Ecological Risk Assessment

Section 3 (New Use on Sorghum)
Propazine
(PC Code 080808, CASN 139-40-2)

IUPAC Name: 6-chloro-N2,N4-di-isopropyl-6-methylthio-1,3,5-triazine-2,4-diamine

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. EXECUTIVE SUMMARY

A. Nature of Chemical Stressor

The Environmental Fate and Effects Division (EFED) has reviewed the proposed new use of propazine (2-chloro-4,6-bis(isopropylamino)-s-triazine) for weed control in sorghum (grain and sweet). Propazine is part of the triazine herbicide family (such as atrazine, cyanazine, simazine) and is very effective at stopping the photosynthetic process in susceptible plants by binding to specific sites within the plant's chloroplasts. Propazine is currently registered for use on container grown ornamentals in greenhouses (Propazine 4L; EPA Reg. No. 1812-352). Propazine is formulated as flowable concentrate and proposed applications are via ground or aerial equipment.

For the 1993, 1994, 1995, 1996, and 1997 use seasons, at the request of sorghum growers, EPA granted section 18 emergency exemptions for the use of propazine in the five states of highest sorghum use: Colorado, Kansas, New Mexico, Oklahoma, and Texas Environmental fate studies indicate that propazine is moderately persistent and mobile. When applied in an outdoor environment, propazine has a high potential to leach into ground water or reach surface waters by runoff. In areas where the soils are highly permeable, the water table is shallow, and sufficient precipitation and/or irrigation occur, the use of propazine may result in surface and ground water contamination. In addition, the use of propazine on sorghum as specified on the proposed label prohibits use on sand, loamy sand, heavy clay, and high organic matter soils. As such, the risk conclusions contained in this assessment would not apply to these soil types.

B. Potential Risks to Non-target Organisms

This screening risk assessment indicates that at the maximum proposed propazine application rate for sorghum, the chronic Level of Concern (LOC) for freshwater invertebrates inhabiting surface waters adjacent to a propazine treated field is exceeded and these organisms may be at risk for adverse chronic effects on survival and growth when exposed to propazine in surface runoff and/or leachate as a result of spray application. Based on the available data, low risks are anticipated for freshwater and marine/estuarine invertebrates following acute exposure and to freshwater and marine/estuarine fish and marine/estuarine invertebrates following chronic exposure. Potential risk to freshwater and marine/estuarine fish following acute exposure could not be estimated due to lack of valid toxicity data. Lack of toxicity data do not rule out the possibility of risk to fish following acute exposure.

There are exceedances of the LOCs for endangered vascular and non-vascular aquatic plants for runoff/drift from ground and aerial spray applications of propazine to sorghum. However, there are no exceedances of LOCs for unlisted vascular aquatic plants. There are exceedances of LOCs for unlisted non-vascular aquatic plants, assuming that the maximum predicted propazine concentrations would come in contact with freshwater non-vascular plants. Consequently, endangered vascular and non-vascular plants and non-endangered non-vascular plants inhabiting surface waters adjacent to a treated field would be at risk for adverse effects to growth and development when exposed to propazine as a result of the proposed labeled use on sorghum. Although there are

currently no listed non-vascular plants, there is concern for indirect effects on organisms dependent upon non-vascular plants for survival.

Acute avian risk quotients (RQs) were not calculated because the results of the toxicity studies indicate that the acute LD_{50} and LC_{50} are greater than highest dose/concentration tested with no mortalities. A qualitative assessment was conducted comparing the estimated Environmental Exposure Concentrations (EECs) with the highest dose/concentration tested in each study. The highest EECs ranged from 4-fold lower to more than an order of magnitude lower than the highest dose/concentration tested in the acute oral and dietary avian studies. Therefore, the acute risk of mortality to birds, reptiles and terrestrial-phase amphibians is low. There is, however, a concern for acute sublethal effects (weight loss) as these effects are observed at anticipated EECs. No chronic avian toxicity data are available; therefore, no risks were estimated. Lack of toxicity data do not rule out the possibility of risk to birds, reptiles and terrestrial-phase amphibians following chronic exposure. The observed sublethal effects in birds following acute exposure and the observed effects in mammals following chronic exposure increase the uncertainty over the potential risk to birds, reptiles and terrestrial-phase amphibians following chronic exposure.

The chronic LOC is exceeded for all weight classes of mammals consuming short grasses, tall grasses, and broadleaf forage/small insects at both the maximum and mean predicted residue levels; and for 15 and 35 g mammals consuming fruit and large insects at the maximum predicted residue levels. Consequently, mammals would be at risk for effects on reproduction and/or growth following chronic exposure to propazine with the proposed labeled use. As with birds, acute mammalian risk quotients (RQs) were not calculated because the results of the toxicity study indicated that the acute LD_{50} is greater than highest dose tested. A qualitative assessment, comparing the estimated Environmental Exposure Concentrations (EECs) with the highest dose tested indicates that there is no concern for acute risk to mammals because the EECs are less than an order of magnitude of the highest dose tested in the acute mammalian study.

For the aerial spray application of propazine and the maximum application rate, the acute LOC was exceeded for nonendangered monocots and dicots located in adjacent areas and in semi-aquatic areas primarily as a result of runoff; and for both nonendangered monocots and dicots as a result of spray drift. Likewise, the acute LOC was exceeded for nonendangered monocots in semi-aquatic areas and nonendangered dicots in adjacent and semi-aquatic areas as the result of runoff from ground spray applications. For both ground and aerial spray application, the LOC was exceeded for endangered monocots and dicots located in adjacent and semi-aquatic areas primarily as a result of runoff. The LOC for endangered species was also exceeded for monocots and dicots in dry areas exposed to spray drift from aerial applications. Consequently, nonendangered and endangered monocots and dicots inhabiting dry and semi-aquatic areas adjacent to a treated field would be at risk for adverse effects to growth and development following exposure to propazine with the proposed labeled use.

Tables I-B1 and I-B2 summarize the environmental risk conclusions for aquatic and terrestrial animals and plants.

Table I-B1. Summary of environmental risk conclusions for aquatic animals and plants			
Taxa	**Assessment Endpoint**	**Use Patterns with LOC Exceedances**	**Summarized Risk Characterization and Important Uncertainties**
Freshwater Fish and Aquatic Phase Amphibians	Acute Risk	Unknown	No valid acute toxicity data are available. Lack of data does not rule out potential risk.
	Chronic Risk	None	Chronic LOCs are not exceeded for any of the proposed uses.
Freshwater Invertebrates	Acute Risk	None	LC_{50} > highest concentration tested (HCT). Highest peak aquatic EEC 61 times lower than HCT for this use; therefore, concern for acute risk to freshwater invertebrates is low.
	Chronic Risk	Chronic LOC exceeded for both Kansas (aerial) and Texas (aerial and ground) scenarios (1.2 lbs ai/A, 1 application/year).	Application rate for Texas scenario needs to be reduced by 46% to 0.65 lb ai/A for the chronic LOC not to be exceeded. For Kansas scenario, rate needs to be reduced by 5% for chronic LOC not to be exceeded.
Marine/ Estuarine Fish	Acute Risk	Unknown	No valid acute toxicity data are available. Lack of data does not rule out potential risk.
	Chronic Risk	None	Chronic LOCs are not exceeded for any of the proposed uses.
Marine/ Estuarine Invertebrates	Acute Risk	None	Acute LOCs are not exceeded for any of the proposed uses.
	Chronic Risk	None	Chronic LOCs are not exceeded for any of the proposed uses.
Aquatic Plants	Acute Risk	Acute endangered species LOCs exceeded for aquatic non-vascular and vascular plants for both Texas and Kansas sorghum scenarios (1.2 lbs ai/A, 1 application/year).	Although no listed non-vascular plants, there is still a concern for indirect effects on organisms dependent upon non-vascular plants for food and shelter. Application rates need to be reduced by 93% for the LOC for aquatic plants not to be exceeded.

Table I-B2. Summary of environmental risk conclusions for terrestrial animals and plants			
Taxa	**Assessment Endpoint**	**Use Patterns with LOC Exceedances**	**Summarized Risk Characterization and Important Uncertainties**
Birds, Reptiles and Terrestrial Phase Amphibians	Acute Risk	None	Avian RQs not calculated; acute LD_{50} and LC_{50} > highest dose/concentration tested with no mortalities. Highest EECs range from 4-fold to an order of magnitude less than highest dose/concentration tested. Therefore, acute risk of mortalities is low. Sublethal effects (weight loss) may occur at anticipated EECs.
	Chronic Risk	Unknown	No chronic avian toxicity data available; sublethal effects in birds following acute exposure and observed effects in mammals following chronic exposure increase the uncertainty over the potential risk to birds, reptiles and terrestrial-phase amphibians

Table I-B2. Summary of environmental risk conclusions for terrestrial animals and plants			
Taxa	**Assessment Endpoint**	**Use Patterns with LOC Exceedances**	**Summarized Risk Characterization and Important Uncertainties**
			following chronic exposure.
Mammals	Acute Risk	None	Mammalian RQs not calculated; acute LD_{50} > HDT. Highest EEC an order of magnitude less than the HDT. Therefore, acute risk of mortalities is low.
	Chronic Risk	Chronic LOC exceeded for 1.2 lbs ai/A, 1 application/year with both Kansas and Texas scenarios.	Chronic LOC exceeded for all weight classes of mammals consuming short grasses, tall grasses, and broadleaf forage/small insects; 15 and 35 g mammals consuming fruit and large insects.
Non-target Invertebrates	Acute Risk	Not quantitatively assessed.	Propazine is relatively non-toxic with a 96-hr. mortality rate of 2.47% at a dose of 96.69 µg/bee. Acute risks to terrestrial insects likely to be low.
Terrestrial Plants	Acute Risk	Acute LOC exceeded for nonendangered monocots and dicots (1.2 lbs ai/A, 1 application/year.	Acute LOC exceeded for nonendangered monocots and dicots for both ground and aerial spray application (1.2 lbs ai/A, 1 application/year). Nonendangered and endangered monocots and dicots inhabiting dry and semi-aquatic areas adjacent to a treated field at risk.

Table I-B3 summarizes the listed species at risk associated with either direct or indirect effects following application of propazine at the requested rates.

Concerns For Federally Listed as Endangered and/or Threatened Species

Table I-B3. Listed species risks associated with direct or indirect effects due to applications of propazine on sorghum		
Listed Taxon	**Direct Effects**	**Indirect Effects**
Terrestrial and semi-aquatic plants - monocots	Yes	Yes through effects to pollinators (mammals; uncertain with birds, reptiles, terrestrial-phase amphibians)
Terrestrial and semi-aquatic plants - dicots	Yes	Yes through effects to pollinators (mammals; uncertain with birds, reptiles, terrestrial-phase amphibians)
Terrestrial invertebrates	No for terrestrial insects; unknown for other terrestrial invertabrates (insufficient data)	Yes through effects to terrestrial and aquatic plants (food and habitat)
Birds	Possible: no chronic avian data; sublethal effects in acute studies coupled with similar effects in mammalian reproduction study increase uncertainty for birds.	Yes through effects to terrestrial and aquatic plants (food and habitat), mammals, freshwater invertebrates)
Terrestrial-phase amphibians	Possible: no acute or chronic data and no chronic avian data (see comment for birds)	Yes through effects to terrestrial and aquatic plants (food and habitat), mammals, freshwater invertebrates)
Reptiles	Possible: no acute or chronic	Yes through effects to terrestrial

Table I-B3. Listed species risks associated with direct or indirect effects due to applications of propazine on sorghum		
Listed Taxon	**Direct Effects**	**Indirect Effects**
	data and no chronic avian data (see comment for birds)	and aquatic plants (food and habitat), mammals, freshwater invertebrates)
Mammals	Yes with chronic exposure.	Yes through effects to terrestrial and aquatic plants, mammals, freshwater invertebrates.
Aquatic non-vascular plants*	Yes	No
Aquatic vascular plants	Yes	No
Freshwater fish	Unknown with acute exposure (no acute data); No after chronic exposure.	Yes through effects to terrestrial plants (stream quality), aquatic plants (food and habitat) and freshwater invertebrates (food)
Aquatic-phase amphibians	Unknown with acute exposure (no acute data); using chronic data on fish as surrogate – No after chronic exposure.	Yes through effects to terrestrial plants (stream quality), aquatic plants (food and habitat) and freshwater invertebrates (food)
Freshwater crustaceans	Using data on daphnia as surrogate – No after acute exposure and Yes after chronic exposure.	Yes through effects to terrestrial plants (stream quality), aquatic plants (food and habitat) and other freshwater invertebrates (food).
Mollusks	No after acute exposure; Using chronic data on crustaceans as surrogate - No after chronic exposure.	Yes through effects to terrestrial plants (stream quality) and aquatic plants (food and habitat).
Marine/estuarine fish	Unknown: no acute data No after chronic exposure.	Yes through effects to terrestrial plants (tributary/estuary quality) and aquatic plants (food and habitat)
Marine/estuarine crustaceans	No after acute and/or chronic exposure.	Yes through effects to terrestrial plants (tributary/estuary quality), aquatic plants (food and habitat) and other marine/estuarine invertebrates (food).

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

As noted above, propazine may not be applied to selected soils and as such the risk conclusions do not apply to locations where sorghum is grown on these soils. More details on the risk conclusions can be found in the Executive Summary of the Ecological Risk Science Chapter for propazine.

C. Conclusions – Exposure Characterization

Propazine, like the other triazine chemicals, is weakly basic (pKa = 1.85 at 22°C), can be easily protonated at low soil pH values, and is likely to exist as a neutral species at soil pH values more than two pH units above the pKa. Adsorption of protonated propazine is pH-dependent, with a maximum adsorption at or near the pKa. Soil organic matter plays an important role in the adsorption of propazine and other s-triazines, affecting their movement in soil.

The herbicide propazine is expected to be persistent and mobile in most soils, and it is resistant to breakdown by hydrolysis, photolysis, or biodegradation. Propazine does not adsorb as strongly to soil particles as other triazine herbicides. In most soils used in batch equilibrium studies, especially sand and sandy loam soils, it binds weakly to soil particles. Likewise, studies have shown that depending on soil temperature, moisture, and pH, it can become unbound. It is therefore very likely that in areas where soils are highly permeable, the water table is shallow, or where there is irrigation and/or high rainfall, the use of propazine may result in ground water contamination.

Routes of aquatic exposure evaluated in this screening risk assessment focused on deposition, runoff and spray drift from aerial and ground applications of propazine. The propazine exposure characterization, combined the environmental fate data with the Tier II models Pesticide Root Zone Model (PRZM) version 3.12beta and Exposure Analysis Modeling System (EXAMS) version 2.98 linked to simulate the transport of the pesticide off the field, and to estimate EECs in a standard pond based on the propazine aerial and ground applications at the proposed maximum application rate for sorghum (1.2 lb a.i./acre).

Routes of exposure for the terrestrial assessment of birds and mammals were developed using the T-REX (Ver.1.2.3) model to estimate propazine residues on food types as the result of application to sorghum. Likewise, EECs for non-target terrestrial plants were estimated for broadcast spray application using the TerrPlant (Ver 1.0) model in conjunction with AgDrift (Ver. 2.0.1). AgDrift provides further refinement of spray drift dispersion and deposition to plants located in proximity to treated fields or treated water bodies. There were no reported incidents from propazine use recorded in the Ecological Incident Information System (EIIS) as of June 2006.

D. Conclusions – Effects Characterization

The submitted acute toxicity study with a freshwater invertebrate (daphnid) provides a 48-hr EC_{50} value of >5.32 ppm ai (NOAEC 5.32 ppm ai, highest concentration tested) for the TGAI. No valid acute freshwater fish studies are available for propazine.

For freshwater fish (early life-stage or a full life-cycle test), propazine induced a significant reduction in length in fathead minnows with a NOAEC of 0.72 mg ai/L. Likewise, propazine induced reductions in growth (length and weight) in daphnids with a NOAEC of 0.047 ppm ai.

Propazine is categorized as moderately toxic to the mysid shrimp, based on mortality and sublethal effects (LC_{50} = 4.20 ppm ai). Propazine is categorized as practically non-toxic to the eastern oyster at the limit of solubility with an EC_{50} >3.72 mg ai/L. In an early life-stage study with sheepshead minnow, propazine affected embryo survival and hatching success at 2.59 mg ai/L with a NOAEC of 1.34 mg ai/L. This study was used to assess the chronic risk of propazine to estuarine/marine fish. For the life-cycle toxicity study with estuarine/marine invertebrates, propazine induced significant effects to growth and reproduction at 0.706 ppm ai in mysid shrimp with a NOAEC of 0.269 ppm ai. No

toxicity studies were submitted by the registrant to assess the acute risk of propazine to estuarine/marine fish species.

Aquatic plant toxicity studies with propazine provide an EC_{50} of 0.10 ppm ai for freshwater vascular plants (duckweed) with a NOAEC of 0.022 ppm ai, based on frond density. The lowest EC_{50} for freshwater non-vascular plants (diatom) is 0.0248 ppm ai with a NOAEC of 0.0065 ppm ai, based on cell density.

Available acute toxicity data indicate propazine is at most, slightly toxic to birds. The upland gamebird acute oral LD_{50} value was >1,640 mg ai/kg. There were no mortalities. A NOAEL was determined to be 244 mg ai/kg based on weight loss. The acute dietary LC_{50}s were >4,930 ppm and >5,140 for bobwhite quail and mallard, respectively. No avian reproduction studies were submitted by the registrant.

