** = 60 mg/kg/day, **Developmental LOAE**L = not established. **Developmental NOAEL** = 60 mg/kg/day,
870.1300 (81-3)	Acute inhalation – rat DEA salt of Mefluidide	>5.2 mg/L MRID 41888801
870.1300	Acute inhalation – rat	>5.4 mg/L

Table E 10 Toxicity Profile of Mefluidide sub chronic and developmental toxicity and its salts (114001, 114002, 114003) [a]		
Guideline No./ Study type	**MRID No.(year)/Doses/ classification**	**Results**
(81-3)	Mefluidide tech.	MRID 41964601
870.3800 (83-4) 3-generation reproduction [rat]	00082748, (1979) 0, 600, 1800, 6000 ppm, 93% a.i. (M/F: 0/0, 34/60, 102/183, 346/604 mg/kg/d) **Acceptable/guideline**	**The parental systemic LOAEL** = 346/604 mg/kg bw/day (M/F), based on decreased body weights. **The parental systemic NOAEL** = 102/183 mg/kg bw/day in males/females. **The offspring LOAEL** = 346/604 mg/kg bw/day in males/females, based on decreased body weights in both sexes and both litters in all generations. **The offspring NOAEL** = 102/183 mg/kg bw/day in males/females. **The reproductive LOAEL** was not observed. **The reproductive NOAEL** = 346/604 mg/kg bw/day in males/females.

M = Males; F = Females

[a] Status (acceptability) based on HEDs guidelines.

Table E-11: Toxicity of Mefluidide to Terrestrial Plants (vegetative vigor)[1]								
		EC_{25}, lbs ai/acre		**NOEC (lbs ai/acre)**				
Most Sensitive Species	**% a.i.**	**a.i.**	**a.e.**	**a.i.**	**a.e.**	**Most sensitive parameter**	**MRID**	**Status**
114002- Mefluidide Diethanolamine salt								
***Monocot* - Sorghum**	**29.5**	0.14		0.06		Shoot fresh weight	435496-01	Supplemental
***Dicot* - Mustard**	**29.5**	0.0073		0.0039		Shoot fresh weight		

1 Seedling emergence studies were not available for Mefluidide formulations

Additional preliminary reviews were conducted on the following submitted studies to determine the most sensitive species for endpoint selection. The results of the preliminary reviews concluded that the most sensitive endpoints will remain the same in all cases as well as in all risk conclusions.

MRID 73633 Fink, Robert. 1975. Final Report: Acute Dietary LC_{50} of MBR 12325 in Mallard Ducks. Unpublished study performed by Truslow Farms, Incorporated, Chestertown, MD. Laboratory report number 136-102. Study sponsored by Riker Laboratories, Inc., Sterling, VA. Study completed April 3, 1975.

MRID 73634 Fink, Robert. 1975. Final Report: Acute Dietary LC_{50} of MBR 12325 in Bobwhite Quail. Unpublished study performed by Truslow Farms, Incorporated, Chestertown, MD. Laboratory report number 136-101. Study sponsored by Riker Laboratories, Inc., Sterling, VA. Study completed April 3, 1975.

MRID 73632 Fink, Robert. 1975. Final Report: Acute Oral LD_{50} of MBR 12325 in Mallard Ducks. Unpublished study performed by Truslow Farms, Incorporated, Chestertown, MD. Laboratory report number 136-103. Study sponsored by Riker Laboratories, Inc., Sterling, VA. Study completed April 3, 1975

MRID 73635 Rausima, Gary. 1975. Four-Day Static Aquatic Toxicity Studies with MBR 12325 Technical and MBR 12325-4S in Rainbow Trout and Bluegills. Unpublished study performed by Industrial Bio-Test Laboratories, Inc. Laboratory report number 621-07032. Study submitted by Riker Laboratories, Inc. Final report issued July 21, 1975.

MRID 80027 Rhuberick, John C. 1980. Acute Toxicity of MBR 12325 (Technical) to the Rainbow Trout (*Salmo gairdneri*). Unpublished study conducted by Biospherics Incorporation, Rockville, MD. Study sponsored by Agrichemicals 3M Company, St. Paul, MN. Study completed on February 23, 1980.

MRID 87475 Rhuberick, John C. 1980. Acute Toxicity of MBR 12325 (Technical) to the Bluegill Sunfish (*Lepomis macrochirus*). Unpublished study conducted by Biospherics Incorporation, Rockville, MD. Laboratory report number 80-PL-14-AQ. Study sponsored by Agrichemicals 3M Company, St. Paul, MN. Study completed on March 12, 1980.

MRID 41893801 Murphy, Daniel and G.T. Peters. 1991. Mefluidide: A 96-Hour Flow-Through Toxicity Test with the Bluegill (*Lepomis macrochirus*). Unpublished study performed by Wildlife International, Ltd., Easton, Maryland. Laboratory report number 281A-112. Study sponsored by PBI Gordon, Kansas City, Missouri. Study completed May 23, 1991.

MRID 41893802 Murphy, Daniel and G.T. Peters. 1991. Mefluidide: A 96-Hour Flow-Through Toxicity Test with the Rainbow Trout (*Oncorhynchus mykiss*). Unpublished study performed by Wildlife International, Ltd., Easton, Maryland. Laboratory report number 281A-111. Study sponsored by PBI Gordon, Kansas City, Missouri. Study completed May 23, 1991

MRID 41893803 Holmes, Catherine M. and G.T. Peters. 1991. Mefluidide: A 48-Hour Flow-Through Acute Toxicity Test with the Cladoceran (*Daphnia magna*). Unpublished study performed by Wildlife International, Ltd., Easton, Maryland. Laboratory report number 281A-110. Study sponsored by PBI Gordon, Kansas City, Missouri. Study completed May 23, 1991.