Propazine is categorized as practically non-toxic to small mammals on an acute oral basis (LD_{50} value >5,050 mg/kg). In a 3-generation reproduction study with rats, no treatment-related effects on reproduction were observed; consequently, the NOAEL for reproductive toxicity was ≥50 mg/kg bw/day, the highest dose tested. The parental/offspring NOAEL was 5 mg/kg/day based on decreased body weights in both sexes.

Terrestrial plant toxicity studies with monocots and dicots indicate that seedling emergence and vegetative vigor are severely impacted by exposure to propazine. Seedling emergence, based on shoot weight, was adversely impacted in monocots (onion) at an EC_{25} of 0.035 lb ai/A and in dicots (lettuce) with an EC_{25} of 0.016 lb ai/A. Vegetative vigor in monocots, based on shoot weight, was adversely impacted in monocots (wheat) at an EC_{25} of 0.046 lb ai/A and in dicots (cucumber) at an EC_{25} of 0.10 lb ai/A. The observed effects to monocots and dicots included stunting, chlorosis, necrosis, and plant death.

E. Uncertainties and Data Gaps

There are a number of areas of uncertainty in the terrestrial and the aquatic organism risk assessment that could potentially cause an underestimation of risk. First, this assessment accounts only for exposure of non-target organisms to propazine, but not to its degradation products. The risks presented in this assessment could be underestimated if degradates also exhibit toxicity under the conditions of use as stated on the label as limited data are available concerning the toxicity of the degradates. Second, the risk assessment only considers the most sensitive species tested from a limited set of toxicity studies conducted with relatively few species and only considers a subset of possible use scenarios. For the aquatic organism risk assessment, there are uncertainties associated with the PRZM/EXAMS models, input values, and the use of surrogate scenarios. The potential impacts of these uncertainties are outlined in the Aquatic Exposure, the Terrestrial Exposure and the Risk Characterization sections of this document.

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

Acute risks for freshwater fish were not characterized because the submitted study was determined to be invalid based on solubility issues. A high degree of uncertainty exists for the freshwater toxicity data for propazine until it can be shown that the results reflect that the tests were conducted up to the limit of solubility or provide a definitive median lethal concentration. An acceptable study will improve the certainty of the ecological risk assessment.

Chronic risk to avian species was not characterized because no studies with the TGAI were submitted. Sublethal effects in the acute avian studies coupled with similar effects observed in the mammalian reproduction study increase the uncertainty of effects in birds following chronic exposure.

Current data are not available to assess potential risk of propazine degradates to aquatic fish and invertebrates and terrestrial plants.

Fate studies indicate propazine is persistent and mobile raising concerns about the impact on groundwater and surface water. The field dissipation studies that have been submitted are considered unacceptable or supplemental resulting in a significant uncertainty for this transport pathway. To address this uncertainty, studies are needed to comprehensively ascertain the mobility of propazine and its degradates under field conditions.

No aerobic or anaerobic aquatic metabolism studies are available for use in this assessment. Therefore, EFED has made an assumption that propazine is two times as persistent in aerobic aquatic environments as it is in aerobic soil. Data on the aquatic metabolism of propazine will be needed to address this uncertainty.

Tables I-E1 and I-E2 summarize the environmental fate and ecological toxicity data gaps for propazine and the value of additional testing.

TABLE I-E1. Environmental Fate Data Requirements for Propazine

Guideline #	Data Gap	Value of Additional Testing
162-3	Anaerobic Aquatic Metabolism	**Medium**. Lack of date led to assumption of half life in aquatic exposure modeling. Submission of data can remove uncertainty in this assumption
162-4	Aerobic Aquatic Metabolism	**Medium**. Lack of date led to assumption of half life in aquatic exposure modeling. Submission of data can remove uncertainty in this assumption
164-1	Terrestrial Field Dissipation	**Low**. Data classified as supplemental. Additional data, or a new study, needed to confirm leaching potential of compound. Lack of storage stability data and fact that propazine was found in controls is problematic.

TABLE I-E2. Ecological Toxicity Data Requirements for Propazine		
Guideline #	**Data Gap**	**Value of Additional Testing**
71-4	Avian reproduction (bobwhite quail) (mallard duck)	**High.** No study is available. Other chemicals in this class indicate reproductive effects to birds. Sublethal effects in the acute avian studies coupled with similar effects observed in the mammalian reproduction study increase the uncertainty for effects observed in birds following chronic exposure.
72-1	Freshwater fish acute LC_{50} (rainbow trout) (bluegill sunfish)	**Medium.** No valid studies available. Chronic toxicity NOAEC/LOAEC from fathead minnow study plus a comparison with chemicals from similar class indicate that LC_{50} is likely sufficiently high not to exceed acute LOC for endangered species.
72-2	Freshwater invertebrate acute EC_{50} (daphnia)	**Pending.** A study has been reviewed but not finalized by the Agency (MRID 442873-05). The study is scientifically sound but does not fulfill guideline requirements because daphnids were not exposed up to 100 ppm ai. Consequently, the acute toxicity of propazine to freshwater invertebrates cannot be categorized. If it can be shown that the test was conducted up to the limit of solubility, the study could be upgraded to acceptable. However, for these requested uses, a comparison of the highest concentration tested in the daphnid study with the peak EEC for the proposed uses shows that there were no effects in daphnids at concentrations 61 times higher than the highest peak EEC.
72-3a	Estuarine/marine fish acute LC_{50} (sheepshead minnow)	**Medium.** No studies available. Chronic toxicity NOAEC/LOAEC from sheepshead minnow study plus a comparison with chemicals from similar class indicate that LC_{50} is likely sufficiently high not to exceed acute LOC for endangered species.
72-4a	Freshwater fish early life stage (fathead minnow)	**Low.** The study was classified as supplemental because pH and hardness exceeded recommended levels, potentially affecting solubility.
72-4d	Estuarine/marine invertebrate life cycle (mysid)	**Low.** The study was classified as supplemental due to deviations in study design.

II. PROBLEM FORMULATION

A. Stressor Source and Distribution

1. Source and Intensity

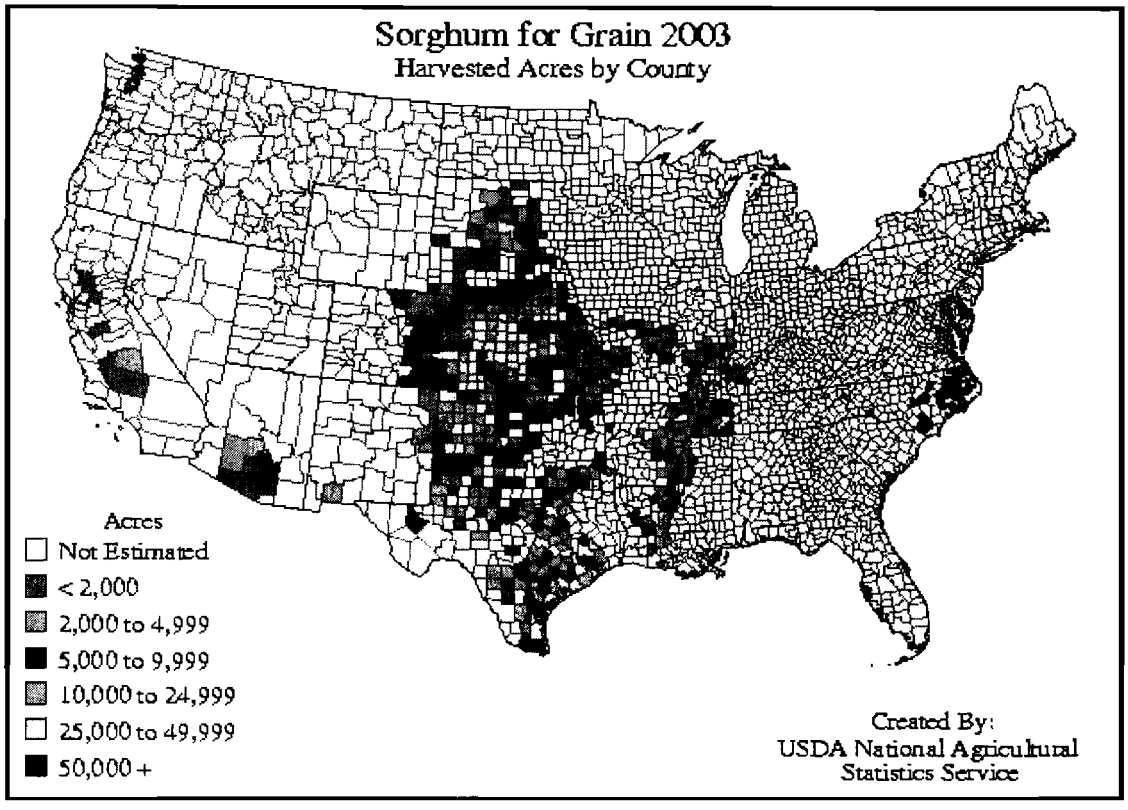


Figure II-A1. Sorghum growing areas in the US (USDA, 2003 data).

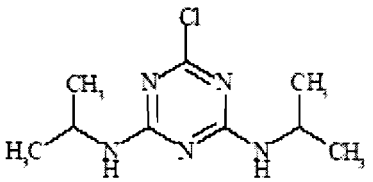
The proposed use of propazine (2-chloro-4,6-bis(isopropylamino)-s-triazine) is for weed control in sorghum (grain and sweet). The proposed label allows one application per crop cycle (growing season) with the maximum application rate for sorghum of 1.2 lb a.i./acre (A). Figure II.a.1. depicts areas in the US where sorghum was grown and harvested in 2003 thus providing an indication of likely propazine use areas. Potential use areas are indicated in the Midwest states of Colorado, New Mexico, Kansas, Nebraska, Oklahoma, Texas and South Dakota, southern regions of Arizona and California, along the Mississippi river valley and along the eastern coastal regions of North Carolina and Maryland. Propazine is currently registered for use on container grown ornamentals in greenhouses (Propazine 4L; EPA Reg. No. 1812-352).

2. Physical/Chemical/Fate and Transport Properties

Propazine is a colorless crystalline solid. It is stable in neutral, slightly acid, or alkaline media, but is hydrolyzed by stronger acids and alkalis. It is nonflammable and non corrosive under normal use conditions, however may burn if exposed to heat or flame. Thermal decomposition may produce toxic oxides of carbon and nitrogen, and toxic and

corrosive fumes of chlorides. Table II-A1 provides a summary of some properties for propazine.

Propazine is expected to be moderately persistent and mobile in most soils, and it is resistant to breakdown by hydrolysis, photolysis, or biodegradation. Batch equilibrium experiments suggest that propazine is mobile, with Freundlich K_d values ranging from 0.67 to 3.19 in two separate studies involving 8 soil textures. The K_{oc} values ranged from 65 to 268 in these same studies. The mobility of propazine is also noted in the supplemental terrestrial field dissipation studies suggesting that propazine dissipates slowly from the upper 6 inches (half-lives of 51 days in TX, and 7 to 58 days in NC, <30 to 149 days in NY, <31 days in CA, and 60 to >357 days in NE) and may leach to ground water. It has also been reported in the literature that if released to soil, propazine will persist longer in dry or cold conditions or other conditions which inhibit biological and chemical activity (Worthing, C.R., ed., 1983. "The pesticide manual: A world compendium. Croydon, England: The British Crop Protection Council"). Therefore, it is very likely that the use of propazine may result in groundwater and/or surface water contamination in areas where soils are highly permeable, the water table is shallow, or where there is irrigation and/or high rainfall. Volatility and air photolysis are not expected to be major routes of dissipation due to the low vapor pressure (2.9×10^{-8} torr at 20°C).



Common name: Propazine
Chemical name: 2-chloro-4,6-bis(isopropylamino)-s-triazine
CAS number: 139-40-2
Trade names: Propazine 4L

Table II-A1. Physical and Chemical Properties of Propazine

Molecular formula	$C_9H_{16}ClN_5$
Molecular weight	229.71
Physical state	Crystal
Melting point	212-214°C
Vapor pressure	2.9×10^{-8} mm Hg at 20°C
Water solubility	8.6 mg/L water at 20°C
Henry's Law Constant	1.02×10^{-9} atm.m^3/mol (calculated)
Log K_{ow}	2.91
pK_a	1.85 at 22°C

3. Pesticide Type, Class and Mode of Action

Propazine is part of the triazine herbicide family (such as atrazine, cyanazine, simazine) and is very effective at stopping the photosynthetic process in susceptible plants by binding to specific sites within the plant's chloroplasts. The mode of action is inhibition of photosynthesis by stopping electron flow in Photosystem II, which in turn inhibits the

formation and release of oxygen. Currently, Griffin L.L.C. is seeking registration for propazine as a selective herbicide for control of weeds in sorghum.

4. Overview of Pesticide Usage

Propazine has been previously registered for use on sorghum and in greenhouse ornamentals. However, due to economic considerations, in 1990, the propazine registration for sorghum was voluntarily cancelled by the Registrant (then Ciba-Geigy). For the 1993, 1994, 1995, 1996, and 1997 use seasons, at the request of sorghum growers, EPA granted section 18 emergency exemptions for the use of propazine to the five states of highest sorghum use: Colorado, Kansas, New Mexico, Oklahoma, and Texas. Currently, propazine is only registered for use on container grown ornamentals in greenhouses.

Propazine is proposed for use as a selective herbicide in sorghum before planting, at planting and after crop (sorghum) emergence for control of many annual broadleaf weeds such as pigweed, devil's claw, carpetweed, smartweed, kochia, morningglory, ragweed, velvetleaf and others. Application can be made via ground sprayer or aerial broadcast for sorghum. End use formulations of propazine that are manufactured by Griffin L.L.C. include a 98% wettable powder technical product and a 43% flowable concentrate end use product (Propazine 4L). Table II-A2 lists the food and non-food uses (based on application and use rates) for propazine according to the proposed label information.

Table II-A2. Use Information for Propazine 4L (43% a.i.)

Crop (Application type)	Soil Texture	Rate
Container-grown ornamentals in greenhouses (ground)	Sand, Loamy Sand, and Sandy Loam	0.0117 lb ai/1000ft^2
	Loam, Silt, Silty Loam, Silty Clay Loam, and Sandy Clay Loam	0.0195 lb ai/1000ft^2
	Sandy Clay, Clay Loam, Silty Clay Loam, and Peat-Lite Mixes	0.0352 lb ai/1000ft^2
Sorghum -Grain and Sweet (ground and aerial)	Sand, Loamy Sand, Heavy Clay, High OM	Do not use
	Sandy Loam, Loam, Silt Loam, and Clay Loam	1.2 lb ai/A

In addition, the use of propazine on sorghum as specified on the proposed label prohibits use on sand, loamy sand, heavy clay, and high organic matter soils. As such, the risk conclusions contained in this assessment would not apply to these soil types.

B. Receptors

For the screening level risk assessment on propazine, toxicological data generated on representative test species belonging to broad taxonomic groups are summarized, then utilized in an assessment of risk for each group. These data are obtained from registrant-submitted studies. Table II-E1 in the Analysis Plan section provides the taxonomic groups and surrogate test species evaluated for ecological effects in the screening-level risk assessment for propazine. Within each of these very broad taxonomic groups, an acute and/or chronic measure of effect is selected from the available test data. A

complete discussion of all toxicity data available for this risk assessment for propazine and the resulting measurements of effect selected for each taxonomic group are included in Appendix F.

1. Aquatic Effects

Spray drift and runoff to adjacent bodies of water are the most likely sources of propazine exposure to nontarget aquatic organisms, including endangered and threatened species. In addition, the mobility of propazine in soils indicates that in areas where soils are highly permeable, the water table is shallow, or where there is irrigation and/or high rainfall; leaching to groundwater may occur, which may result in exposure to aquatic organisms where a potential hydrological connection to surface water bodies exists. Propazine is not expected to bioaccumulate in aquatic organisms or to adsorb to sediments; consequently risk to benthic-dwelling organisms should be minimal.

For propazine, effects on aquatic organisms are estimated from acute and chronic laboratory studies submitted to the Agency by the registrant. The toxicity data for propazine will be used to assess risk to fish, aquatic invertebrates, and aquatic plants. Acute data are available for freshwater invertebrates [water flea (*Daphnia magna*)] and marine/estuarine invertebrates [eastern oyster (*Crassostrea virginica*) and saltwater mysid (*Mysidopsis bahia*)]. Reproductive or growth effects from chronic exposure are estimated from studies conducted with fish and invertebrates. For propazine, data are available to evaluate the chronic effects on freshwater fish and invertebrates and estuarine/marine fish and invertebrates. Toxicity data are available for aquatic vascular plants (duckweed, *Lemna gibba*); non-vascular algae (green algae, *Selenastrum capricornutum*; blue-green algae, *Anabaena flos-aquae*); and freshwater and marine diatoms (*Navicula pelliculosa, Skeletonema costatum*).

2. Terrestrial Effects

Ground deposition from spray application and spray drift with resulting residues on foliage and on flowers and seeds are the most likely sources of propazine exposure to nontarget terrestrial organisms, including endangered and threatened species. Current data were not provided to determine the potential exposure to birds, mammals, and pollinators from residues on foliage, flowers, and seeds. The effect of acute exposure to propazine on all bird species is estimated from acute oral and dietary studies on either bobwhite quail (*Colinus virginianus*) and/or mallard duck (*Anas platyrhynchos*). These species also act as surrogates for reptiles and terrestrial-phase amphibians. Propazine acute oral toxicity effects data are available for the bobwhite quail only. Acute dietary toxicity data are available for both bobwhite quail and mallard duck. No toxicity studies have been conducted to determine the potential chronic effects to birds or the effect of residues to pollinators.

Effects on mammals are estimated from acute and chronic laboratory studies reviewed by the Registration Division (RD) and Health Effects Division (HED), respectively. Propazine effects data for mammals are available for acute (rat) and chronic [(reproductive (rat) and developmental (rat and rabbit))] oral exposure. An additional source of exposure to propazine could be in puddled waters on treated fields through

preening and grooming, involving the oral ingestion of material from the feathers or fur. Propazine is expected to be moderately persistent and mobile in most soils and is resistant to breakdown by hydrolysis, photolysis, or biodegradation. Consequently, exposure to birds, small mammals, and soil invertebrates through dermal contact or ingestion of soils could occur. Exposure to propazine via inhalation would be expected to be low due to its low vapor pressure. Currently, screening level assessments do not address exposure via the dermal and inhalation routes (see Assumptions, Limitations, Uncertainties, Strengths and Data Gaps section for further explanation).

Spray drift presents a potential risk to non-target plants inhabiting edge habitats adjacent to target fields and riparian vegetation along streams and/or ponds in close proximity to sprayed fields. In addition, uptake in plant roots could occur through ground spray application. Studies (seedling emergence and vegetative vigor) were submitted to evaluate the effects of propazine to terrestrial monocots and dicots.

3. Ecosystems at Risk

The proposed uses of propazine could result in exposure to aquatic and terrestrial organisms inhabiting flowing, non-flowing or transient freshwater bodies and to wildlands (forests, wetlands and ecotones; such as edge and riparian habitats). For uses in coastal areas, aquatic habitats also include marine ecosystems, including estuaries. For both terrestrial and aquatic animal species, direct and indirect acute and chronic exposures are considered. For screening level assessment purposes, risk will be assessed to aquatic animals and plants assumed to occur in small, static ponds receiving runoff and drift from treated areas. Aquatic animal species of potential concern include freshwater fish and invertebrates, estuarine/marine fish and invertebrates, and amphibians. Aquatic plant species of concern include vascular and non-vascular plants.

The terrestrial ecosystems potentially at risk include the treated area and areas immediately adjacent to the treated area that might receive drift (wind dispersion) or runoff, and might include other cultivated fields, fence rows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats, wetlands, and other uncultivated areas. For screening level assessment purposes, risk will be assessed to terrestrial animals assumed to exclusively occur in the treated area. Terrestrial animal species of potential concern include birds, mammals, beneficial invertebrates, and earthworms. Propazine is readily absorbed through the foliage and roots of plants; consequently, it could be injurious to non-target plant species by drift, runoff, or root and foliar uptake. Terrestrial plant species of concern include monocots, dicots, and semi-aquatic plant species.

C. Assessment Endpoints

The typical assessment endpoints for screening-level pesticide ecological risk assessments are reduced survival and reproductive and growth impairment for both terrestrial and aquatic animal species. For terrestrial and semi-aquatic plants, the screening assessment endpoint is the perpetuation of populations of non-target species. Existing testing requirements have the capacity to evaluate emergence of seedlings and vegetative vigor. Although it is recognized that these endpoints 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 competitive ability and reproductive success. For aquatic plants, the assessment endpoint is the maintenance and growth of standing crop or biomass. Measures of effect for this assessment endpoint focus on algal and vascular plant growth rates and biomass measurements.

This ecological risk assessment considers single application at the maximum propazine application rate to fields that have vulnerable soils to estimate exposure concentrations. This assessment is not intended to represent a site- or time-specific analysis. Instead, it is intended to represent high-end exposures at a national level. Likewise, the most sensitive toxicity endpoints are used from surrogate test species to estimate treatment-related direct effects on acute mortality and chronic reproductive, growth and survival assessment endpoints. Toxicity tests are intended to determine effects of pesticide exposure on birds, mammals, fish, terrestrial and aquatic invertebrates, and plants. These tests include short-term acute, subacute, and reproduction studies and are typically arranged in a hierarchical or tiered system that progresses from basic laboratory tests to applied field studies. The toxicity studies are used to evaluate the potential of a pesticide to cause adverse effects, to determine whether further testing is required, and to determine the need for precautionary label statements to minimize the potential adverse effects to non-target animals and plants (CFR 40 §158.202, 2002). A summary of measurements of effect selected to characterize potential ecological risks associated with exposure to propazine are provided in Table II-E1 in the Analysis Plan section.

In order to protect threatened and endangered species, all assessment endpoints are measured at the individual level. Measuring endpoints at the individual level also provides 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.

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 drift may impact the sites.

D. Conceptual Model

1. Risk Hypotheses

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

Based on the mobility and persistence of propazine, the mode of action, and the food-web of the target aquatic and terrestrial ecosystems, propazine has the potential to cause

reduced survival, and reproductive and growth impairment for both aquatic and terrestrial animal and plant species.

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

2. Diagram

All potential routes of exposure are considered and are presented in the conceptual site model. The conceptual site model shown in Figure II-D1 for ground and aerial spray applications generically depicts the potential source of propazine, release mechanisms, abiotic receiving media, biological receptor types, and effects endpoints of potential concern.

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. The assessment of ecological exposure pathways, therefore, includes an examination of the source and potential migration pathways for constituents, and the determination of potential exposure routes (e.g., ingestion, inhalation, dermal absorption).

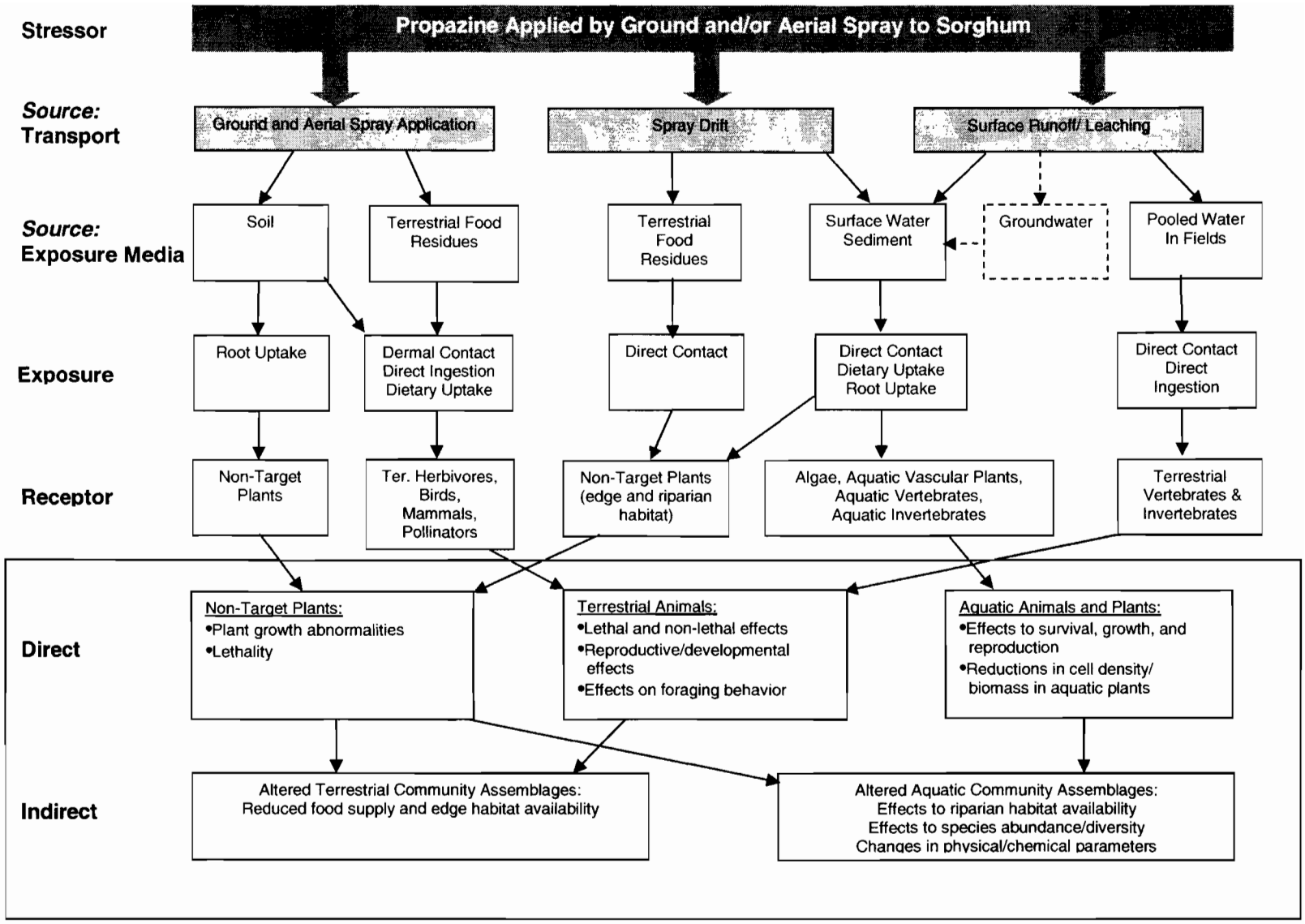


Figure II-D1. Ecological Risk Assessment Conceptual Model for Propazine

E. Analysis Plan

The Agency's new use science chapter for propazine consists of a deterministic screening level risk quotient analysis. The aquatic and terrestrial assessments focus on the proposed agricultural use of propazine for weed control in sorghum with the highest application rate (1.2 lb ai/A) as specified by the current label (as of 8/01/05). Potential exposure pathways (i.e., runoff and spray drift) result from ground and aerial application of aqueous propazine formulations to sorghum.

The Agency reviewed the available laboratory environmental fate data submitted in support of the proposed new use of propazine to determine propazine persistence and mobility. Based on this data, the Agency developed its quantitative aquatic assessment of propazine exposure using the PRZM/EXAMS model to represent potential propazine use areas. Likewise, terrestrial wildlife may be exposed to propazine through the plant or animal material that they contact or consume as food. For ground and aerial spray applications of propazine, exposure to terrestrial wildlife was estimated by relating food item residues to pesticide application using the Kenaga nomogram as modified by Fletcher (Hoerger and Kenaga, 1972; Fletcher *et al.*, 1994). A computer model (T-REX, Version 1.2.3) was used to predict degradation of residues on foliar surfaces and insects. For mammals, the residue concentration was converted to a daily oral dose based on fractions of body weight consumed daily. Terrestrial non-target plant exposure characterization employed runoff and spray drift scenarios based on propazine use on sorghum and were estimated using OPP's TerrPlant model (Version 1.0) as well as the AgDrift 2.0.1 model to provide further refinement of spray drift dispersion and deposition to terrestrial plants located in proximity to treated fields.

The most sensitive aquatic and terrestrial eco-toxicological values from studies submitted to the Agency were used in this quantitative assessment. Risks were estimated based on a deterministic approach, where a single point estimate of toxicity is divided by an exposure estimate to calculate a risk quotient (RQ). The acute and chronic RQ values for each taxonomic group identified as an assessment endpoint were compared to the Agency's Levels of Concern (LOCs). LOCs serve as criteria for categorizing potential risk to non-target organisms. RQ values were calculated in the risk estimation section for each endpoint, and characterization and interpretation of risk is described in the risk description. Risks for each taxonomic group were described based on available lines of evidence from registrant-submitted studies, open literature, and incident reports. In addition, a preliminary assessment of listed species of concern was also completed.

No degradates were included in this assessment. One major degradate detected at > 10% of applied, hydroxyl-propazine (2-hydroxy-4,6-bis(isopropylamino)-s-triazine) was not included in this assessment due to the fact that it was determined to not be of toxicological concern in the assessments for atrazine and simazine and the fact that no environmental fate data was available. The minor degradates, desethylatrazine (2-amino-4-chloro-6-isopropylamino-s-triazine or DEA) and 2,4-diamino-6 chloro-s-triazine (DACT), were not included in this assessment mostly due to their low detection in the laboratory soil metabolism studies and in the terrestrial field studies (less than 5% of

Total Applied Radioactivity (TAR)). Laboratory and field studies indicate that DEA and DACT, if formed in the environment, would not be present nor would persist at any significant concentration compared to parent propazine to adversely impact the results of the ecological risk assessment. In addition, toxicity studies indicate that the degradates exhibit similar toxic responses in birds, mammals and aquatic plants as the parent propazine.

Table II-E1 summarizes the assessment endpoints and measures of ecological effects and exposure used in the ecological risk assessment for propazine.

Table II-E1. Assessment Endpoints and Measures of Ecological Effects and Exposure for Propazine			
Taxonomic Group	**Assessment Endpoint (Abundance)**	**Surrogate Species and Measures of Ecological Effect**	**Measures of Exposure**
Birds [a]	Survival	Bobwhite quail acute oral LD_{50} Bobwhite quail and mallard duck subacute dietary LC_{50}	Maximum residues on food items (foliar)
	Reproduction and growth	Bobwhite quail and mallard duck chronic reproduction NOAEC and LOAEC (no studies available)	
Mammals	Survival	Laboratory rat acute oral LD_{50}	
	Reproduction and growth	Laboratory rat oral reproduction chronic NOAEC and LOAEC	
Freshwater fish [b]	Survival	Rainbow trout and bluegill sunfish acute LC_{50} (no valid study available)	Peak EEC
	Reproduction and growth	Fathead minnow chronic (early life-stage) NOAEC and LOAEC	60-day average EEC
Freshwater invertebrates	Survival	Water flea (and other freshwater invertebrates) acute EC_{50}	Peak EEC
	Reproduction and growth	Water flea chronic (life cycle) LOAEC	21-day average EEC
Estuarine/marine fish	Survival	Sheepshead minnow acute LC_{50} (no study available)	Peak EEC
	Reproduction and growth	Sheepshead minnow chronic (early life-stage) NOAEC and LOAEC	60-day average EEC
Estuarine/marine invertebrates	Survival	Eastern oyster acute EC_{50} and mysid acute LC_{50}	Peak EEC
	Reproduction and growth	Mysid chronic NOAEC and LOAEC	21-day average EEC

Table II-E1. Assessment Endpoints and Measures of Ecological Effects and Exposure for Propazine			
Taxonomic Group	**Assessment Endpoint (Abundance)**	**Surrogate Species and Measures of Ecological Effect**	**Measures of Exposure**
Terrestrial plants [c]	Survival and growth	Monocot and dicot seedling emergence and vegetative vigor EC_{25}, EC_{05}, and NOAEC values	Estimates of runoff and spray drift to non-target areas
Insects	Survival (not quantitatively assessed)	Honeybee acute contact LD_{50} (no study available)	Maximum application rate
Aquatic plants and algae	Survival and growth	Algal and vascular plant (i.e., duckweed) EC_{50} and NOAEC values for growth rate and biomass measurements	Peak EEC

[a]Birds represent surrogates for amphibians (terrestrial phase) and reptiles.
[b]Freshwater fish may be surrogates for amphibians (aquatic phase).
[c]Four species of two families of monocots, of which one is corn; six species of at least four dicot families, of which one is soybeans.
LD_{50} = Lethal dose to 50% of the test population; NOAEC = No observed adverse effect concentration; LOAEC = Lowest observed adverse effect concentration; LC_{50} = Lethal concentration to 50% of the test population; EC_{50}/EC_{25} = Effect concentration to 50%/25% of the test population.

Key Uncertainties and Information Gaps

The following uncertainties and information gaps were identified as part of the problem formulation for propazine:

- Acute risks for freshwater fish were not characterized because the submitted study was determined to be invalid based on solubility issues. Uncertainty exists for the freshwater toxicity data for propazine until it can be shown that the tests were conducted up to the limit of solubility.

- Chronic risk to avian species was not characterized because no studies with the TGAI were submitted.

- Current data were not available to determine the potential exposure to birds, mammals, and pollinators from residues on foliage, flowers, and seeds.

- No field toxicity studies are available. Spray drift presents a potential risk to non-target plants inhabiting edge habitats adjacent to target fields and riparian vegetation along streams and/or ponds in close proximity to sprayed fields.

- $ Current data were not provided to determine the potential risks of propazine degradates to fish and aquatic invertebrate and terrestrial plant species.

- $ Dermal contact and soil ingestion pathways for terrestrial mammals and birds were not evaluated because these routes of exposure are not currently considered in deterministic risk assessments. Uncertainties associated with exposure pathways for terrestrial animals are discussed in greater detail in Section IV.C.

- $ Risks to semiaquatic wildlife via consumption of pesticide-contaminated fish were not evaluated. However, given that bioaccumulation of propazine is expected to be low, ingestion of fish by piscivorus wildlife is not likely to be of concern.

- $ Risks to top-level carnivores were not evaluated due to a lack of data for these receptors. Ingestion of grass, plants, fruits, insects, and seeds by terrestrial wildlife was considered; however, consumption of small mammals and birds by carnivores was not evaluated. In addition, food chain exposures for aquatic receptors (i.e., fish consumption of aquatic invertebrates and/or aquatic plants) were also not considered. However, propazine's low K_{ow} suggests that it is not likely to bioaccumulate.

- $ Surrogates were used to predict potential risks for species with no data (i.e., reptiles and amphibians). It was assumed that use of surrogate effects data is sufficiently conservative to apply to the broad range of species within taxonomic groups. If other species are more or less sensitive to propazine and its degradates than the surrogates, risks may be under or overestimated, respectively.

- $ Fate studies indicate propazine is persistent and mobile raising concerns about the impact on groundwater and surface water. The field dissipation studies that have been submitted are considered unacceptable or supplemental resulting in a significant uncertainty for this transport pathway. Additional data is needed to comprehensively ascertain the mobility of propazine and its degradates under field conditions.