Seedling emergence test (MRID 471907-01) preliminary review results

A preliminary review was conducted on the submitted seedling emergence test MRID 471907-01 to determine if LOC exceedences would decrease with additional toxicity data. Based on the reported results of the author the most sensitive dicot is mustard with an EC25 of 0.0625 and a NOEC of 0.0625. The most sensitive monocot is is oat with an EC25 of 0.034 and a NOEC of 0.031. It is unclear however the determination of the EC25 of 0.0625 and a NOEC of 0.0625 for dicots since 30 percent inhibition occurred at 0.0078 and 20 percent inhibition occurred at 0.0039. In addition, results were reported using pooled controls. The blank or solvent controls were not clearly identified in the raw data. Therefore, control -1.00000 and 0.00000 need to be identified as to which one is the solvent and blank control. In reported controls there are differences of one order of magnitude. If the identified blank controls in this study have magnitudes of order differences in the reported responses, this study would be considered unacceptable.

Therefore, EFED used the nuthatch statistical program on mustard dry weight using the assumed blank control with response values of 0.88, 0.55, 0.58 and 0.33 which resulted in an EC25 of 0.0032 and a NOEC of 0.0156 for the most sensitive dicot (mustard).

EFED also used the nuthatch statistical program on oat dry weight using the assumed blank control with response values of 1.09, 1.14, 0.83 and 1.15 which resulted in an EC25 of 0.080 and a NOEC of 0.03125 for the most sensitive monocot (oat).

After a full review of the above seedling emergence study for validity and review of statistics, higher LOC exceedences may result for granular and ground spray applications based on EC25 and NOEC values than in existing estimated values in the assessment. Based on EC25 of 0.0032 and a NOEC of 0.0156 for dicots (mustard) the highest RQs were 159 (ground spray) nonlisted species, 33 (ground spray) listed species 78 (granular) nonlisted species and 16 (granular) for listed species.
Dicots continued to show more sensitivity than monocots. Based on EC25 of 0.080 and a NOEC of 0.03125 for monocots (oat), RQ exceedences for monocots ranged from 1.65 to 8.06 for granular and spray applications. Refer to Appendix D for all calculations from the preliminary review of the seedling emergence test.

After full review of the above seedling emergence test if considered acceptable, the following risk conclusion remains the same in the assessment based on preliminary review of the seedling emergence test:

Terrestrial and Semi-aquatic Plants (Listed Species and Non-Listed Species) LOCs were exceeded for monocots and dicots with the 1.0 lb ae/A spray applications of mefluidide-K and

mefluidide-DEA. LOCs were exceeded for dicots and monocots (granular applications) with 0.5 lb ae/acre of mefluidide. Dicots demonstrated more sensitivity than monocots in all application scenarios.

Acute Non- Endangered granular and spray applications (preliminary review of seedling emergence test)

TERRPLANT
MEFLUIDIDE-K, MEFLUIDIDE-DEA (1.0 lbs ae/A) GROUND SPRAY ONLY

Terrestrial Plant EECs and Acute Non Endangered RQs (November 9, 2005; version 1.2.1)

Input Values								
Application Rate (lb a.e./acre)	**1.0**	**Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)**				**Risk Quotients (RQs) for NON-GRANULAR formulation applications**			
Runoff Value (0.01, 0.02, or 0.05 if chemical solubility <10, 10-100, or >100 ppm, respectively)	**0.05**	**Application Method**	**Total Loading to Adjacent Areas (EEC = Sheet Runoff +Drift)**	**Total Loading to Semi-aquatic Areas (EEC = Channelized Runoff + Drift)**	**DRIFT EEC***	**Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC25**		**Emergence RQs, Semi-aquatic Areas RQ = EEC/Seedling Emergence EC25**	
Minimum Incorporation Depth (cm)	**0**					**Monocot**	**Dicot**	**Monocot**	**Dicot**
		Ground Unincorp.	**0.06**	**0.51**	**0.01**	**0.750**	**18.75**	**6.38**	**159.38**
Seed Emerg Monocot EC25 (lb a.e./acre)	**0.08**	**Ground Incorp**	**0.06**	**0.51**	**0.01**	**0.75**	**18.75**	**6.38**	**159.38**
Seed Emerg Dicot EC25 (lb a.e./acre)	**0.0032**								

EECs for GRANULAR formulation applications (lbs a.i./acre) 0.5lb ae/A Terrestrial Plant EECs and Acute Non Endangered RQs (November 9, 2005; version 1.2.1)			**RQs for GRANULAR formulation applications**			
Application Method	**Total Loading to Adjacent Areas (EEC = Sheet Runoff)**	**Total Loading to Semiaquatic Areas (EEC = Channelized Runoff)**	**Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC25**		**Emergence RQs, Semiaquatic Areas RQ = EEC/Seedling Emergence EC25**	
			Monocot	**Dicot**	**Monocot**	**Dicot**
Unincorp.	**0.0250**	**0.2500**	**0.31**	**7.81**	**3.13**	**78.13**
Incorp.	**0.0250**	**0.02500**	**0.31**	**7.81**	**0.31**	**7.81**

Acute Endangered granular and spray applications (preliminary review of seedling emergence test)

TERRPLANT
MEFLUIDIDE-K, MEFLUIDIDE-DEA (1.0 lbs ae/A) GROUND SPRAY ONLY

Terrestrial Plant EECs and Acute Endangered RQs (November 9, 2005; version 1.2.1)

	Input Values							
Application Rate (lb a.e./acre)	**1.0**	**Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)**				**Risk Quotients (RQs) for NON-GRANULAR formulation applications**			
Runoff Value (0.01, 0.02, or 0.05 if chemical solubility <10, 10-100, or >100 ppm, respectively)	**0.05**	**Application Method**	**Total Loading to Adjacent Areas (EEC = Sheet Runoff +Drift)**	**Total Loading to Semi-aquatic Areas (EEC = Channelized Runoff + Drift)**	**DRIFT EEC***	**Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC25**		**Emergence RQs, Semi-aquatic Areas RQ = EEC/Seedling Emergence EC25**	
Minimum Incorporation Depth (cm)	**0**					**Monocot**	**Dicot**	**Monocot**	**Dicot**
		Ground Unincorp.	**0.06**	**0.51**	**0.01**	**0.194**	**3.85**	**1.65**	**32.69**
Monocot NOAEC	**0.31**	**Ground Incorp**	**0.06**	**0.51**	**0.01**	**0.19**	**3.85**	**1.65**	**32.69**
Divot NOAEC	**0.0156**								