III. ANALYSIS

A. Use Characterization

For this risk assessment, propazine comes in one formulation as an aqueous solution. Propazine is proposed for use as a selective herbicide in sorghum before planting or after planting but before sorghum or weeds emerge for control of annual broadleaf weeds. Application can be made via ground sprayer or aerial broadcast for sorghum. Formulations of propazine that are manufactured by Griffin L.L.C. include a 98% wettable powder technical product and a 43% flowable concentrate end use product (Propazine 4L). The proposed label for use of Propazine 4L o sorghum is provided in Appendix A.

Figure II-a 1. depicts areas in the US where sorghum was grown and harvested in 2003 thus providing an indication of likely propazine use areas. Potential use areas are indicated in the Midwest states of Colorado, New Mexico, Kansas, Oklahoma, Texas and South Dakota, southern regions of Arizona and California, along the Mississippi river valley and along the eastern coastal regions of North Carolina and Maryland.

In addition, the use of propazine on sorghum as specified on the proposed label prohibits use on sand, loamy sand, heavy clay, and high organic matter soils. As such, the risk conclusions contained in this assessment would not apply to these soil types.

B. Exposure Characterization

The propazine exposure characterization in this assessment combined the environmental fate data with Tier II exposure models to estimate environmental exposure concentrations (EECs). Exposure models estimate EECs following the conceptual diagram of propazine usage and potential exposure endpoints shown in Figure II-b 2. EECs for aquatic endpoints are developed using the Tier II surface water models PRZM/EXAMS. These models determine EECs based on geographic areas nationwide and product use sites in close proximity to water bodies. The input parameters used in this assessment were selected from the environmental fate data submitted by the registrant and in accordance with US EPA-OPP EFED water model parameter selection guidelines, *Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides*, Version II, February 28, 2002. A detailed aquatic resource exposure assessment is attached in Appendix C. The goal of Tier II aquatic modeling is to better define the range of EECs that can be reasonably expected under variable weather conditions. Likewise, EECs for birds and terrestrial mammals are estimated using the T-REX 1.2.3 model and EECs for non-target plants are estimated by the TerrPlant 1.0 and AgDrift 2.0.1 models.

Griffin L.L.C. is seeking registration for propazine to be used as a selective herbicide in the control of annual grasses in sorghum (grain and sweet sorghum).

1. Environmental Fate and Transport Characterization

a. Summary of Empirical Data

Environmental fate studies reviewed suggest that propazine is moderately persistent and mobile. If applied in an outdoor environment, propazine has a high potential to leach into ground water or reach surface waters by runoff. In areas where the soils are highly permeable, the water table is shallow, and sufficient precipitation and/or irrigation occur, the use of propazine may result in ground water contamination. A summary of some physical, chemical and fate properties of propazine is provided in Table III-B1.

Table III-B 1. Physicochemical and Fate Properties of Propazine		
Property	**Value**	**Reference (MRID)**
Physicochemical Properties		
Chemical Name	2-chloro-4,6-bis(isopropylamino)-s-triazine	
Chemical Group	Triazine	
CAS Number	139-40-2	
Molecular Weight	229.71 g/mole	Product Chemistry
Molecular Formula	$C_9H_{16}ClN_5$	Product Chemistry
Water solubility	8.6 mg/L	Product Chemistry
Melting point	212-214°C	Product Chemistry
Vapor Pressure	2.90 x 10-8 Torr at 20° C	Product Chemistry
pKa	1.85 at 22°C (Montgomery, '93)	Product Chemistry
Density	1.162 g/cm^3	Product Chemistry
Henrys Law Constant	1.02 x 10^{-9} atm –m^3/mole	Product Chemistry
Log Kow	2.91 (Montgomery, '93)	Product Chemistry
Fate Properties		
Hydrolysis half-lives	Stable at pH 5, 7 , and 9 (20°C)	436898-02
Direct Aqueous Photolysis half-lives	Stable (24-hr irradiation xenon arc lamp for 15 days)	441848-05
Soil Photolysis half-lives	Stable (199 days, 12-hr irradiation xenon arc lamp; 211 days dark control)	441848-06
Aerobic Soil Metabolism half-lives	289 Days (sandy loam; 67% sand, 23% silt, 10% clay, 1.0% OC, pH 6.8) 12-24 Weeks (calculated 15 wks; loamy sand soil; 9% clay, 86% sand; 2.2% OC; pH 5.6)	441848-07 001537-12
Anaerobic Soil Metabolism half-life	8 Weeks (non sterile loamy sand soil, incubated anaerobically after 4 wks of aerobic incubation)	001537-13
Aerobic Aquatic Metabolism	No data	
Adsorption/desorption Adsorption/desorption	Propazine $K_{d\text{-}ads}$ / $K_{d\text{-}des}$ (mL/g) 0.34/6.09 (loamy sand), 1.14/3.78 (sandy loam), 2.69/16.8 (loam), 3.19/44.7 (clay loam) $K_{oc\text{-}ads}$ (mL/g) 83 (loamy sand); 123 (sandy loam); 158 (loam); 65(clay loam)	001529-97
Adsorption/desorption Adsorption/desorption	$K_{d\text{-}ads}$ / $K_{d\text{-}des}$ (mL/g) 0.67/86.4 (sand,0.25 %OC, 7.6 pH); 1.28/11.9 (sandy loam; 1%OC, 6.8%pH); 1.30/27.0 (silty clay; 1.36%OC, 5.9 pH); 1.35/6.7 (loam; 1.71%OC, 7.6 pH) $K_{oc\text{-}ads}$ (mL/g) 268 (sand); 128 (sandy loam); 96 (silty clay); 79 (loam)	436898-04
Adsorption/desorption	2-hydroxy-propazine $K_{d\text{-}ads}$ / $K_{d\text{-}des}$ (mL/g) 1.45/6.61 (sandy loam); 0.28/4.62 (sand); 1.33/3.12 (loam); 4.57/12.36 (silty clay)	442873-13

Table III-B 1. Physicochemical and Fate Properties of Propazine		
Property	**Value**	**Reference (MRID)**
Adsorption/desorption	$K_{oc\text{-}ads}$ (mL/g) 145 (sandy loam); 329 (sand); 78 (loam); 342 (silty clay)	
Terrestrial Field Dissipation	NC (Wilson Co) 1.2 lb ai/A - bare ground sandy loam (0-6") and sandy clay loam (6-12") t ½ = 7.2 days (1-21 days) t ½ = 58.2 days (28-184 days)	442873-14
	TX (Armstrong Co) 1.2 lb ai/A - bare ground loamy sand (0-6" and 6-12") T ½ = 52 days (186-day study)	441848-09

b. Degradation and Metabolism

Existing laboratory studies indicate that propazine is stable to hydrolysis and photolysis (both aqueous and in soils). However, published literature on propazine and related chloro-s-triazines indicate that the chemical may be susceptible to hydrolysis after adsorption onto the surface of soil colloids (a surface catalysis effect). Propazine is persistent under laboratory aerobic soil conditions with half-lives ranging from 15 weeks in loamy sand soil to 41 weeks in sandy loam soil. The major soil metabolite was 2-hydroxy propazine (2-hydroxy-4,6-bis(isopropylamino)-s-triazine) and comprised a maximum of 31% of the total applied radioactivity (TAR) after one year. Minor degradates consist of desethylatrazine (2-amino-4-chloro-6-isopropylamino-s-triazine or DEA) (<2% of TAR) and 2-hydroxy desethylatrazine (<5% of TAR). No studies were submitted on the persistence of degradates (both major and minor) in the environment. Chemical structures of the propazine degradates are presented in Appendix B.

Propazine is not likely to volatilize from near surface soils or surface waters under normal environmental conditions, due to its low vapor pressure (2.9×10^{-8} torr at 20°C). If released to water, propazine is not expected to bioconcentrate in aquatic organisms, adsorb to sediment and/or suspended particulate matter, or to volatilize. This assessment assumes that propazine exhibits slow biodegradation in natural water based upon its biodegradation in soil, however, no data is available to confirm this assumption.

c. Transport and Mobility

Propazine does not adsorb as strongly to soil particles as other triazine herbicides. In most soils used in batch equilibrium studies, especially sand and sandy loam soils, it binds weakly to soil particles ($K_{oc\text{-}ads}$ = 268 and 128 mL/g, respectively). Literature

studies also showed that depending on soil temperature, moisture, and pH, it can become unbound (Worthing, 1983). The major degradate, 2-hydroxy propazine is slightly less mobile, with $K_{oc\text{-}ads}$ values ranging from 78 (loam) to 342 (silty clay) mL/g. In sand and sandy loam soils, the $K_{oc\text{-}ads}$ values are 329 and 145 mL/g, respectively.

Based on the information summarized above, propazine is expected to be persistent and mobile in most soils, and it is resistant to breakdown by hydrolysis, photolysis, or biodegradation. The mobility of propazine is also noted in the fields, where supplemental terrestrial field dissipation studies suggest that propazine dissipates slowly from the upper 6 inches (half-lives of 51 days in TX, and 7 to 58 days in NC, <30 to 149 days in NY, <31 days in CA, and 60 to >357 days in NE) and may leach to ground water. It has also been reported in the literature that if released to soil, propazine will persist longer in dry or cold conditions or other conditions which inhibit biological and chemical activity (Worthing, 1983). It is therefore very likely that in areas where soils are highly permeable, the water table is shallow, or where there is irrigation and/or high rainfall, the use of propazine may result in ground water contamination.

d. Field Studies

The four submitted field studies were either unacceptable or considered supplemental because of inadequate sampling depths (only the upper 12 inches were sampled), lack of freezer stability data (some samples were frozen for up to 3 years), and/or the presence of propazine in the control and treated plots prior to the start of the study. Supplemental data suggest that propazine, applied as a wettable powder at 2.4 to 4.8 lb a.i./A/yr, dissipated from the upper 6 inches with a half-life of <30 to 149 days in NY, <31 days in CA, and 60 to >357 days in NE. The degradates hydroxy-propazine, G-2873 [2-chloro-4,6-diamino-s-triazine], and G-30033 [2-chloro-4-amino-6-isopropylamino-s-triazine] were detected in one or more of the field studies (NY, CA, NE).

The major laboratory soil degradate, 2-hydroxy propazine was seen in the 0-3" and 3-6" soil layers of the terrestrial field studies at approximately 15% of parent at day 1, and decreased to less than 5% of parent by day 93. The other two minor degradates desethylatrazine (DEA) and 2,4-diamino-6 chloro-s-triazine (DACT), which are common to atrazine and simazine, were detected only in the 0-3" soil layer, each at less than 5% of parent at day 1, however decreasing to less than 1% by day 28.

e. Review of Published Literature on the Environmental Fate of Propazine

The environmental fate of propazine in published scientific literature is limited and published studies vary in quality and usually contain insufficient information on procedures or raw data to adequately assess the results. However, these research findings can provide supplemental information on the environmental fate of propazine. The following discussion comes primarily from three published reviews -

Khan (1980), Montgomery (1993), and Wolfe et al (1990) - which summarize several published studies.

Propazine, like the other triazine chemicals, is weakly basic (pKa .1.85 at 22°C; Montgomery, 1993), can be easily protonated at low soil pH values, and is likely to exist as a neutral species at soil pH values more than two pH units above the pKa (Koshinen and Harper, 1990). Adsorption of protonated propazine is pH-dependent, with a maximum adsorption at or near the pKa (Khan, 1980). Soil organic matter plays an important role in the adsorption of propazine and other s-triazines, affecting their movement in soil (Hayes, 1970).

The chemical hydrolysis of s-triazines, including propazine, is catalyzed by surface adsorption on soil colloids (Khan, 1980; Wolfe et al, 1991). Studies by Russell et al (1968), Brown and White (1969), and Nearpass (1972) found evidence that the chemical hydrolysis of propazine was catalyzed by adsorption onto organic matter and clay.

Montgomery (1993) summarized soil adsorption data from four studies (Burkhard and Guth, 1981; Harris, 1966; Talbert and Fletchall, 1965; Walker and Crawford, 1970) involving 38 soils. The reported adsorption K_d values averaged 3.4 mL/g, with a range of 0.1 to 20.5. In 35 of the 38 soils, the K_d values were less than 4.7. The K_{oc} values averaged 155 mL/g (ranging from 29 to 363), which are within the range of the K_{oc} values reported in the above mentioned environmental fate studies submitted by the registrant.

2. Measures of Aquatic Exposure

a. Aquatic Exposure Modeling

Tier II Estimated Environmental Concentrations (EEC) for propazine were estimated using EFED's aquatic models PRZM and EXAMS. PRZM is used to simulate pesticide transport as a result of runoff and erosion from an 10-ha agricultural field and EXAMS considers environmental fate and transport of pesticides in surface water and predicts EECs in a standard pond (10,000-m^2 pond, 2-m deep) with the assumption that the small field is cropped at 100%. Calculations are carried out with the linkage program shell - PE4V01.pl - which incorporates the standard scenarios developed by EFED. Additional information on these models and crop scenarios can be found at: http://www.epa.gov/oppefed1/models/water/index.htm.

The proposed agricultural use of propazine for broadleaf weed control in sorghum was simulated with the sorghum crop scenarios for Texas and Kansas. The Texas and Kansas crop scenarios were chosen as they are the two states with the most harvested acreage of sorghum. Kansas ranks first in the nation for sorghum production with 220 million bushels harvested in 2004 while Texas ranks second (114 million bushels in 2002).

The maximum application rate (1.2 lb a.i./A from the proposed propazine 4L label) was modeled for the Kansas and Texas sorghum scenarios. Application dates were based on the propazine label information as well as on reported planting dates stated in the USDA crop profiles for sorghum grown in Texas and Kansas. Based on the environmental fate data described above (Section III.B.1.) and sorghum crop scenarios, EECs for aquatic exposure were estimated. Table III-B2. contains the propazine input parameters for the PRZM/EXAMS models. Note that the Texas sorghum scenario was developed for the cumulative assessment for the organophosphate insecticides it was used in this assessment to provide spatial context to the EEC generated using the Kansas sorghum scenario.

EEC's were developed for the parent propazine only (Table III-B3.); as insufficient data exist to fully assess the persistence and mobility of propazine's major degradate, hydroxy-propazine [2-hydroxy-4,6,bis(isopropylamino)-s-triazine] in the environment. Furthermore, based on the risk assessment of the atrazine and simazine, hydroxy-propazine was not considered to be of toxicological concern to human health. The minor degradates DEA and DACT, although of equal potency toxicologically compared to parent propazine, were also not included in this assessment mostly due to their low detection in the laboratory soil metabolism studies and in the terrestrial field studies (less than 5% of Total Applied Radioactivity (TAR)). For atrazine and simazine, these chlorinated degradates were formed at much higher percentage, and ample monitoring data were available to adequately estimate their concentrations versus those of the parents. However, for propazine, minimal monitoring data exist for an adequate quantitative assessment of the chlorinated degradates. Additionally, as mentioned above, laboratory and field studies indicate that DEA and DACT, if formed in the environment, would not be present nor would persist at any significant concentration compared to parent propazine to adversely impact the results of the ecological risk assessment, as presented in this document.

The proposed propazine label for sorghum stipulates buffer, or setback, distances for surface water bodies adjacent to treated fields. The label specify setback distances of 66 feet and 200 feet for propazine applications surrounding intermittent/perennial streams and lakes/reservoirs, respectively. These distances were incorporated into this assessment using AgDrift to estimate the impact of a setback distance of 66 feet on the fraction of drift reaching a surface water body. The revised spray drift percentages, which are incorporated into the PRZM/EXAMS modeling, are 0.6% for ground applications and 6.5% for aerial applications.

Models to estimate the effect of setbacks on load reduction for runoff are not currently available. It is well documented that vegetated setbacks can result in a substantial reduction in pesticide load to surface water (USDA, NRCS, 2000). It is expected that the presence of a well vegetated setback between the site of propazine application and receiving water bodies could result in reduction in loading. Therefore, the aquatic EECs presented in this assessment are likely to over-estimate exposure in areas with well-vegetated setbacks. While the extent of load reduction

can not be accurately predicted through each relevant stream reach in the action area, data from USDA (USDA, 2000) suggest reductions could range from 11 to 100%.

b. Aquatic Exposure Monitoring and Field Data

Several sources of surface water monitoring data were reviewed, including data from USGS reconnaissance studies, USGS National Water Quality Assessment Program (NAWQA) and the US EPA's Office of Water STORET Database (1997). The USGS reconnaissance post application monitoring data were performed on numerous streams within the 10 states comprising the Midwestern corn belt in 1989, 1990, 1994, and 1995. The maximum propazine contamination was detected in Ohio at 3.8 ppb. The reason for this high detection is uncertain given that Ohio is not a sorghum growing area (Figure II-a 1) but it could possibly be associated with the only other registered use on nurseries. Although these data provide useful information, Kansas and Southern Nebraska were the only areas in the primary propazine market area covered by this USGS study. Furthermore, multiple pesticide residue studies not designed specifically for propazine may include many sampling stations outside of propazine use areas even within Kansas and Southern Nebraska.

A review of the STORET Database (1997) reports concentrations of propazine residues ranging from 9.1 to 105 ppb for Kansas (detection limits of 0.5 to 1.2 ppb), and from 0.4 to 2.1 ppb for Texas (detection limit of 0.1 ppb) and 0.1 to 0.3 ppb (detection limits of 0.1 ppb) in Oklahoma. There was no detection in surface water for Colorado and New Mexico. Overall, propazine was found in 33 out of 1,097 (3% frequency of detection) surface water samples reported in these references for states located in the Midwest.

A review of surface water and groundwater monitoring data collected as part of the USGS NAWQA program reports detects of propazine in water samples from several areas in the US (http://water.usgs.gov/nawqa/). NAWQA monitoring data from 1991 to 2005 indicate propazine groundwater concentrations of 0.25 - 1.7 ppb (5 detects out of 61 samples, or 8.2% frequency of detection) in Nebraska and surface water concentrations of 0.06 - 1.08 ppb (79 detects out of 136 samples, or 58.1% frequency of detection). Monitoring data from Iowa indicates no detects in groundwater (145 samples) and surface water concentrations of 0.06 - 0.36 ppb (25 detects out of 63 samples, or 39.7% frequency of detection). Texas surface water monitoring data shows two detects (0.06 and 0.31 ppb) out of 25 samples (8% frequency of detection) while surface water data for the Mississippi River Embayment (MO, AR, MS, LA) indicates propazine concentrations of 0.06 - 0.85 ppb (22 detects in 67 samples, or 32.8% frequency of detection). Another 65 samples from the upper Mississippi River valley and the northeast US (NY, CT, DE) showed no detection of propazine (detection limit of 0.05 ppb).

Nationally, a total of 140 out of 562 surface water samples (24.9% frequency of detection) contained concentrations of propazine above the limit of quantitation. The maximum concentration detected was 1.69 ppb in Nebraska, while the average

concentration from all detections was 0.21 ppb. The bulk of the detections from this analysis were in Nebraska with fewer detections in Iowa, Missouri, and Louisiana.

Although limited monitoring data were available, data were not abundant in the areas of high propazine use and high run off potential, such as the coastal areas of Texas. Furthermore, for some of the data the quality of the available monitoring data is not sufficiently reliable and at times could not be adequately or reasonably assessed due to the following problems:

- information about the application dose or rate, areas of pesticide use, and farming practices involving application frequency and irrigation are insufficient or not available;
- the STORET monitoring database is a collection of isolated studies because the monitoring activities were not performed in a consistently uniform manner due to differences in study designs that radically affected the results;
- characterization of the sampling sites such as susceptibility of the watershed soils to runoff, soil index, monthly precipitation, and residence times of surface water bodies is inadequate;
- for the STORET data the integrity of the sampling techniques, preservation procedures, and storage methods are questionable or sometimes not documented;
- and, analytical methods and limits of detections are different in several monitoring studies, thus contributing to difficulty in data interpretation. Surface water monitoring results are presented here to corroborate the ability of propazine to contaminate surface waters and should be used qualitatively only.

Table III-B 2. PRZM/EXAMS Input Parameters for Propazine

Parameter	Value	Comment	Source
Application Rate per Event	1.2 lb a.i./A	aerial and ground spray application to sorghum	Propazine 4L label
Number of Applications per Crop Season	1 application per year		Propazine 4L label
Aerobic Soil Metabolism t ½	480 days [1]	estimated upper 90th percentile	MRID 441848-07
Anaerobic Soil Metabolism t ½	56 days		MRID 001537-13
Spray Drift Fraction	0.006 / 0.065	ground / aerial	AgDrift Modeling for label specified buffers
Application Efficiency	0.99 / 0.95	ground / aerial	EFED Guidance, 2002

Table III-B 2. PRZM/EXAMS Input Parameters for Propazine			
Parameter	**Value**	**Comment**	**Source**
Aerobic Aquatic Degradation t ½	960 days [2]	No data; estimated (2x aerobic soil metabolism half-life)	EFED Guidance, 2002
Anaerobic Aquatic Degradation t ½	112 days [3]	No data; estimated (2x anaerobic soil metabolism half-life)	EFED Guidance, 2002
Aqueous Photolysis t ½	Stable	pH 7	MRID 441848-05
Hydrolysis t ½	Stable		MRID 436898-02
Soil Partition Coefficient (K_{oc})	125 mL/g [4]	Average K_{oc}	MRIDs 001529-97, 436898-04
Molecular Weight	230 g/mole		Product Chemistry
Water Solubility @ 20°C	2.9 mg/L		Product Chemistry
Vapor Pressure	2.9E-8 torr		Product Chemistry

[1] Upper 90th Percentile based on mean half-lives of 289 and 105 days.
[2] 2x aerobic soil metabolism half-life (EFED Modeling Input Parameter Guidance, 2002).
[3] 2x anaerobic soil metabolism half-life (EFED Modeling Input Parameter Guidance, 2002).
[4] Average from all acceptable adsorption/desorption data including K_{oc} values of 65, 83, 123, 158, 79, 96, 128, and 268 (MRIDs 001529-97 and 436898-04).

Table III-B 3. Estimated Environmental Concentrations (µg/L) of Propazine in Surface Water

Simulation Scenario	Concentration (µg/L)*						
Sorghum (1.2 lb a.i./A)	**Peak**	**96 hour**	**21-day**	**60-day**	**90-day**	**Annual Mean**	**Yearly Average**
Sorghum (KS)							
Aerial spray	53.9	53.8	53.2	52.0	51.0	44.9	35.7
Ground spray	40.8	40.7	40.2	39.5	38.8	33.9	25.8
Sorghum (TX)							
Aerial spray	89.8	89.8	88.1	85.1	83.0	67.0	45.6
Ground spray	82.0	81.7	80.4	77.6	75.7	60.8	39.0

* One in ten year value
Input and output for PRZM3.12/EXAMS2.98 modeling is presented in Appendix C.

3. Measures of Terrestrial Exposure

a. Terrestrial Exposure Modeling

Terrestrial wildlife exposure estimates are typically calculated for bird and mammals, emphasizing a dietary exposure route for uptake of pesticide active ingredients. These exposures are considered as surrogates for terrestrial-phase amphibians as well as reptiles. For exposure to terrestrial wildlife, such as birds and small mammals, pesticide residues on food items are estimated, based on the assumption that organisms are exposed to a single pesticide residue in a given exposure scenario. For this terrestrial exposure assessment, aerial and ground spray application methods for propazine are considered.

For propazine spray applications, estimation of pesticide concentrations in wildlife food items focuses on quantifying possible dietary ingestion of residues on vegetative matter and insects. No field residue data or field study information is available; therefore, the residue estimates are based on a nomogram that relates food item residues to pesticide application rate. The EECs are generated from a spreadsheet-based model (T-REX Version 1.2.3) that calculates the decay of a chemical applied to foliar surfaces for single or multiple applications. Terrestrial EECs estimated using the T-REX model are presented in Table III-B4.

The terrestrial exposure assessment is based on the methods of Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994). Terrestrial EECs for aerial and ground spray applications were derived for sorghum. Uncertainties in the terrestrial EECs are primarily associated with a lack of data on interception and subsequent dissipation from foliar surfaces. When data are absent, as in this case, EFED assumes a 35-day foliar dissipation half life, based on the work of Willis and McDowell (1987). For propazine, EFED assumed a default half life of 35 days.

The EECs on food items may be compared directly with dietary toxicity data or converted to an oral dose, as is the case for small mammals. The risk assessment for propazine uses upper bound (i.e., 90^{th} percentile) and mean predicted residues as the measure of exposure on selected avian or mammalian food items immediately following propazine application (at the maximum label rate) for sorghum. For mammals, the residue concentration is converted to daily oral dose based on the fraction of body weight consumed daily as estimated through mammalian allometric relationships.

Table III-B 4. Terrestrial Bird and Mammal EEC's (Residues) Following Application of Propazine to Sorghum

Terrestrial Use	Application. Rate (lbs a.i./A)	Food Items	Maximum EEC (mg/L)	Mean EEC (mg/L)
Sorghum	1.2	Short Grass	288	102
		Tall Grass	132	43
		Sm. Insects, Broadleaf Plants	162	54
		Lg. Insects, Fruits, Pods	18	8

Effects on non-target terrestrial plants are most likely to occur as a result of spray drift and/or runoff from aerial and ground applications of the liquid formulation. Spray drift and runoff is an important factor in characterizing the risk of propazine to non-target plants, which is assumed to reach off-site areas. The TerrPlant model (Ver.1.0) predicts EECs for terrestrial plants located in dry and semi-aquatic areas adjacent to the treated field. The EECs are based on the application rate and solubility of the pesticide in water and drift characteristics, which depend on ground or aerial applications. The amount of propazine that runs off is a proportion of the application rate and is assumed to be 1% based on propazine's solubility of <10 ppm in water. Drift from ground and aerial applications are assumed to be 1% and 5%, respectively, of the application rate. For dry areas, the loading of pesticide active ingredient from runoff to an adjacent non-target area is assumed to occur from one acre of treatment to one acre of non-target area and is characterized as "sheet runoff". 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 and is characterized as "channelized runoff". Predicted terrestrial plant EECs following ground and aerial spray applications of propazine to sorghum are summarized in Table III-B5.

Table III-B 5. EECs for Terrestrial Plants Located Adjacent to Propazine Treated Sorghum Fields

Terrestrial Use	Application Method	Concentration (lbs a.i./A)		
		Total Loading to Areas Adjacent to Treated Areas[1]	Total Loading to Semi-Aquatic Areas Adjacent to Treated Areas[2]	Drift to Adjacent Areas[3]
Sorghum (1.2 lbs a.i./A)	Aerial	0.067	0.132	0.06
	Ground	0.024	0.132	0.012

[1] EEC = Sheet Runoff + Drift (1% for ground; 5% for aerial)
[2] EEC = Channelized Runoff + Drift (1% for ground; 5% for aerial)
[3] EEC for ground (appl. rate x 1% drift); for aerial (appl. rate x 5% drift)

C. Ecological Effects Characterization

1. Aquatic Effects Characterization

Table III-C1 presents the toxicity endpoint values from the studies used to calculate RQs and estimate risk to aquatic receptors from exposure to propazine through surface runoff/leaching. Details of the registrant-submitted studies for aquatic animals and plants are provided below and in Appendix F.

Table III-C 1. Propazine Toxicity Endpoint Values for Assessing Risk to Aquatic Organisms

Exposure Scenario	Species	Exposure Duration	Toxicity Endpoint Value	Endpoint	Reference (Classification)
Freshwater Fish					
Acute	No valid studies available				
Chronic	Fathead minnow *Pimephales promelas*	Early life stage	NOAEL = 0.72 mg ai/L	Reduction in length	MRID 442873-07 (Supplemental)
Freshwater Invertebrates					
Acute	Water flea *Daphnia magna*	48 hours	EC_{50} = >5.32 ppm ai NOAEC = 5.32 ppm ai	Lethality	MRID 442873-05 (Awaiting final EFED review)
Chronic	Water flea *Daphnia magna*	21 days	NOAEC = 0.047 ppm ai LOAEC = 0.091 ppm ai	Growth	MRID 443276-02 (Core)
Estuarine/Marine Fish					
Acute	No data submitted				
Chronic	Sheepshead minnow *Cyprinodon variegatus*	36-day	NOAEC = 1.34 mg ai/L LOAEC = 2.59 mg ai/L	Embryo survival; hatching success	MRID 441848-02 (Awaiting final EFED)
Estuarine/Marine Invertebrates					

Table III-C 1. Propazine Toxicity Endpoint Values for Assessing Risk to Aquatic Organisms					
Exposure Scenario	**Species**	**Exposure Duration**	**Toxicity Endpoint Value**	**Endpoint**	**Reference (Classification)**
Acute	Saltwater mysid *Mysidiopsis bahia*	96 hours	LC_{50} = 4.20 ppm ai NOAEC = 0.586 ppm ai	Lethality	MRID 441848-01 (Acceptable)
Chronic	Saltwater mysid *Mysidiopsis bahia*	28-day	NOAEC = 0.269 ppm ai LOAEC = 0.706 ppm ai	Growth; Reproduction	MRID 441848-03 (Supplemental)
Aquatic Plants					
Nonvascular	Diatom *Navicula pelliculosa*	120 days	EC_{50} = 0.0248 ppm ai NOAEC = 0.0065 ppm ai	Cell density	MRID 442873-10 (Core)
Macrophytes	Duckweed *Lemna gibba*	120 days	EC_{50} = 0.10 ppm ai NOAEC = 0.022 ppm ai	Frond density	MRID 442873-09 (Core)

a. Aquatic Animals

(1) Freshwater Fish and Invertebrates, Acute

Fish toxicity studies for two freshwater species using the TGAI are required to establish the acute toxicity of propazine to fish. The preferred test species are rainbow trout (a coldwater fish) and bluegill sunfish (a warmwater fish). No valid acute freshwater fish studies are available for either the parent propazine or the degradates.

A freshwater aquatic invertebrate toxicity test using the TGAI is required to establish the toxicity of propazine to aquatic invertebrates (Table III-C2). The preferred test species is *Daphnia magna*. A submitted acute study for daphnids provided a 48-hr EC_{50} value of >5.32 ppm ai (NOAEC 5.32 ppm ai) for the TGAI. This value will be used to assess acute risk of propazine to freshwater invertebrates (MRID 442873-05). The classification of this study is currently being reevaluated in order to determine if daphnids were exposed to propazine at the limit of solubility. In addition, no toxicity data are available to assess the acute risk of the degradates to freshwater invertebrate species.

Table III-C 2. Freshwater Invertebrate Acute Toxicity for Propazine					
Species	**% ai**	**48-hour EC50 (ppm ai)**	**Toxicity Category**	**MRID No. Author, Year**	**Study Classification**
Waterflea *(Daphnia magna)*	98.0	>5.32	moderately toxic	442873-05 Murrell, 1994	Awaiting final EFED review

(2) Freshwater Fish and Invertebrates, Chronic

For freshwater fish chronic studies (early life-stage or a full life-cycle test) the preferred species is the fathead minnow. In an early life-stage study, propazine induced a significant reduction in length with a NOAEL of 0.72 mg ai/L (Table III-C3.). This value will be used to assess the chronic risk of propazine to freshwater fish (MRID 442873-07). The study was classified as supplemental because pH and

hardness exceeded recommended levels, potentially affecting solubility. No toxicity data are available to assess the chronic risk of the degradates to freshwater fish species.

Table III-C 3. Freshwater Fish Chronic Toxicity for Propazine

Species	% ai	NOAEL/LOAEL (mg ai/L)	Endpoints Affected	MRID No. Author, Year	Study Classification
Early Life Stage Study under Flow-through Conditions					
Fathead minnow (*Pimephales promelas*)	98.0	0.72/1.14	Growth	442873-07 Rhodes, 1995	Supplemental

For life-cycle studies on freshwater invertebrates, the preferred test species is *Daphnia magna*. Submitted data show reductions in growth (length and weight) in daphnids following exposure to propazine. The NOAEC of 0.047 ppm ai will be used to assess chronic risk of propazine to freshwater invertebrates (MRID 443276-02). No toxicity data are available to assess the chronic risk of the degradates to freshwater invertebrate species.

Table III-C 4. Freshwater Invertebrate Chronic Toxicity for Propazine

Species	% a.i.	21-day NOAEC/LOAEC (ppm ai)	Endpoints Affected	MRID Author, Year	Study Classification
Waterflea (*Daphnia magna*)	98.0	0.047/0.091	Growth	443276-02 Murrell & Veltri, 1997	Core

Acute and chronic toxicity testing with estuarine/marine fish and invertebrates using the TGAI is required for propazine because the end-use product is expected to reach the marine/estuarine environment. Propazine is expected to be used in coastal county locations where sorghum may be grown (i.e. Texas, North Carolina, Maryland and Louisiana (Figure II-a 1)).

(3) Estuarine/Marine Fish and Invertebrates, Acute

For acute toxicity testing with estuarine/marine fish, the preferred test species is sheepshead minnow. No toxicity studies were submitted by the registrant to assess the acute risk of propazine or its degradates to estuarine/marine fish species.

For acute toxicity testing with estuarine/marine invertebrates, the preferred species are the mysid shrimp and eastern oyster. Propazine is categorized as moderately toxic to the mysid shrimp, based on mortality and sublethal effects (LC_{50} = 4.20 ppm ai). Propazine is categorized as practically non-toxic to the eastern oyster at the limit of solubility with an EC_{50} >3.72 mg ai/L (MRIDs 441848-01 and 442873-06). The oyster study was originally classified as supplemental; however, EFED reevaluated

the data and established these effect levels (Table III-C5). No toxicity data are available to assess the acute risk of the degradates to estuarine/marine invertebrate species. The LC_{50} = 4.20 ppm in the mysid study will be used to assess acute risk to marine/estuarine invertebrates.

Table III-C 5. Estuarine/Marine Invertebrate Acute Toxicity for Propazine

Species	% a.i.	96-hour EC_{50}/LC_{50}	Toxicity Category	MRID Author, Year	Study Classification
Eastern oyster *(Crassostrea virginica)*	98.0	>3.72 mg ai/L	practically non-toxic	442873-06 Boeri et al., 1995	Awaiting final EFED review
Mysid *(Mysidopsis bahia)*	98.0	4.20 ppm ai	moderately toxic	441848-01 Boeri et al., 1995	Acceptable

(4) Estuarine/Marine Fish and Invertebrates, Chronic

For the chronic toxicity testing with estuarine/marine fish the preferred test species is sheepshead minnow. In an early life-stage study, propazine affected embryo survival and hatching success at 2.59 mg ai/L (Table III-C6). The NOAEC of 1.34 mg ai/L will be used to assess the chronic risk of propazine to estuarine/marine fish (MRID 441848-02). This study was originally classified as supplemental; however, EFED reevaluated the data and established these effect levels. No toxicity data are available to assess the chronic risk from the degradates to estuarine/marine fish species.