EECs for GRANULAR formulation applications (lbs a.i./acre) 0.5lb ae/A Terrestrial Plant EECs and Acute Endangered RQs (November 9, 2005; version 1.2.1)			**RQs for GRANULAR formulation applications**			
Application Method	**Total Loading to Adjacent Areas (EEC = Sheet Runoff)**	**Total Loading to Semiaquatic Areas (EEC = Channelized Runoff)**	**Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC25**		**Emergence RQs, Semiaquatic Areas RQ = EEC/Seedling Emergence EC25**	
			Monocot	**Dicot**	**Monocot**	**Dicot**
Unincorp.	**0.0250**	**0.2500**	**0.81**	**1.60**	**8.06**	**16.03**

Calculations for Estimated Endpoints

Seedling emergence toxicity data was not available for full review and data was not available from other anilide analogs to derive EC_{25} values. To estimate possible effects measurement endpoints for seedling emergence, EFED assumed that EC_{25} toxicity values for vegetative vigor are equal to seedling emergence measurement endpoints for Mefluidide, Mefluidide-DEA and Mefluidide-K. Therefore, the most sensitive seedling emergence EC_{25} estimated values are 0.105 and 0.0054 lb ae/acre for monocots and dicots, respectively. The NOEC estimated values for seedling emergence are 0.045 and 0.0029 lb ae/acre for monocots and dicots, respectively. These values are used to calculate risk quotients for exposure from combined runoff and spray drift to adjacent fields.

There are insufficient data to establish a definitive toxicity endpoint for freshwater fish chronic effects for the acid and DEA salt acid equivalents for mefluidide. To estimate a potential chronic freshwater fish endpoint for mefluidide the relationship between established acute and chronic endpoints for mefluidide and propanil were considered (see source data in Appendix E). A ratio was determined between the 96h acute freshwater fish endpoints and the chronic freshwater fish endpoints used for RQ calculation for mefluidide (>68.47 mg/L acute freshwater fish) and propanil (2.3mg /L/0.009 mg /L = 256 mg/L). The largest ratio between acute endpoint and chronic endpoint was applied to the Mefluidide acute freshwater fish value to derive an estimated chronic endpoint of 0.267 mg/L (>68.47mg/L/256 = >0.267 mg/L).

There are insufficient data to establish a definitive toxicity endpoint for freshwater invertebrate chronic effects for the acid and DEA salt acid equivalents for mefluidide. To estimate a potential chronic freshwater fish endpoint for mefluidide the relationship between established acute and chronic endpoints for mefluidide and propanil were considered (see source data in Appendix E). A ratio was determined between the 48 h acute freshwater invertebrate endpoints and the chronic freshwater invertebrate endpoints used for RQ calculation for mefluidide (>77.25 mg/L acute freshwater invertebrate) and propanil (1.2mg /L acute freshwater invertebrate/0.086 mg /L chronic freshwater invertebrate = 13.95). The largest ratio between acute endpoint and chronic endpoint was applied to the Mefluidide acute freshwater fish value to derive an estimated chronic endpoint of 5.54 mg/L (>77.25 mg/L/13.95= >5.54 mg/L).

There are insufficient data to establish a definitive toxicity endpoint for estuarine/marine fish and invertebrate chronic effects for the acid and DEA salt acid equivalents for mefluidide. There is also little available data to compare to other anilide herbicides for this taxonomic group For the purposes of this risk assessment, it was assumed that estuarine marine fish and invertebrates were at least as sensitive as freshwater fish and invertebrates in terms of chronic toxicity. Therefore, the estimated endpoint for freshwater invertebrates (>5.54 mg/L) was used to estimate a chronic effects endpoint for estuarine/marine invertebrates and >0.267 mg/L was used to estimate chronic effect endpoint for estuarine marine fish.

There are insufficient data to establish a definitive toxicity endpoint for a NOAEC or EC05 value for vascular plant effects for the acid and DEA salt acid equivalents for mefluidide. To estimate

a potential EC05 endpoint for mefluidide the relationship between established acute and EC05 endpoints for mefluidide and propanil were considered (see source data in Table 1 Appendix E). Comparisons were made between the acute mefluidide endpoint and the propanil EC05 endpoint for vascular plant RQ calculation for mefluidide (>0.515 mg/L acute vascular plant) and propanil (0.11mg /L acute vascular plant/0.0063 mg /L EC05 vascular plant= 17.46). The largest ratio between acute endpoint and EC_{05} was applied to the Mefluidide acute vascular plant value to derive an estimated EC05 endpoint of >0.029 mg/L (>5.15 mg/L/17.46= >0.029 mg/L).

There are insufficient data to establish a definitive toxicity endpoint for a chronic (NOAEC) value for bird effects for the acid and DEA salt acid equivalents for mefluidide. To estimate a potential chronic endpoint for mefluidide the relationship between established acute and chronic endpoints for mefluidide mammals were considered (see source data in Appendix E). Chronic NOAEC values for the most sensitive mammal (mouse) were not available. Therefore, to derive a chronic value for the mouse the acute mefluidide endpoint and the chronic mefluidide endpoint from rat toxicity endpointswere used to derive a chronic mouse value for mefluidide (829.8 mg ae/kg acute mouse) and mefluidide (>4000mg ae /kg acute (rat)/102 mg ae /kg chronic (rat)) = 39.2). The largest ratio between acute endpoint and chronic endpoint was applied to the mefluidide acute mouse value to derive an estimated chronic mouse endpoint of NOAEC>21 mg ae/kg bw (829.8 mg ae/kg bw /39.2= NOAEC >21mg ae/kg bw (mouse)). The acute mefluidide endpoint for bird and the acute and chronic endpoints for the mouse were used to derive a ratio for the chronic bird RQ calculation for mefluidide (>1500 mg ae/kg acute bird) and mefluidide (829.8 mg ae /kg acute (mouse)/ >21mg ae /kg chronic (mouse) = 39.5). The largest ratio between acute endpoint and chronic endpoint was applied to the mefluidide acute bird value to derive an estimated chronic endpoint of NOAEC 38 mg ae/kg bw (>1500mg/L/39.5= NOAEC 38 mg ae/kg bw).