Table III-C 6. Estuarine/Marine Fish Chronic Toxicity for Propazine

Species	% ai	NOAEC/LOAEC (mg ai/L)	Endpoints Affected	MRID No. Author, Year	Study Classification
Early Life Stage Study under Flow-through Conditions					
Sheepshead minnow (*Cyprinodon variegatus*)	98.0	1.34/2.59	Growth	441848-02 Boeri *et al.*, 1995	Awaiting EFED validation

For the life-cycle toxicity study with estuarine/marine invertebrates, the preferred test species is mysid shrimp. The data submitted indicate that propazine produced significant effects to growth and reproduction at 0.706 ppm ai. The NOAEC of 0.269 ppm ai will be used to assess the chronic risk of propazine to estuarine/marine invertebrates (MRID 441848-03); the study was classified as supplemental due to deviations in study design. No toxicity data are available to assess the chronic risk of the degradates to estuarine/marine invertebrate species.

Table III-C 7. Estuarine/Marine Invertebrate Chronic Toxicity for Propazine					
Species	**% ai**	**28-day NOAEC/LOAEC (ppm ai)**	**Endpoints Affected**	**MRID No. Author, Year**	**Study Classification**
Mysid (*Mysidopis bahia*)	98.0	0.269/0.706	Growth Reproduction	441848-03 Boeri et al., 1995	Supplemental

b. Aquatic Plants

Several aquatic plant toxicity studies using the TGAI are required to establish the toxicity of propazine to non-target aquatic plants. The recommendation is for testing of five species: freshwater green alga *(Selenastrum capricornutum)*, duckweed *(Lemna gibba)*, marine diatom *(Skeletonema costatum)*, blue-green algae *(Anabaena flos-aquae)*, and a freshwater diatom (*Navicula pelliculosa*). In a Tier II toxicity test, the 14-day EC_{50} for the freshwater vascular plant (duckweed) is 0.10 ppm ai (NOAEC = 0.022 ppm ai), based on frond density; and the lowest 7-day EC_{50} for the freshwater non-vascular plant (diatom) is 0.0248 ppm ai (NOAEC = 0.0065 ppm ai), based on cell density. These values will be used to assess the risk of propazine to aquatic vascular and nonvascular plants (Table III-C8).

Table III-C 8. Non-Target Aquatic Plant Toxicity for Propazine					
Species [Tier II]	**% ai**	**EC_{50}/NOAEC (ppm ai)**	**Endpoints Affected**	**MRID No. Author, Year**	**Study Classification**
Duckweed (*Lemna gibba*)	98.0	0.10/0.022	Frond density	442873-09 Hicks *et al*, 1995	Core
Green Algae (*Selenastrum capricornutum*)	98.0	0.029/0.012	Cell density	442873-08 Hicks *et al*, 1995	Core
Blue-green Algae (*Anabaena flos-aquae*)	98.0	0.18/0.068	Cell density	442873-12 Gledhill & Bussard, 1995	Core
Diatom (*Navicula pelliculosa*)	98.0	0.0248/0.0065	Cell density	442873-10 Hicks & Gledhill, 1995	Core
Marine Diatom (*Skeletonema costatum*)	98.0	0.025/0.017	Cell density	442873-11 Gledhill & Bussard, 1995	Core

The Tier II results for propazine degradates indicate that the most sensitive algae of the five species is generally the blue-green alga *Anabaena inaequalis* with EC_{50} values ranging from 100 to > 100,000 ppb. All studies were classified as supplemental because NOAEC and raw data were unavailable.

Table III-C 9. Non-Target Aquatic Plant Toxicity for the Degradate Deethylatrazine					
Species (Tier II)	**% ai**	**Conc. (ppb) EC_{50}**	**% Response**	**MRID No. Author, Year**	**Study Classification**
Blue-green algae *Anabaena inaequalis*	> 95	1,000 4,000 2,500	50% red. cell count 50% red. growth rate 50% red. photosynthesis	450874-01 Stratton, 1984	Supplemental
Green algae *Scenedesmus quadricauda*	> 95	1,200 2,000 1,800	50% red. cell count 50% red. Growth rate 50% red. photosynthesis	450874-01 Stratton, 1984	Supplemental
Green algae *Chlorella pyrenoidosa*	> 95	3,200 7,200 1,800	50% red. cell count 50% red. growth rate 50% red. photosynthesis	450874-01 Stratton, 1984	Supplemental
Blue-green algae *Anabaena variabilis*	> 95	3,500 7,500 700	50% red. cell count 50% red. growth rate 50 % red. photosynthesis	450874-01 Stratton, 1984	Supplemental
Blue-green algae *Anabaena cylindrica*	> 95	8,500 5.500 4,800	50% red. cell count 50% red. growth rate 50% red. photosynthesis	450874-01 Stratton, 1984	Supplemental

2. Terrestrial Effects Characterization

Table III-C10 presents the toxicity endpoint values from the studies used to calculate RQs and estimate risk to terrestrial organisms from ground and aerial spray of propazine. Details of the registrant-submitted studies for terrestrial animals are provided below and in Appendix F.

Table III-C 10. Propazine Toxicity Endpoint Values for Assessing Risk to Terrestrial Organisms					
Exposure Scenario	**Species**	**Exposure Duration**	**Toxicity Endpoint Value**	**Endpoint**	**Reference (Classification)**
Mammal					
Acute Oral	Rat *Rattus norvegicus*	Single Oral Dose	LD_{50} = >5050 mg/kg/day	Lethality	MRID 434741-01 (Acceptable)
Reproduction	Rat Charles River CD	3 Gener-ation	NOAEL = 5 mg/kg/day LOAEL = 50 mg/kg/day	Parental/ offspring toxicity	MRID 000414-09 (Acceptable)
Birds					

Table III-C 10. Propazine Toxicity Endpoint Values for Assessing Risk to Terrestrial Organisms					
Exposure Scenario	**Species**	**Exposure Duration**	**Toxicity Endpoint Value**	**Endpoint**	**Reference (Classification)**
Acute Oral	Bobwhite Quail *Colinus virginianus*	21 days	LD_{50} = >1640 mg ai/kg bw NOAEL= 244 mg ai/kg bw	Lethality (none) Weight loss	MRID 442873-01 (Acceptable)
Subacute Dietary	Bobwhite Quail *Colinus virginianus*	8 days	LC_{50} = >4930 ppm ai NOAEL – not determined	Lethality (none) Reduced feed consumption & growth	MRID 442873-02 (Acceptable)
Chronic	No Data Submitted				
Insects					
Acute Contact	Honey bee *Apis mellifera*	96 hours	96.7 µg/bee	2.47% mortality	Atkins et al. 1975 (Scientifically sound)
Terrestrial Plants					
Seedling Emergence	Monocot - onion	Tier II	EC_{25} = 0.035 lb ai/A NOAEC <0.010 lb ai/A	Shoot weight	MRID 441848-04 (Uncertain)
Seedling Emergence	Dicot - lettuce	Tier II	EC_{25} = 0.016 lb ai/A NOAEC <0.0047 lb ai/A	Shoot weight	MRID 441848-04 (Uncertain)
Vegetative Vigor	Monocot - wheat	Tier II	EC_{25} = 0.046 lb ai/A NOAEC <0.020 lb ai/A	Shoot weight	MRID 441848-04 (Uncertain)
Vegetative Vigor	Dicot - cucumber	Tier II	EC_{25} = 0.10 lb ai/A NOAEC <0.075 lb ai/A	Shoot weight	MRID 441848-04 (Uncertain)

a. Terrestrial Animals

(1) Birds, Acute and Subacute

An oral toxicity study using the technical grade of the active ingredient (TGAI) is required to establish the acute toxicity of propazine to birds. The preferred guideline test species is either mallard duck (a waterfowl) or bobwhite quail (an upland gamebird). The submitted acute data indicate that propazine is at most slightly toxic to upland gamebirds with an acute oral LD_{50} value of >1,640 mg ai/kg (Table III-C11). The NOAEL was determined to be 244 mg ai/kg, based on weight loss (MRID 442873-01).

Table III-C 11. Avian Acute Oral Toxicity for Propazine					
Species	**% ai**	**LD_{50}/NOAEL (mg ai/kg)**	**Toxicity Category**	**MRID No. Author, Year**	**Study Classification**
Northern bobwhite quail *(Colinus virginianus)*	98.0	>1,640/244	Slightly toxic	442873-01 Bio-Life Assoc., 1983	Core

The results of the acute avian oral LD_{50} study with DEA show that it is slightly toxic. Ten, forty, ninety, and one-hundred percent mortality was observed in quail exposed to DEA at 445, 735, 1212, and 2000 mg/kg-bw by 14 days (MRID # 465000-09). In addition, sublethal treatment-related effects, including reductions in body weight gain and food consumption, were observed at 270 mg/kg-bw (lowest dose tested) and above.

Table III-C 12. Avian Acute Oral Toxicity for the Degradate Deethylatrazine					
Species	**% ai**	**LD_{50} (mg/kg-bw)**	**Toxicity Category**	**MRID No. Author, Year**	**Study Classification**
Northern bobwhite quail (*Colinus virginianus*)	96%	768	Slightly toxic	465000-09 Stafford, 2005	Acceptable

Two dietary studies using the TGAI are required to establish the subacute toxicity of propazine to birds. The preferred test species are mallard duck and bobwhite quail (Table III-C13.). The data that were submitted show that the 8-day acute dietary LC_{50}'s were >4,930 ppm and >5,140 for bobwhite quail and mallard, respectively; therefore, propazine is at most, categorized as slightly toxic to upland game birds on a subacute dietary basis (MRIDs 442873-02 and MRID 442873-03).

Table III-C 13. Avian Subacute Dietary Studies for Propazine					
Species	**% ai**	**8-Day LC_{50} (ppm ai)**	**Toxicity Category**	**MRID No. Author, Year**	**Study Classification**
Northern bobwhite quail *(Colinus virginianus)*	98.0	>4,930	Slightly toxic	442873-02 Bio-Life Assoc., 1983	Core
Mallard duck *(Anas platyrhynchos)*	98.0	>5,140	Practically non-toxic	442873-03 Bio-Life Assoc., 1983	Core

(2) Birds, Chronic

Avian reproduction studies using the TGAI are usually required for pesticide registration because birds may be subject to repeated or continuous exposure to the pesticide, especially preceding or during the breeding season. The preferred test

species are mallard duck and bobwhite quail. No avian reproduction studies were submitted by the registrant.

(3) Mammals, Acute

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. These toxicity values are reported below (Tables III-C14 and III-C15). The results indicate that propazine is categorized as practically non-toxic (Toxicity Category IV) to small mammals on an acute oral basis (LD_{50} value >5,050 mg/kg; MRID 434741-01).

Table III-C 14. Mammalian Acute Toxicity for Propazine

Species	% ai	Toxicity	Affected Endpoints	MRID No. Author, Year	Study Classification
Rat (Sprague-Dawley)	98.0	LD_{50} >5,050 mg/kg (males/females)	Mortality	434741-01 American Cyanamid Co., 1983	Core

The acute mammalian oral toxicity study with the degradate deethylatrazine (DEA) provides LD_{50} values between 668 and 1881 mg/kg, indicating that it is slightly toxic when administered via the oral route (Table III-C15).

Table III-C 15. Mammalian Acute Toxicity for the Degradate Deethylatrazine

Species	% ai	Toxicity Value	Affected Endpoints	MRID No. Author, Year	Study Classification
Laboratory rat (*Rattus norvegicus*)	98.0	668 mg/kg 1,881 mg/kg	LD_{50} (mortality)	430132-02 Kuhn, 1991	Core

(4) Mammals, Developmental/Reproductive

In developmental toxicity studies, administration of propazine by gavage produced maternal toxicity in both Sprague-Dawley rats and New Zealand rabbits with a NOAEL of 10 mg/kg bw/day (Table III-C16). Decreased ossification was also observed in offspring of rats, resulting in a developmental NOAEL of 10 mg/kg/day. No treatment-related effects in developmental parameters were observed in rabbits. Salivation was also observed in rats at doses ≥500 mg/kg/day (MRIDs 001502-42 and 441534-01).

In a 3-generation reproduction study with rats exposed to propazine, no treatment-related effects on reproduction were observed; consequently, the NOAEL for reproductive toxicity was ≥50 mg/kg bw/day. Based on decreased body weights in males and females, the parental/offspring NOAEL was 5 mg/kg/day. This value will be used to assess the chronic risk of propazine to mammals (MRID 000414-09).

Table III-C 16. Mammalian Developmental/Reproductive Toxicity for Propazine					
Species	**% Purity**	**Test Type**	**Toxicity**	**Affected Endpoints**	**MRID No. Study author (Classification)**
Rat (Sprague Dawley)	99.1	Developmental	NOAEL/LOAEL = 10/100 mg/kg bw/day NOAEL/LOAEL = 10/100 mg/kg bw/day	Maternal tox[1] Developmental	001502-42 Salamon, 1985 (Acceptable)
Rabbit (New Zealand White)	98	Developmental	NOAEL/LOAEL = 10/50 mg/kg bw/day	Maternal tox[2]	441534-01 Knapp, 1995 (Acceptable)
Rat (Charles River CD)	NA	Reproduction	NOAEL/LOAEL = 5/50 mg/kg bw/day NOAEL/LOAEL = ≥50/>50 mg/kg bw/day	Parental/ offspring tox[3] Reproductive tox	000414-09 Jessup *et al.*, 1979 (Acceptable)

[1] Maternal toxicity – Decreased body weight and food consumption; salivation was also observed.
Developmental toxicity – Decreased ossification.
[2] Maternal toxicity – Decreased body weight gain and food consumption
Developmental toxicity - No treatment-related effects were observed.
[3]Parental/offspring toxicity – Decreased body weights in males and females
Reproductive toxicity - No treatment-related effects were observed.

In subchronic studies with the degradates, it appears that deethylatrazine (DEA) and diaminochlorotriazine (DACT) also produced decreased body weights in rats at doses as low as 25 ppm ai and 250 ppm ai, respectively (Table III-C17). DEA and DACT also resulted in developmental effects in rats at 100 ppm ai (fused sternebrae and poor ossification) and 500 ppm ai (embryo resorption and poor ossification), respectively.

Table III-C 17. Mammalian Subchronic and Reproduction Toxicity for the Propazine Degradates					
Species	**% ai**	**NOAEL/LOAEL (ppm ai)**	**LOAEL Endpoints**	**MRID No. Author, Year**	**Study Classification**
Laboratory rat (*Rattus norvegicus*) Fed for 14 days	98.2 DACT (G-28273)	NOAEL < 100 LOAEL 100 200	red. LH and prolactin levels red. estrogen, LH, prolactin and progesterone	415109-01 Hazleton Lab., 1990	Supplemental
Laboratory rat (*Rattus norvegicus*) 13-week diet	95.7 DEA (G-30033)	NOAEL 50 LOAEL 500	red. in female body weight red. in food efficiency for male and female rats	430132-06 Ciba-Geigy, 1991	Acceptable-Guideline
Laboratory rat (*Rattus norvegicus*) 13-week diet	98.2 DACT (G-28273)	NOAEL 10 LOAEL 100 NOAEL 100 LOAEL 250	Estrous cycle effects in female rats red. body weight gain in males and female Week 12	430132-07 Ciba-Geigy, 1991	Core-Guideline
Dog – Beagle	95.7 DEA	NOAEL 100 LOAEL 1,000	red. body weight & weight gain in males and females;	430132-04 Ciba-	Core-Minimum

Table III-C 17. Mammalian Subchronic and Reproduction Toxicity for the Propazine Degradates					
Species	**% ai**	**NOAEL/LOAEL (ppm ai)**	**LOAEL Endpoints**	**MRID No. Author, Year**	**Study Classification**
(*Canis* sp.) 13-week Feeding	(G-30033)		red. heart to brain weight; normocytic/normochromic anemia, paroxysmal atrial fibrillation and right atrial wall hemorrhagic inflammation with angiomatous hyperplasia	Geigy, 1992	
Dog – Beagle (*Canis* sp.) 1-Year Feeding	98.7 DACT (G-28273)	NOAEL 5 LOAEL 100	1 of 8 females had tremors	413924-01 Ciba-Geigy, 1990	Minimum
Laboratory rat (*Rattus norvegicus*) Dosed on Days 6-15	95.7 DEA (G-30033)	NOAEC 5 LOAEC 25 Development: NOAEL 25 LOAEC 100	red. body weight; weight gain and food consump. Fused sternebrae 1 & 2 Poor ossification of digit 5	430132-09 Ciba-Geigy, 1992	Acceptable-Guideline
Laboratory rat (*Rattus norvegicus*) Dosed on Days 6-15	98.2 DACT (G-28273)	NOAEL 500 LOAEL 3000 Development: NOAEL 50 LOAEC 500	red. body weight gain and food consumption incr. resorption of embryos incr. unossified bones	413924-02 Ciba-Geigy, 1989	Minimum

(5) Insects, Acute Contact

In an acute contact study with the honey bee, propazine was determined to be relatively non-toxic. At 96 hours, mortality was 2.47% at a dose of 96.69 µg/bee (Atkins et al. 1975). The study was scientifically sound and showed that propazine is relatively non-toxic to honey bees.

(6) Insects, Residual Contact

No residual contact toxicity study was submitted by the registrant.

b. Terrestrial Plants

Tier II terrestrial plant toxicity studies were conducted to establish the toxicity of propazine to non-target terrestrial plants (MRID 441848-04). This study was reevaluated in 2006 and additional statistical analyses were performed. Classification of the study is awaiting final EFED review.

Results of Tier II toxicity studies with monocots and dicots indicate that seedling emergence and vegetative vigor are severely impacted by exposure to propazine. Seedling emergence, based on shoot weight, was adversely impacted in monocots (onion) at an EC_{25} of 0.035 lb ai/A and in dicots (lettuce) with an EC_{25} of 0.016 lb ai/A (Table III-C18). Vegetative vigor in monocots, based on shoot weight, was adversely impacted in monocots (wheat) at an EC_{25} of 0.046 lb ai/A and in dicots (cucumber) at an EC_{25} of 0.10 lb ai/A. The observed effects to monocots and dicots included stunting, chlorosis, necrosis, and plant death. These values will be used to assess the risk of propazine to non-target terrestrial plant species.

Terrestrial Field Studies

Terrestrial field studies were not submitted.

Table III-C 18. Terrestrial Non-Target Plant Toxicity.[a]										
Species	**Seedling Emergence**						**Vegetative Vigor**			
	Shoot weight		**Shoot length**		**% Emergence**		**Shoot weight**		**Shoot length**	
	EC_{25} (lb ai/A)	**NOAEC (lb ai/A)**	**EC_{25} (lb ai/A)**	**NOAEC (lb ai/A)**	**EC_{25} (lb ai/A)**	**NOAEC (lb ai/A)**	**EC_{25} (lb ai/A)**	**NOAEC (lb ai/A)**	**EC_{25} (lb ai/A)**	**NOAEC (lb ai/A)**
Monocots										
Corn	>2.4	2.4	>2.4	2.4	>2.4	2.4	<2.5	2.5	>2.5	2.5
Oat	0.050	<0.010	0.056	0.010	0.066	0.036	0.11	0.0022	0.13	0.0022
Onion	**0.035**	**<0.010**	0.051	0.018	0.098	0.071	0.096	0.075	0.20	0.075
Ryegrass	0.83	0.077	>2.4	0.59	>2.4	2.4	0.17	0.075	0.46	0.31
Wheat	0.14	0.010	0.83	0.010	>1.7	1.2	**0.046**	**0.020**	0.071	0.038
Dicots										
Cabbage	0.098	<0.011	0.12	<0.011	0.19	0.020	0.13	0.011	0.18	0.077
Cucumber	0.12	0.077	0.13	0.16	0.12	0.16	**0.10**	**<0.075**	0.19	0.075
Lettuce	**0.016**	**0.0047**	0.034	0.018	0.065	0.036	0.10	0.075	0.21	0.15
Radish	0.16	0.077	0.36	0.30	1.4	0.30	0.22	0.075	0.38	0.15
Soybean	0.97	0.59	1.5	0.59	1.7	0.59	0.66	0.038	0.68-1.2	0.15
Tomato	0.18	<0.077	0.27	0.077	0.66	0.30	0.15	0.038	0.19	0.038

[a]MRID 441848-04, Study authors D. Schwab *et al.* 1996.

IV. RISK CHARACTERIZATION

A. Risk Estimation - Integration of Exposure and Effects Data

Risk characterization integrates EECs and toxicity estimates and evaluates the likelihood of adverse ecological effects to non-target species. In a deterministic approach, an exposure estimate is divided by a single point estimate of toxicity (**Table IV-A1**) to calculate a risk quotient (RQ). The RQ is then compared to the Agency's levels of concern (LOCs) that serve as criteria for categorizing potential risk to non-target organisms (**Appendix G**).

Table IV-A1. Toxicity reference values used to calculate risk quotients for propazine

Taxonomic Group	Assessment Endpoint	Measure of Effect
Birds	Survival Sublethal effects	Bobwhite quail LD_{50} = >1640 mg ai/kg bw; NOAEL= 244 mg ai/kg bw. LC_{50} = >4930 ppm ai; NOAEL not determined. (MRID 442873-01)
	Reproduction, Growth	No data submitted
Mammals	Survival	Rat LD_{50} = >5050 mg/kg/day (MRID 434741-01)
	Reproduction, Growth	Rat NOAEL = 5 mg/kg/day, LOAEL = 50 mg/kg/day (MRID 000414-09)
Terrestrial Invertebrates	Survival	Honey bee: 96 hours: 2.5% mortality at 96.7 µg/bee
Terrestrial Plants	Survival, Growth	Seedling emergence onion EC_{25} = 0.035 lb ai/A; NOAEC <0.010 lb ai/A Seedling emergence lettuce EC_{25} = 0.016 lb ai/A; NOAEC <0.0047 lb ai/A Vegetative vigor wheat EC_{25} = 0.046 lb ai/A; NOAEC <0.020 lb ai/A Vegetative vigor cucumber EC_{25} = 0.10 lb ai/A; NOAEC <0.075 lb ai/A (MRID 441848-04)
Freshwater Fish	Survival	No valid studies available
	Reproduction, Growth	Fathead minnow NOAEC = 0.72 mg ai/L (MRID 442873-07)
Freshwater Invertebrates	Survival	Water flea EC_{50} = >5.32 ppm ai; NOAEC = 5.32 ppm ai (MRID 442873-05)
	Reproduction, Growth	Water flea NOAEC = 0.047 ppm ai; LOAEC = 0.091 ppm ai (MRID 443276-02)
Estuarine/marine Fish	Survival	No data submitted
	Reproduction, Growth	Sheepshead minnow NOAEC = 1.34 mg ai/L; LOAEC = 2.59 mg ai/L (MRID 441848-02)
Estuarine/marine Invertebrates	Survival	Saltwater mysid LC_{50} = 4.20 ppm ai; NOAEC = 0.586 ppm ai (MRID 441848-01)
	Reproduction, Growth	Saltwater mysid NOAEC = 0.269 ppm ai; LOAEC = 0.706 ppm ai (MRID 441848-03)
Aquatic Plants	Survival, Growth	Diatom EC_{50} = 0.0248 ppm ai; NOAEC = 0.0065 ppm ai (MRID 442873-10). Duckweed EC_{50} = 0.10 ppm ai; NOAEC = 0.022 ppm ai (MRID 442873-09).

1. Non-target Aquatic Animals and Plants

a. Fish and Invertebrates

Acute Risks

A comparison of estimated peak propazine concentrations in surface water following application to sorghum to the acute toxicity values (LC_{50}/EC_{50}s) for freshwater and marine/estuarine invertebrates is provided in Table IV-A2. Acute risk quotients were not calculated for freshwater or estuarine/marine fish due to the lack of acute toxicity information. Acute risk quotients (RQs) for estuarine/marine invertebrates are less than the Level of Concern (LOC), indicating adverse effects are not expected. Acute risk quotients for freshwater invertebrates were not calculated because the acute EC_{50} value for freshwater invertebrates is greater than the highest concentration tested. A qualitative discussion of the risk to freshwater invertebrates based on this study will be provided in the Risk Description section.

Table IV-A2. Summarized Acute Risks for Aquatic Organisms [a,b]

Scenario (1.2 lbs a.i./A)	Peak EEC (ppb)	Freshwater Fish	Freshwater Invertebrate	Estuarine/Marine Fish	Estuarine/Marine Invertebrate[d]
Sorghum in Kansas					
Aerial App.	53.9	NA[c]	Not estimated	NA	0.01
Ground App.	40.8		Not estimated		<0.01
Sorghum in Texas					
Aerial App.	89.8	NA	Not estimated	NA	0.02
Ground App	82.0		Not estimated		0.02

[a] Detailed calculations of PRZM 3.12/EXAMS 2.98 modeling are provided in Appendix C.
[b] Acute toxicity threshold (LC_{50}) was 4.2 ppm for estuarine/marine invertebrates.
[c] There are no valid acute toxicity studies for freshwater and estuarine/marine fish; thus, RQ's were not calculated. RQs were not calculated for freshwater invertebrates because the EC_{50} is greater than the highest concentration tested.
[d] Acute aquatic LOCs: acute endangered species 0.05, acute restricted use 0.1, acute non-listed species 0.5

Chronic Risks

The aquatic chronic LOC of 1 is exceeded for freshwater invertebrates based on the 21-day average EEC for the sorghum crop scenarios in Kansas and Texas. All other chronic RQs for freshwater and estuarine/marine fish as well as estuarine/marine invertebrates are below the chronic LOC of 1 (Table IV-A3). Chronic risk to aquatic invertebrates is discussed further in the Risk Description section.

Table IV-A3. Summarized Chronic Risks for Aquatic Organisms [a,b,c]					
Scenario (1.2 lbs a.i./A)	21/60 Day EECs (ppb)	Freshwater Fish	Freshwater Invertebrate	Estuarine/Marine Fish	Estuarine/Marine Invertebrate
Sorghum in Kansas					
Aerial App.	53.2/52.0	0.07	**1.13***	0.04	0.20
Ground App.	40.2/39.5	0.05	0.86	0.03	0.15
Sorghum in Texas					
Aerial App.	88.1/85.1	0.12	**1.87***	0.06	0.33
Ground App.	80.4/77.6	0.11	**1.71***	0.06	0.30

[a] Detailed calculations of PRZM 3.12/EXAMS 2.98 modeling are provided in Appendix C.
[b] Chronic toxicity thresholds were NOAEC of 0.72 ppm for freshwater fish and NOAEC of 0.047 ppm for freshwater invertebrate. Estuarine/marine fish NOEAC was 1.34 ppm and invertebrate NOAEC was 0.269 ppm.
[c] RQ calculation based on 60-day EEC for fish and 21-day EEC for invertebrates.
*RQ exceeds the chronic risk LOC of 1.0

b. Aquatic Plants

For propazine, there are exceedances of the LOC for listed vascular and non-vascular aquatic plants exposed to runoff/drift from ground and aerial spray applications to sorghum (Table IV-A4). There are no exceedances of the LOC for unlisted vascular aquatic plants for the Kansas and Texas scenarios; however, there are exceedances of the LOC for unlisted non-vascular aquatic plants. Risk to aquatic plants will be discussed further in the Risk Description section.

Table IV-A4. Summarized Acute Aquatic Plant Risk Quotients [a,b,c,d]					
Scenario (1.2 lbs a.i./A)	**Peak EEC (ppb)**	**Endangered Vascular**	**Endangered Non-vascular**	**Non-endangered**	
				Vascular	**Non-vascular**
Sorghum in Kansas					
Aerial App.	53.9	**2.45***	**8.29***	0.54	**2.17****
Ground App.	40.8	**1.85***	**6.28***	0.41	**1.65****
Sorghum in Texas					
Aerial App.	89.8	**4.08***	**13.82***	0.90	**3.62****
Ground App.	82.0	**3.72***	**12.62***	0.82	**3.31****

[a] Detailed calculations of PRZM/EXAMS modeling is provided in Appendix C.
[b]* RQ exceeds the Endangered Species LOC; RQ > 1.0.
[c]** RQ exceeds the aquatic plant risk LOC; RQ > 1.0.
[d] The endangered toxicity threshold (NOAEC) was 0.022 ppm for vascular plants and 0.0065 for non-vascular plants; acute toxicity thresholds (EC_{50}) were 0.10 ppm (MRID 442873-09) and 0.0248 ppm (442873-10) for vascular and freshwater non-vascular plants, respectively.

2. Non-target Terrestrial Animals

a. Birds

Acute Risks

Acute avian RQs were not calculated with either the oral gavage study or the subacute dietary study with bobwhite quail because the LD/LC_{50} values are greater than the highest dose/concentration tested. A qualitative discussion of the acute risk to birds, reptiles, and terrestrial-phase amphibians will be provided in the risk description.

Chronic Risks

Chronic risks to birds were not assessed due to the lack of avian chronic toxicity studies.

b. Mammals

Acute Risks

The acute RQs for mammals were not calculated because the LD_{50} value obtained from the acute oral study is greater than the highest dose tested. A qualitative discussion of acute risk to mammals will be provided in the risk description.

Chronic Risks

To evaluate the chronic risk to mammals, RQs were calculated using the rat reproductive NOAEL of 5 mg/kg bw and NOAEC of 100 ppm. The RQs are detailed in Table IV-A5 and are summarized in Appendix D. Assuming maximum and mean residue levels at the maximum single application rate (1.2 lbs a.i./A for sorghum), the chronic dose-based risk quotients exceed the chronic LOC for mammals for the 15 g, 35 g, and 1000g mammal weight classes consuming short grass, tall grass and broadleaf forage/small insects. The 15g and 35g mammal RQs exceed the chronic LOC when consuming the maximum predicted propazine residue on fruit/large insects. The chronic LOC for all weight classes of mammals consuming seeds/pods was not exceeded. At the maximum residue levels, the chronic dietary-based RQs exceed the chronic LOC for all food categories except fruit, large insects, seeds and pods. The chronic dietary-based RQ exceeds the chronic LOC for mammals consuming short grass using mean residues levels. Chronic risk to mammals is discussed further in the Risk Description section.

Table IV-A5. Mammalian Chronic Risk Quotient Summary

Food type	Weight class (g)	RQs for 1.2 lbs a.i./A			
		Predicted maximum residues		Predicted mean residues	
		Dose-Based RQs	Dietary-Based RQs	Dose-Based RQs	Dietary-Based RQs
Short grass	15	**24.99***	2.88*	**8.82***	1.02*
	35	**21.34***		**7.57***	
	1000	**11.44***		**3.98***	
Tall grass	15	**11.45***	1.32*	**3.73***	0.43
	35	**9.78***		**3.21***	
	1000	**5.24***		**1.68***	
Broadleaf forage, small insects	15	**14.06***	1.62*	**4.67***	0.54
	35	**12.01***		**4.01***	
	1000	**6.44***		**2.11***	
Fruit, large insects	15	**1.56***	0.18	0.73	0.08
	35	**1.33***		0.62	
	1000	0.72		0.33	
Seeds, pods	15	0.35		0.16	
	35	0.30		0.14	
	1000	0.16		0.07	

[a] Chronic reproductive toxicity NOAEL = 5 mg/kg bw/day; NOAEC = 100 ppm.

[b] Detailed calculations of the T-REX model (Ver.1.2.3) and Chronic RQs are provided in Appendix D.

[c] * RQ exceeds the Chronic Risk LOC; RQ > 1.0.

c. Non-Target Terrestrial-phase Amphibians, Reptiles and Beneficial Invertebrates

EFED currently uses surrogate data (birds) for terrestrial non-target amphibians and reptiles and does not quantify risks to terrestrial non-target insects. Risks are qualitatively discussed in the Risk Description section of this document.

3. Non-target Terrestrial Plants in Terrestrial and Semi-aquatic Environments

Table IV-A6 presents terrestrial plant RQs based on propazine use on sorghum for both ground and aerial spray applications. For the terrestrial use of propazine and the maximum application rate of 1.2 lbs a.i./A from aerial spray application, the acute LOC is exceeded for nonendangered monocots and dicots located in adjacent areas and in semi-aquatic areas primarily as the result of runoff; and for nonendangered monocots as a result of spray drift (Table IV-A6). Likewise, the acute LOC is exceeded for monocots in semi-aquatic areas and dicots in adjacent and semi-aquatic areas primarily as the result of runoff from ground spray applications. RQs are higher for aerial applications when compared to ground applications. This would be expected given the percentages of drift assumptions of 5% and 1% for aerial and ground sprays, respectively.

For both ground and aerial spray application, the LOC is exceeded for endangered monocots and dicots located in adjacent and semi-aquatic areas (Table IV-A6). The LOC for endangered species is exceeded for monocots and dicots in dry areas exposed to spray drift from both ground and aerial applications.

Table IV-A6. Terrestrial Plant Risk Quotient Summary for Terrestrial Spray Use on Sorghum [a,b,c,d]

Scenario	Non-endangered RQs			Endangered RQs		
	Terrestrial Adjacent area	Semi-aquatic Adjacent area	Drift	Terrestrial Adjacent area	Semi-aquatic Adjacent area	Drift
Sorghum (1.2 lbs a.i./A)						
Ground spray application						
Monocot	0.69	**3.77****	0.34	**>2.40***	**>13.20***	**>1.20***
Dicot	**1.50****	**8.25****	0.75	**5.11***	**28.09***	**2.55**
Sorghum (1.2 lbs a.i./A) *Aerial spray application*						
Monocot	**2.06****	**5.14****	**1.71****	**6.72***	**13.20***	**6.00***
Dicot	**4.50****	**11.25****	**3.75****	**14.30***	**28.09***	**12.77***

[a] Detailed calculations for RQs and TerrPlant Ver. 1.0 input and output are provided in Appendix E.
[b] Non-endangered toxicity thresholds (EC_{25}) were 0.035, 0.016, 0.046, and 0.10 lb a.i./A for seedling emergence monocot, seedling emergence dicot, vegetative vigor monocot, and vegetative vigor dicot, respectively.
[c] Endangered toxicity thresholds (NOAEC) were <0.01, 0.0047, 0.02, and <0.075 lb a.i./A for seedling emergence monocot, seedling emergence dicot, vegetative vigor monocot, and vegetative vigor dicot, respectively.
[d]* RQ exceeds the Endangered Species LOC; RQ >1.0.
** RQ exceeds the Acute Risk LOC; RQ >1.0.