Calculations for Estimated Endpoints

Table #1 Summary of Calculations for Estimated Endpoints

ENDPOINT DESIRED For Mefluidide	Acute/Chronic mefluidide =ratio	Acute/Chronic Propanil =ratio	Acute Endpoint Mefluidide/ratio= endpoint	Estimated Endpoint
Chronic Fish		2.3/0.009=256	>68.47/256=>0.267	
Chronic Invertebrate		1.2/0.086=13.95	>77.25/13.95=>5.54	
Chronic Bird (used mammal rat and mouse toxdata body weight)	>4000 mefluidide rat /102mefuidide rat =39.2 (829.8 mg ae/kg bw (mouse) /39.2= NOAEC >21mg ae/kg bw (mouse)). 829.8 mg ae /kg acute (mouse)/ >21mg ae /kg chronic (mouse) = 39.5		>1500/39.5=38	
EC05 vascular plant		0.11/0.0063=17.46	>0.515/17.46=>0.029	
EC05 non-vascular plant		0.016/0.02=0.80	>0.629/0.80=>0.786	
Seedling emergence EC05 and EC25				EC05 and EC25 values are equal to vegetative vigor values

Due to data gaps for chronic studies for freshwater and estuarine marine fish and invertebrates and chronic studies for birds EFED reviewed the analog Propanil to obtain estimated LD50 and LC50 values for Mefluidide from acute to chronic ratios
Also for the most sensitive estuarine marine invertebrate Propanil is 2 orders more toxic than Mefluidide and no chronic estuarine marine studies were available for Propanil.
No chronic studies for birds were submitted for Propanil.

Tables #2 to #4 summarize endpoints from mefluidide and propanil considered for estimated values. Bolded values were used in endpoint selection for acute and chronic ratios.

Table#2 Summary of Aquatic and Terrestrial Plant Toxicity Data used for Risk Quotient Calculation Mefluidide and Propanil Application(bolded values were used in acute to chronic ratios)

Species	Mefluidide	Propanil
Aquatic Plant: *Navicula* Tier I Nonvascular	**EC_{50} = >0.629 mg ae/L** NOAEC N/A due to Tier one study	
Freshwater diatom		**0.016 mgai/L** **EC05 0.02**
Aquatic Plant: *Lemna gibba* Tier I Vascular	**EC_{50} = 0.515 mg ae/L** NOAEC N/A due to Tier one study	**.11 mg ai/L** **EC05 0.0063**
Terrestrial Plant: Vegetative Vigor	Most sensitive endpoint: (N/Afor Propanil) Fresh Weight **Most sensitive monocot: Sorghum NOAEC 0.045 lb ae/A; EC_{25} 0.105 lb ae/A** **Most sensitive dicot: Mustard** **NOAEC 0.0029 lb ae/A; EC_{25} 0.0054lb ae/A**	N/A for Propanil
Terrestrial Plant: Seedling Emergence	(No studies submitted) Vegetative Vigor enpoints from mefluidide were used for this data gap.	EC25 1.4 lb ai/A for Propanil

Table#3 Summary of Terrestrial Acute and Chronic Toxicity Data used for Risk Quotient Calculation for Mefluidide and Propanil Application (bolded values were used in acute to chronic ratios)

Species	Acute Toxicity				Chronic Toxicity	
	Mefluidide **LD_{50}** **mg ae/kg-bw**	**Propanil** **LD_{50}** **mg ae/kg-bw**	**Mefluidide** **LC_{50}**	**Propanil** **LC_{50}**	**Mefluidide** **NOAEC**	**Propanil** **NOAEC**
Laboratory rat	**>4000 Rat** Used to calculate chronic bird enpoint	1080			**102** Used to calculate chronic bird enpoint	300
Laboratory mouse	**829.8** Used to calculate chronic bird enpoint					
Northern Bobwhite Quail (*Colinus virginianus*) Limit study(Tier l)	**>1500** Used to calculate chronic bird enpoint		>3750	2311	No studies submitted	No studies submitted

Table#4 Summary of Acute and Chronic Aquatic Toxicity Data used for Risk Quotient Calculation for Mefluidide and Propanil Application (bolded values were used in acute to chronic ratios)

Species	Acute Toxicity				Chronic Toxicity	
	Mefluidide 96-hr LC_{50} (mg/L ae)	**Mefluidide 48-hr EC_{50} (mg/L ae)**	**Propanil 96-hr LC_{50}(mg ai/L)**	**Propanil 48-hr EC_{50} (mg ai/L)**	**Mefluidide NOAEC / LOAEC (mg/L)**	**Propanil NOAEC / LOAEC (mg/L)**
Rainbow Trout *Oncorhynchus mykiss* Coldwater species Freshwater fish	**>68.47**		**2.3**		No studies submitted	No studies submitted
Fathead minnow Freshwater fish					No studies submitted	**.009**
Water flea *Daphnia magna* Freshwater Invertebrate		**>77.25**		**1.2**	No studies submitted	**.086**
Sheepshead minnow Estuarine marine fish	>84.75		4.6		No studies submitted	No studies submitted
Mysid shrimp Estuarine marine invertebrate				.400	No studies submitted	No studies submitted
Eastern oyster Estuarine marine Invertebrate		67			No studies submitted	No studies submitted

Summary of Endpoints (LC_{50} or EC_{50}, mg ae/L) for Aquatic and Terrestrial Toxicity used in RQ calculations for Mefluidide [1]

Summary of endpoints (LC_{50} or EC_{50}, mg ae/L) for Aquatic Toxicity used in RQ calculations for Mefluidide [1]			
TAXANOMIC GROUP	**Acute endpoint**	**Chronic endpoint**	**MRID/ Estimated value**
Acute freshwater fish	>68.47* Rainbow Trout		MRID 418937-02
Chronic freshwater fish		>0.267	Estimated value acute to chronic ratio
Acute freshwater inverts	>77.25* Daphnid		MRID 418937-03
Chronic freshwater inverts		>5.54	Estimated value acute to chronic ratio
Acute estuarine/marine fish	>84.75* Sheepshead minnow		MRID 425623-03
Chronic estuarine/marine fish		>0.267	Estimated value acute to chronic ratio
Acute estuarine/marine inverts	67* Eastern oyster		MRID 425624-01
Chronic estuarine/marine inverts		>5.54	Estimated value acute to chronic ratio

[1] For fish and invertebrates data evaluating Potassium Mefluidide, Diethanolamine Mefluidide and Mefluidide have been bridged for the runoff risk assessment.

Summary of endpoints (LC_{50} or EC_{50}, mg ae/L) for Plant Toxicity used in RQ calculations for Mefluidide[1]			
TAXONOMIC GROUP	**Acute endpoint**	**EC05 and NOAEC**	
Acute vascular plant	0.515* Lemna		MRID 435266-01 Tier I(8% growth stimulation) Used this value as **EC_{50},**
Vascular plant (EC05)		>0.29	Estimated value acute to chronic ratio
Acute non-vascular plant	0.629* Navicula		MRID 435266-05 Tier I(11.5% growth reduction) Used this value as **EC_{50},**
Non-vascular plant(EC05)		>0.786	Estimated value acute to chronic ratio
Terrestrial Plant: Vegetative Vigor	Monocot:* Sorghum EC_{25} 0.105 lb ae/A Dicot:* Mustard EC_{25} 0.0054lb ae/A	Monocot:* Sorghum NOAEC 0.045 lb ae/A Dicot:* Mustard NOAEC 0.0029 lb ae/A	MRID 435496-01
Terrestrial Plant: Seedling Emergence			N/A

Summary of endpoints (LD_{50} mg ae/L) for Terrestrial Toxicity data used in RQ calculations for Mefluidide[1]			
TAXONOMIC GROUP	**Acute endpoint**	**Chronic endpoint**	
Acute Avian	>1500* Bobwhite quail		MRID 416019-01 Used this non-definitive endpoint as LD50
Chronic Avian		38	Estimated value acute to chronic ratio based on mammal data
Acute mammal	829.8* mouse		MRID 00047116
Chronic mammal		102* rat	MRID 00082748

[1]For terrestrial plants data evaluating Potassium Mefluidide, Diethanolamine Mefluidide and Mefluidide have been bridged for the terrestrial risk assessment.

*most sensitive species tested

Summary of Mammal and Avian RQS with both 35 day and 4 day half lives

Mammalian dose-based acute RQ values for proposed uses of Mefluidide K and Mefluidide DEA based on a mouse LD_{50} = 829.8 mg/kg -bw and upper-bound Kenaga values[1]. 35day half life (A 4day half life with either 1 and 3 applications = 1 application at 35 day)

Use	Application Rate lbs. ae/A (# app / interval, days)	Body Weight, g	Mammalian Acute Risk Quotients (upper-bound Kenaga residues)					
			Short Grass (1app)	Short Grass (3 app)	Tall Grass(1app)	Tall Grass(3app)	Broadleaf Plants/Small Insects((1app)	Broadleaf Plants/Small Insects(3 app)
Ornamental Turf (mefluidide salts only) Ground spray	1.0	15	0.26	0.42	0.12	0.19	0.14	0.23
		35	0.22	0.36	0.10	0.16	0.12	0.20
		1000	0.12	0.19	0.05	0.09	0.07	0.11

[1] For mammal toxicity assessments, data evaluating Potassium Mefluidide, Diethanolamine Mefluidide and Mefluidide toxicity have been bridged because toxicity is expected to come from the benzene ring of mefluidide. Therefore, the most sensitive Mefluidide endpoint was selected to represent mammals for all application scenarios.

Mammalian dose-based chronic RQ values for proposed uses of MefluidideK and Mefluidide DEA based based on a rat reproductive NOAEC of 102 mg ae/kg-bw/day and upper-bound Kenaga residues[1] based on a 35day half life (4day half life with 1 and 3 application rates)= 1 application 35 day)

Use	Application Rate lbs. ae/A (# app / interval, days)	Body Weight, g	Mammalian Acute Risk Quotients (upper-bound Kenaga residues)					
			Short Grass (1app)	Short Grass (3 app)	Tall grass(1app)	Tall grass (3 app)	Broadleaf Plants/Small Insects(1app)	Broadleaf Plants/Small Insects(3 app)
Ornamental Turf (mefluidide salts only) Ground spray	1.0 3 per season 42 day interval	15	1.02	1.66	0.47	0.76	0.57	0.93
		35	0.87	1.42	0.40	0.65	0.49	0.80
		1000	0.47	0.76	0.21	0.35	0.26	0.43

[1] For mammal toxicity assessments, data evaluating Potassium Mefluidide, Diethanolamine Mefluidide and Mefluidide toxicity have been bridged because toxicity is expected to come from the benzene ring of mefluidide. Therefore, the most sensitive Mefluidide endpoint was selected to represent mammals for all application scenarios.

Avian dose-based acute RQ values for proposed uses of MefluidideK and Mefluidide DEA based on a bobwhite quail LD_{50} >1500 mg/kg -bw and upper-bound Kenaga values[1]. 35day half life (4day half life with 1 and 3 application rates)= same as 1 application 35 day)

Use	Application Rate lbs. ae/A (# app / interval, days)	Body Weight, g	Avian Acute Risk Quotients (upper-bound Kenaga residues) Short Grass (1app)	Short Grass (3 app)	Tall Grass(1app)	Tall Grass(3app)	Broadleaf Plants/Small Insects((1app)	Broadleaf Plants/Small Insects(3 app)
Ornamental Turf (mefluidide salts only) Ground spray	1.0	20	0.25	0.41	0.12	0.19	0.14	0.23
		100	0.11	0.18	0.05	0.08	0.06	0.10
		1000	0.04	0.06	0.02	0.03	0.02	0.03

[1] For mammal toxicity assessments, data evaluating Potassium Mefluidide, Diethanolamine Mefluidide and Mefluidide toxicity have been bridged because toxicity is expected to come from the benzene ring of mefluidide. Therefore, the most sensitive Mefluidide endpoint was selected to represent mammals for all application scenarios.

Appendix F Guideline Sequence Bibliographies for Ecological Effects

PC 14001--Mefluidide

Guideline: 71-1 Avian Single Dose Oral Toxicity

MRID: 41602101
Culotta, J.; Campbell, S.; Hoxter, K.; et al. (1990) Mefluidide: An Acute Oral Toxicity Study with the Northern Bobwhite: Wildlife Int. Project No. 281-106. Unpublished study prepared by Wild- life International Ltd. 17 p.

Guideline: 71-2 Avian Dietary Toxicity

MRID: 41602102
Foster, J.; Driscoll, C.; Hoxter, K.; et al. (1990) Mefluidide: A Dietary LC50 Study with the Northern Bobwhite: Lab Project Number: 281-104. Unpublished study prepared by Wildlife Inter- national Ltd. 17 p.

MRID: 41602103
Foster, J.; Driscoll, C.; Hoxter, K.; et al. (1990) Mefluidide: A Dietary LC50 Study with the Mallard: Lab Project No: 281-105. Unpublished study prepared by Wildlife International Ltd. 19 p.

Guideline: 72-3 Acute Toxicity to Estuarine/Marine Organisms

MRID 425624-01
Graves, W.C. and J.P. Swigert. (1992) Technical Mefluidide: A 96-Hour shell deposition Test with Eastern Oyster Project No. 281A-121 Prepared by Wildlife International Ltd

MRID 425624-02

Graves, W.C. and J.P. Swigert. (1992) Technical Mefluidide: A 96-Hour flow through acute toxicity test with the salt water mysid. Project No. 281A-122a Prepared by Wildlife International Ltd

PC 114002—Mefluidide-DEA

Guideline: 71-1 Avian Single Dose Oral Toxicity

MRID: 41601901

Culotta, J.; Campbell, S.; Smith, G. (1990) Diethanolamine Salt of Mefluidide: An Acute Oral Toxicity Study with the Northern Bob- white: Lab Project Number: 281-103. Unpublished study prepared by Wildlife International Ltd. 17 p.

Guideline: 71-2 Avian Dietary Toxicity

MRID: 41601902

Foster, J.; Driscoll, C.; Hoxter, K.; et al. (1990) Diethanolamine Salt of Mefluidide: A Dietary LC 50 Study with the Northern Bob- white: Lab Project Number: 281-101. Unpublished study prepared by Wildlife International Ltd. 17 p.

MRID: 41601903

Foster, J.; Driscoll, C.; Hoxter, K.; et al. (1990) Diethanolamine Salt of Mefluidide: A Dietary LC50 Study with the Mallard: Lab Project Number: 281-102. Unpublished study prepared by Wildlife International Ltd. 19 p.

Guideline: 72-1 Acute Toxicity to Freshwater Fish

MRID: 41893701

Murphy, D.; Peters, G. (1991) Diethanolamine Salt of Mefluidide: A 96-Hour Flow-Through Acute Toxicity Test with the Bluegill (Lep- omis macrochirus): Final Report: Lab Project Number: 281A-114. Unpublished study prepared by Wildlife International Ltd. 56 p.

MRID: 41893702

Murphy, D.; Peters, G. (1991) Diethanolamine Salt of Mefluidide: A 96-Hour Flow-Through Acute Toxicity Test with the Rainbow Trout (Oncorhynchus mykiss): Final Report: Lab Project Number: 281A- 1113. Unpublished study prepared by Wildlife International Ltd. 56 p.

Guideline: 72-2 Acute Toxicity to Freshwater Invertebrates

MRID: 41893703

Holmes, C.; Peters, G. (1991) Diethanolamine Salt of Mefluidide: A 48-Hour Flow-Through Toxicity Test with the Cladocern (Daphnia magna): Final Report: Lab Project Number: 281A-109. Unpublished study prepared by Wildlife International Ltd. 54 p.

Guideline: 72-3 Acute Toxicity to Estuarine/Marine Organisms

MRID: 42562301
Graves, W.; Swigert, J. (1992) Diethanolamine Salt of Mefluidide: A 96-hour Shell Deposition Test with the Eastern Oyster (Crassostrea virginica): Final Report: Lab Project Number: 281A-124A. Unpublished study prepared by Wildlife International Ltd. 46 p.

MRID: 42562302
Graves, W.; Swigert, J. (1992) Diethanolamine Salt of Mefluidide: A 96-hour Flow-through Acute Toxicity Test with Saltwater Mysid (Mysidopsis bahia): Final Report: Lab Project Number: 281A-125. Unpublished study prepared by Wildlife International Ltd. 45 p.

MRID: 42562303
Graves, W.; Swigert, J. (1992) Diethanolamine Salt of Mefluidide: A 96-hour Flow-through Acute Toxicity Test with the Sheepshead Minnow (Cyprinodon variegatus): Final Report: Lab Project Number: 281A-126. Unpublished study prepared by Wildlife International Ltd. 45 p.

Guideline: 122-2 Aquatic plant growth

MRID: 43526601
Hughes, J.; Alexander, M.; Conder, L. (1995) The Toxicity of Diethanolamine (DEA) Salt of Mefluidide to Navicula pelliculosa: Lab Project Number: 15-01-3. Unpublished study prepared by Carolina Ecotox, Inc. 58 p.

MRID: 43526602
Hughes, J.; Alexander, M.; Conder, L. (1995) The Toxicity of Diethanolamine (DEA) Salt of Mefluidide to Skeletonema costatum: Lab Project Number: 15-01-4. Unpublished study prepared by Carolina Ecotox, Inc. 60 p.

MRID: 43526603
Hughes, J.; Alexander, M.; Conder, L. (1995) The Toxicity of Diethanolamine (DEA) Salt of Mefluidide to Selenastrum capricornutum: Lab Project Number: 15-01-1. Unpublished study prepared by Carolina Ecotox, Inc. 60 p.

MRID: 43526604
Hughes, J.; Alexander, M.; Conder, L. (1995) The Toxicity of Diethanolamine (DEA) Salt of Mefluidide to Anabaena flos-aquae: Lab Project Number: 15-01-2. Unpublished study prepared by Carolina Ecotox, Inc. 62 p.

MRID: 43526605
Hughes, J.; Alexander, M.; Conder, L. (1995) The Toxicity of Diethanolamine (DEA) Salt of Mefluidide to Lemna gibba: Lab Project Number: 15-01-5. Unpublished study prepared by Carolina Ecotox, Inc. 59 p.

Guideline: 123-1 Seed germination/seedling emergence and vegetative vigor
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MRID: 43549601
Crosby, K. (1995) Effect of DEA Mefluidide on Vegetative Vigor of Plants: Lab Project Number: 6272-92-0223-BE-001. Unpublished study prepared by Ricerca, Inc. 213 p.

Guideline: 141-1 Honey bee acute contact

MRID: 42562801
Hoxter, K.; Bernard, W.; Smith, G. (1992) An Acute Contact Toxicity Study with the Honey Bee: Diethanolamine Salt of Mefluidide: Final Report: Lab Project Number: 281-111A. Unpublished study prepared by Wildlife Int'l Ltd. 16 p.

PC 114003 Mefluidide-K

Guideline: 141-1 Honey bee acute contact

MRID: 42562802
Hoxter, K.; Bernard, W.; Smith, G. (1992) An Acute Contact Toxicity Study with the Honey Bee: Potassium Salt of Mefluidide: Final Report: Lab Project Number: 281-112A. Unpublished study prepared by Wildlife Int'l Ltd. 16 p.

Appendix G: The Risk Quotient Method and Levels of Concern

The Risk Quotient Method is the means used by EFED to integrate the results of exposure and ecotoxicity data. For this method, risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values (i.e., RQ = EXPOSURE/TOXICITY), both acute and chronic. These RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to non-target organisms and the need to consider regulatory action. EFED has defined LOCs for acute risk, potential restricted use classification, and for endangered species.

The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories:

(1) acute - there is a potential for acute risk; regulatory action may be warranted in addition to restricted use classification;
(2) acute restricted use - the potential for acute risk is high, but this may be mitigated through restricted use classification
(3) acute endangered species - the potential for acute risk to endangered species is high, regulatory action may be warranted, and
(4) chronic risk - the potential for chronic risk is high, regulatory action may be warranted.

Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to non-target insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from required studies. Examples of ecotoxicity values derived from short-term laboratory studies that assess acute effects are: (1) LC_{50} (fish and birds), (2) LD_{50} (birds and mammals), (3) EC_{50} (aquatic plants and aquatic invertebrates), and (4) EC_{25} (terrestrial plants). Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic effects are: (1) LOAEL (birds, fish, and aquatic invertebrates), and (2) NOAEL (birds, fish and aquatic invertebrates). The NOAEL is generally used as the ecotoxicity test value in assessing chronic effects.

Risk presumptions, along with the corresponding RQs and LOCs are summarized in Table E.

Table F: Risk Presumptions and LOCs		
Risk Presumption	**RQ**	**LOC**
Birds[1]		
Acute Risk	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.5
Acute Restricted Use	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEC	1
Wild Mammals[1]		
Acute Risk	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.5
Acute Restricted Use	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEC	1
Aquatic Animals[2]		
Acute Risk	EEC/LC_{50} or EC_{50}	0.5
Acute Restricted Use	EEC/LC_{50} or EC_{50}	0.1
Acute Endangered Species	EEC/LC_{50} or EC_{50}	0.05
Chronic Risk	EEC/NOAEC	1
Terrestrial and Semi-Aquatic Plants		
Acute Risk	EEC/EC_{25}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1
Aquatic Plants[2]		
Acute Risk	EEC/EC_{50}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1

[1] LD_{50}/sqft = (mg/sqft) / (LD_{50} * wt. of animal)
LD_{50}/day = (mg of toxicant consumed/day) / (LD_{50} * wt. of animal)

2 EEC = (ppb or ug/L) in water

Appendix H ECOTOX Results

MEFLUIDIDE
Papers that were accepted for ECOTOX

Acceptable for ECOTOX and OPP

Agnello, A. M., Bradley, J. R. Jr., and Van Duyn, J. W. (1986). Plant-Mediated Effects of Postemergence Herbicides on Epilachna varivestis (Coleoptera: Coccinellidae). *Environ.Entomol.* 15: 216-220.

EcoReference No.: 71019
Chemical of Concern: MFD,FZFB,SXD; Habitat: T; Effect Codes: REP,GRO,BEH,ENV; Rejection Code: LITE EVAL CODED(SXD,MFD),OK(ALL CHEMS).

Griffin, J. L. and Harger, T. J. (1990). Red Rice (Oryza sativa) Control Options in Soybeans (Glycine max). *Weed Technol.* 4 : 35-38.

EcoReference No.: 74045
User Define 2: WASH
Chemical of Concern: MTL,BT,FZFP,ACR,SXD,HFP,MFD,FZF,QZF; Habitat: T; Effect Codes: POP; Rejection Code: NO CONTROL,TARGET(SXD).

Kwon, S. L., Smith, R. J. Jr., and Talbert, R. E. (1991). Red Rice (Oryza sativa) Control and Suppression in Rice (O. sativa). *Weed Technol.* 5: 811-816.

EcoReference No.: 74741
Chemical of Concern: MLT,FNP,AMC,SXD,MFD; Habitat: A; Effect Codes: PHY,POP; Rejection Code: LITE EVAL CODED(MFD),OK(ALL CHEMS).

Marini, R. P., Byers, R. E., and Sowers, D. L. (1989). Growth Regulators and Herbicides for Delaying Apple Fruit Abscission. *Hortscience* 24: 957-959.

EcoReference No.: 76104
Chemical of Concern: BZO,TPR,DMB,PBZ,DMZ,FXP,PDM,MFD; Habitat: T; Effect Codes: GRO; Rejection Code: OK(FXP,DMZ,PBZ),OK TARGET(DMB),NO ENDPOINT(MFD,PDM,BZO,TPR).

Potter, D. A., Spicer, P. G., Redmond, C. T., and Powell, A. J. (1994). Toxicity of Pesticides to Earthworms in Kentucky Bluegrass Turf. *Bull.Environ.Contam.Toxicol.* 52: 176-181.

EcoReference No.: 39542
Chemical of Concern: 24DXY,AZD,BFT,BMY,CPZ,CYF,DTP,EP,FNF,FPD,FSTAl,FVL,MFD,MYC,PRM,TEZ,TPM; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(AZD,FVL,BFT,CYF),OK(ALL CHEMS).

Potter, D. A., Spicer, P. G., Redmond, C. T., and Powell, A. J. (1994). Toxicity of Pesticides to Earthworms in Kentucky Bluegrass Turf. *Bull.Environ.Contam.Toxicol.* 52: 176-181.

EcoReference No.: 39542
Chemical of Concern:
24DXY,AZD,BFT,BMY,CPZ,CYF,DTP,EP,FNF,FPD,FSTAl,FVL,MFD,MYC,PRM,TEZ,TPM;
Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL
CODED(MFD,AZD,FVL,BFT,CYF),OK(ALL CHEMS).

Smith, R. J. Jr. (1989). Cropping and Herbicide Systems for Red Rice (Oryza sativa) Control. *Weed Technol.* 3: 414-419.

EcoReference No.: 73748
User Define 2: WASH
Chemical of Concern: MTL,TFN,PAQT,ACR,BT,MFD
Endpoint: POP; Habitat: T; Rejection Code: OK.

Storey, G. K. and Gardner, W. A. (1986). Sensitivity of the Entomogenous Fungus Beauveria bassiana to Selected Plant Growth Regulators and Spray Additives. *Appl.Environ.Microbiol.* 52: 1-3.

EcoReference No.: 82489
Chemical of Concern: MFD,PBZ,FPD; Habitat: T; Effect Codes: POP,MOR,REP; Rejection Code: LITE EVAL CODED(MFD),OK(ALL CHEMS).

Turner, K. E., Paterson, J. A., Kerley, M. S., and Forwood, J. R. (1990). Mefluidide Treatment of Tall Fescue Pastures: Intake and Animal Performance. *J.Anim.Sci.* 68: 3399-3405.

EcoReference No.: 82719
Chemical of Concern: MFD; Habitat: T; Effect Codes: PHY,BEH,GRO; Rejection Code: LITE EVAL CODED(MFD).

Wimer, S. K., Ward, J. K., Anderson, B. E., and Waller, S. S. (1986). Mefluidide Effects on Smooth Brome Composition and Grazing Cow-Calf Performance. *J.Anim.Sci.* 63: 1054-1062.

EcoReference No.: 82721
Chemical of Concern: MFD; Habitat: T; Effect Codes: BCM,POP; Rejection Code: LITE EVAL CODED(MFD).

Acceptable for ECOTOX but not OPP

Agnello, A. M., Van Duyn, J. W., and Bradley, J. R. Jr. (1986). Influence of Postemergence Herbicides on Populations of Bean Leaf Beetle, Cerotoma trifurcata (Coleoptera: Chrysomelidae) and Corn Earworm, Heliothis zea (Lepidoptera: Noctuidae), in Soybeans. *J.Econ.Entomol.* 79: 261-265.

EcoReference No.: 72071
Chemical of Concern: MFD,SXD,FZFB; Habitat: T; Effect Codes: POP; Rejection Code: NO MIXTURE(SXD,MFD,FZFB),CONTROL(ACR).

Arnold, C. E., Aldrich, J. H., and Martin, F. G. (1983). Vegetative and Flowering Response of Peach to Mefluidide. *Act Hortic* 137: 145-152.

EcoReference No.: 44149
Chemical of Concern: MFD; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(MFD).

Atkin, J. C. (1984). The Use of Mefluidide to Control Grass Growth in Amenity Areas. *Asp App Biol* 6: 45-53.

EcoReference No.: 31485
Chemical of Concern: MFD; Habitat: T; Rejection Code: TARGET(MFD).

Banko, T. J. (1985). Evaluation of Growth Regulator Effects of Embark, Atrinal, Blazer, and Bayleton on Container-Grown Azaleas . *J.Environ.Hortic.* 3: 149-152.

EcoReference No.: 31450
Chemical of Concern: TDF,ACF,DKGNa,MFD; Habitat: T; Effect Codes: GRO; Rejection Code: OK(ACF),NO ENDPOINT(TDF,TARGET-DKGNa,MFD).

Belander, G. and Winch, J. E. (1985). Herbicides for Sod-Seeding Legumes on Shallow Soil Pastures. *Can.J.Plant Sci.* 65: 1049-1055.

EcoReference No.: 44163
Chemical of Concern: GYP,MFD,FZFB,PAQT; Habitat: T; Effect Codes: POP,BCM; Rejection Code: OK(ALL CHEMS),OK TARGET(MFD).

Chappell, W. E., Coartney, J. S., and Link, M. L. (1977). Plant Growth Regulators for Highway Maintenance. *Proc.South.Weed Sci.Soc.* 30: 300-305.

EcoReference No.: 40596
Chemical of Concern: MFD,MLH; Habitat: T; Effect Codes: GRO,REP; Rejection Code: OK(ALL CHEMS),OK TARGET(MFD).

Elkins, D. M., Vandeventer, J. W., and Briskovich, M. A. (1977). Effect of Chemical Growth Retardants on Turfgrass Morphology. *Agron J* 69: 458-461.

EcoReference No.: 43015
Chemical of Concern: MFD,MLH; Habitat: T; Effect Codes: GRO,MOR; Rejection Code: OK(ALL CHEMS),OK TARGET(MFD).

Field, R. J. and Whitford, A. R. (1983). Response of Perennial Ryegrass, Prairie Grass, and Browntop to the Growth Retardant, Mefluidide. *Nz J Exp Ag* 11: 199-203 .

EcoReference No.: 44162
Chemical of Concern: MFD; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).

Gerrish, J. R. and Dougherty, C. T. (1983). Tall Fescue Sward Response to Mefluidide and Nitrogen. *Agron J* 75(6): 895-898.

EcoReference No.: 32345
Chemical of Concern: MFD; Habitat: T; Rejection Code: TARGET(MFD).

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