B. Risk Description

The risk hypothesis states that the use of propazine for weed control in sorghum has the potential to compromise survivorship, reproduction, and/or growth of non-target aquatic and terrestrial animals and plants, including Federally-listed endangered and threatened species. Based on the available ecotoxicity data and predicted environmental exposures, this ecological risk assessment supports the presumption of chronic risk to freshwater invertebrates and mammals and risk to non-vascular unlisted aquatic plants and to non-target terrestrial monocots and dicots following aerial and ground applications. This ecological risk assessment also supports the presumption of acute endangered species risk to vascular aquatic plants and non-target terrestrial monocots and dicots. The presumption of acute risk to aquatic invertebrates, mammals and birds; chronic risk to estuarine/marine invertebrates and freshwater and estuarine/marine fish; and risk to non-endangered aquatic vascular plants is not supported by the results of this screening risk assessment. The presumption of acute risk to freshwater and estuarine/marine fish and chronic risk to birds could not be determined in this risk assessment due to the lack of usable toxicity data. As noted above, propazine may not be applied to selected soils and as such the risk conclusions do not apply to locations where sorghum is grown on these soils. More details on the risk conclusions can be found in the Executive Summary of the Ecological Risk Science Chapter for propazine.

1. Risks to Aquatic Organisms

In the conceptual model, spray drift and surface runoff/leaching to adjacent bodies of water were predicted as the most likely sources of exposure of propazine to nontarget aquatic organisms. Risks to aquatic organisms (i.e. fish, invertebrates, and plants) were assessed based on modeled estimated environmental concentrations (EECs) and available toxicity data. Aquatic EECs for the ecological exposure to propazine were estimated using PRZM/EXAMS employing the standard field pond scenario (Table II-B3).

a. Animals

Fish and Invertebrates

Table IV-B1 provides a comparison of the peak EECs in surface water to acute toxicity values for freshwater (FW) and estuarine/marine (E/M) fish and invertebrates. Toxicity studies demonstrate that propazine is moderately toxic to estuarine/marine invertebrates following acute exposure; however, at the peak EECs, there were no exceedances of the Acute Risk, Acute Restricted Use, or Acute Endangered Species LOCs for estuarine/marine invertebrates (Table IV-A2). In a 48-hour flow-through test with freshwater daphnids, no immobilization or sublethal effects were observed at the highest test concentration, resulting in an EC_{50} of >5.32 ppm ai (mean measured concentration) (MRID 442873-05). The study is scientifically sound but does not fulfill guideline requirements because daphnids were not exposed up to 100 ppm ai. Consequently, the acute toxicity of propazine to freshwater invertebrates cannot be categorized. If it can be shown that the test was conducted up to the limit of solubility, the study could be upgraded to acceptable. However, for these requested uses, a comparison of the highest concentration tested

in the daphnid study (5320 ppb) with the highest peak EEC of 89.8 ppb shows that there were no effects in daphnids at concentrations 59 times higher than the highest peak EEC. Therefore, potential acute risk to freshwater invertebrates is expected to be minimal. Toxicity data are unavailable for freshwater and estuarine/marine fish; consequently, the acute risk for these taxonomic groups following exposure to propazine under the proposed labeled uses remains an uncertainty.

Table IV-B 1. Comparison of Peak EECs of Propazine in Surface Water to Aquatic Acute Toxicity Values

Simulation Scenario	EEC's (µg/L)			Toxicity Values (µg/L)		
Sorghum (1.2 lb a.i./A)	Peak	21-day	60-day	FW Invertebrate EC_{50}	E/M Invertebrate LC_{50}	FW & E/M Fish
Sorghum (KS)				5,320	4,200	N/A
Aerial spray	53.9	53.2	52.0			
Ground spray	40.8	40.2	39.5			
Sorghum (TX)						
Aerial spray	89.8	88.1	85.1			
Ground spray	82.0	80.4	77.6			

Table IV-B2 provides a comparison of the 21- and 60-day EECs in surface water to chronic toxicity values for freshwater (FW) and estuarine/marine (E/M) invertebrates and fish, respectively. Chronic exposure of propazine to estuarine/marine invertebrates produced significant effects to reproduction in mysid shrimp at 0.706 ppm ai. However, at the 21-day EEC, the chronic LOC for estuarine/marine invertebrates was not exceeded (Table IV-A3). Chronic exposure of propazine to fathead minnows resulted in significant reductions in length at 1.14 mg ai/L and chronic exposure to sheepshead minnow affected embryo survival and hatching success at 2.59 mg ai/L. However, at the 60-day EEC, there were no exceedances of the aquatic chronic LOC for freshwater and estuarine/marine fish (Table IV-A3).

Chronic exposure of propazine to freshwater invertebrates produced adverse effects to growth at 0.091 ppm ai. Risk quotients for freshwater invertebrates exceeded the chronic LOC (Table IV-A3) when propazine is applied to sorghum and it is assumed that it reaches the surface water by runoff and/or leaching at the predicted PRZM/EXAMS EECs. Consequently, freshwater invertebrates inhabiting surface waters adjacent to a propazine treated field would be at risk for adverse effects on survival and growth following chronic exposure to propazine in surface runoff and/or leachate as a result of spray application at the 21-day average EEC for the Kansas and Texas sorghum crop scenarios. Daphnids play a critical role in aquatic food webs by serving as an intermediate between primary producers and fish. Consequently, changes in daphnid populations, either through direct mortality or sublethal (*e.g.* reproductive, growth) effects, could trigger community- or ecosystem-level responses. When propazine is applied aerially to sorghum, the predicted aquatic exposure is 53.2 µg/L for the Kansas scenario and the NOAEC for the daphnid is 47µg/L, indicating that the chronic LOC for freshwater invertebrates at the application rate of 1.2 lb ai/A is only slightly exceeded for the Kansas scenario. However, when propazine is applied by either aerial or ground spray to sorghum in the Texas scenario, the EEC's are

approximately 1.81 times the NOAEC for the sensitive freshwater daphnid. Keeping all parameters in the modeling scenarios the same and assuming that EECs are reduced linearly with application rate reduction, EFED conducted an analysis of the effect of rate reduction on chronic RQs for aquatic invertebrates. The chronic RQs for sorghum grown in Texas may be reduced to below the chronic LOC of 1.0 if the application rates are reduced by 45% to 0.66 lb ai/A.

Table IV-B 2. Comparison of 21- and 60-day EECs of Propazine in Surface Water to Aquatic Chronic Toxicity Values.

Simulation Scenario	EEC's (µg/L)		Toxicity Values (µg/L)			
Sorghum (1.2 lb a.i./A)	21-day	60-day	FW Invertebrate NOAEC	E/M Invertebrate NOAEC	FW Fish NOAEC	E/M Fish NOAEC
Sorghum (KS)						
Aerial spray	53.2	52.0				
Ground spray	40.2	39.5	47*	269	720	1,340
Sorghum (TX)						
Aerial spray	88.1	85.1				
Ground spray	80.4	77.6				

*RQ exceeded LOC.

b. Aquatic Plants

In aquatic plants, propazine produces adverse effects to growth and cell density in both vascular and nonvascular plants. In the duckweed study, an EC_{50} of 0.010 ppm a.i. (NOAEC of 0.022 ppm a.i) was determined. Algal EC_{50} values ranged from 0.18 to 0.029 ppm ai. The freshwater diatom, *Navicula pelliculosa*, was the most sensitive nonvascular aquatic plant, with an NOAEC of 0.0065 ppm ai. For the use scenario modeled for propazine, there are exceedances of the endangered LOCs for both vascular and non-vascular aquatic plants for runoff/drift from ground and aerial spray applications to sorghum (Table IV-A4). There were no exceedances of the LOC for non-listed vascular aquatic plants for the Kansas and Texas scenarios; however, there were exceedances of the LOC for unlisted non-vascular aquatic plants (Table IV-A4), assuming that the maximum predicted propazine concentrations would come in contact with freshwater nonvascular plants. Consequently, both listed vascular and non-vascular plants and unlisted nonvascular plants inhabiting surface waters adjacent to a treated field would be at risk for adverse effects to growth and development when exposed to propazine as a result of the labeled use on sorghum. Although there are no listed nonvascular plants, there is concern for indirect effects to other taxa as these aquatic plants are a basis for food and other needs. The RQs for "endangered" nonvascular plants range from 0.61 for blue-green algae (Kansas, ground application) to 13.37 (Texas, aerial application) for diatoms.

Table IV-B3 provides a comparison of the peak EECs in surface water to toxicity values for both listed and unlisted vascular and nonvascular aquatic plants for risks associated with exposure of aquatic plants to propazine by surface runoff and/or leaching. Keeping all parameters in the modeling scenarios the same and assuming that EECs are reduced linearly with application rate reduction, EFED conducted an

analysis of the effect of rate reduction on RQs for aquatic plants. The RQs for the aerial spray to sorghum in the Kansas scenario may be reduced to below the aquatic plant LOC (1.0) if the application rates are reduced by 87% to 0.16 lb ai/A. The RQs for the aerial spray to sorghum in the Texas scenario may be reduced to below the aquatic plant LOC (1.0) if the application rates are reduced by 93% to 0.08 lb ai/A. A complete spray drift analysis for exposures to aquatic plants is provided in Section IV.B.3. The potential risk to endangered vascular aquatic plants will be discussed in greater detail in Section IV.B.6.

Table IV-B 3. Comparison of Peak EECs of Propazine in Surface Water to Aquatic Plant Toxicity Values.

Simulation Scenario	EEC's (µg/L)	Toxicity Values (µg/L)			
Sorghum (1.2 lb a.i./A)	Peak	Endangered Vascular NOAEC	Endangered Nonvascular NOAEC	Non-endangered Vascular EC_{50}	Non-endangered Nonvascular EC_{50}
Sorghum (KS)					
Aerial spray	53.9				
Ground spray	40.8	**22***	**6.5***	100	**24.8***
Sorghum (TX)					
Aerial spray	89.8				
Ground spray	82.0				

*RQ's exceeded LOC's.

2. Risks to Terrestrial Organisms

In the conceptual model, ground deposition from spray application and spray drift with resulting residues on foliage and on flowers and seeds are the most likely sources of propazine exposure to nontarget terrestrial organisms, including listed species. Risks to terrestrial organisms (i.e. birds, mammals, and plants) were assessed based on modeled EECs and available toxicity data. As part of the terrestrial assessment, exposure concentrations of propazine to nontarget terrestrial plants and animals were modeled according to the labeled application rate for sorghum. For terrestrial birds and mammals, estimates of initial levels of propazine residues on various food items, which may be contacted or consumed by wildlife, were determined using the Fletcher nomogram followed by a first order decline model TREX 1.2.3. Likewise, the TerrPlant 1.0 model was used to estimate exposure to nontarget plants and the AgDrift 2.0.1 model provided further refinement of spray drift dispersion and deposition to terrestrial plants located in proximity to treated fields.

a. Animals

Birds, Reptiles and Terrestrial-phase Amphibians

Propazine is categorized as at most, slightly toxic to upland game birds (bobwhite quail) on an acute oral basis (LD_{50} >1,640 mg ai/kg) and subacute dietary basis (LC_{50} >4,930 ppm ai). The degradate deethylatrazine is also slightly toxic to bobwhite quail. Propazine is practically nontoxic to waterfowl (mallard) on a subacute dietary basis. Reproduction studies are not available to assess the risk to upland game birds

and waterfowl from developmental/reproductive effects following chronic exposure to propazine under the currently proposed labeled uses.

Acute RQs were not estimated because the LD_{50}/LC_{50}'s were higher than the highest dose/concentration tested. For risk description purposes, the highest dose/concentration tested was compared with the expected terrestrial EECs. The acute oral LD_{50} for bobwhite quail is >1,640 mg ai/kg body weight and the acute dietary LC_{50} for bobwhite quail is >4930 ppm food. Assuming the maximum application rate for sorghum and maximum predicted residue levels, the predicted terrestrial EECs from the T-REX model (Ver.1.2.3) may be as high as 328 mg/kg bw for 20 g birds on a dose basis and 288 ppm for short grass on a dietary basis. In the acute oral LD_{50} study, there were no mortalities at 1640 mg/kg bw (weight adjusted value for 20 g birds is 1181.5 mg/kg bw). There is nearly a 4-fold difference between the EEC of 328 mg/kg bw and the adjusted LD_{50} of 1181.5 mg/kg bw. Therefore, the risk of mortality at these EECs is low. On a dietary basis, again, there were no mortalities at the highest concentration tested (4930 ppm). The difference between the dietary concentration of 288 ppm and the LC_{50} of 4930 ppm is more than an order of magnitude. Again, the potential risk of mortality to birds, reptiles and terrestrial-phase amphibians on a dietary basis is likely to be minimal.

In both the acute oral gavage and acute dietary studies, a possible chemical-induced anorexia occurred. Feed consumption and growth were initially affected by propazine at the 430 mg ai/kg dose in the gavage study (MRID 442873-01). The study authors noted that a NOAEC could be determined to be 244 mg ai/kg due to weight loss up to 72 hours after treatment. In the dietary study with quail, diminished feed consumption, slow growth, and cannibalism were observed at treatments ranging from 578 to 4,930 ppm ai (MRID 442873-02). Feed consumption rates and resultant growth were also affected in the dietary study with mallard ducks at all treatment levels (MRID 442873-03). In the dietary studies, the study authors could attribute the effects to food avoidance; however, in the oral study, the dose-related loss of weight was not related to dietary exposure. The authors suggested that the food avoidance may not just be related to feed palatability but rather result from chemically-induced anorexia. No treatment-related mortalities were observed in either study. In order to evaluate potential sublethal effects associated with acute exposure to propazine on a dose-related basis, the lowest dose (430 mg ai/kg bw – oral) producing effects (weight loss) are compared to predicted avian doses on food residues (EEC equivalent dose) following the application of propazine at 1.2 lbs ai/A. Table IV-B5 summarizes this comparison. For the use of propazine on sorghum with spray applications of 1.2 lbs ai/A, the highest EEC equivalent dose is 328 mg ai/kg-bw for short grass consumed by a 20g bird. The adjusted LOAEL for 20g birds is 310 mg ai/kg-bw. Therefore, at the predicted EEC for short grass, weight loss may be expected, indicating that there may be risks to acute sublethal effects in birds, reptiles and terrestrial-phase amphibians following spray applications.

Table IV-B 4. Comparison of Avian Sublethal Values with Predicted Doses on Food Residues[a]			
		1.2 lbs a.i./A	
Food Type	Weight class (g)	Predicted EEC Equivalent Dose (mg ai/kg-bw)	Adjusted LOAEL [b] (mg ai/kg-bw)
short grass	20	328	310
	100	187	394
tall grass	20	150	310
broadleaf forage, small insects	20	184	310

[a] Acute effect levels: LOAEL: 430 mg ai/kg-bw (oral); 578 ppm ai (dietary)

[b] See Appendix D for T-Rex modeling results.

No chronic avian studies are available. Decreased body weight and food consumption were observed in the acute avian studies and similar effects were observed in the developmental and reproduction studies in mammals. It is likely that similar effects would also be observed in the avian reproduction studies. This increases the uncertainty of risk to birds, reptiles and terrestrial phase amphibians following chronic exposure.

Mammals

Propazine is classified as practically non-toxic to small mammals on an acute oral basis (LD_{50} value of >5,050 mg/kg). The degradate deethylatrazine is classified as slightly toxic to small mammals on an acute oral basis (LD_{50} values from 668 to 1,881 mg/kg). When RQs are estimated using the LD_{50} of >5,050 mg/kg and assuming the maximum application rate for sorghum and maximum predicted residue levels; neither the Acute Risk, Acute Restricted Use, or Acute Endangered Species Risk LOCs were exceeded (Table IV-B6); consequently, mammals would not be at risk for direct effects on foraging behavior following acute exposure to propazine under the currently proposed labeled uses (Table IV-B6).

Table IV-B 5. Mammalian Acute Risk Quotient Summary [a,b,c,d]			
		1.2 lbs a.i./A	
Food type	Weight class (g)	Predicted maximum residues	Predicted mean Residues
short grass	15	0.02	0.01
	35	0.02	0.01

Table IV-B 5. Mammalian Acute Risk Quotient Summary [a,b,c,d]			
Food type	Weight class (g)	1.2 lbs a.i./A	
		Predicted maximum residues	Predicted mean Residues
	1000	0.01	<0.01
	15	0.01	<0.01
	35	0.01	<0.01
tall grass	1000	0.01	<0.01
	15	0.01	<0.01
	35	0.01	<0.01
broadleaf forage, small insects	1000	0.01	<0.01
	15	<0.01	<0.01
	35	<0.01	<0.01
fruit, large insects	1000	<0.01	<0.01
	15	<0.01	<0.01
	35	<0.01	<0.01
seeds, pods	1000	<0.01	<0.01

[a] Acute toxicity threshold was LD_{50} = 5050 mg/kg-bw.
[b] Detailed calculations of the T-REX model (Ver.1.2.3) and Acute RQs are provided in Appendix D.
[c] RQs in this table were calculated for the maximum labeled application rate of 1.2 lbs a.i./A for sorghum.
[d] * RQ exceeds the Endangered Species Level of Concern (LOC); RQ > 0.10.
** RQ exceeds the Acute Restricted Use LOC; RQ > 0.20.
*** RQ exceeds the Acute Risk LOC; RQ > 0.50.

In a 3-generation reproduction study with rats, propazine produced decreased body weights in males and females, resulting in a parental/offspring NOAEC of 5 mg/kg/day. No treatment-related effects on reproduction were observed; consequently, the NOAEC for reproductive toxicity was ≥50 mg/kg bw/day. In developmental toxicity studies, administration of propazine by gavage produced maternal toxicity in both Sprague-Dawley rats and New Zealand rabbits with a NOAEC of 10 mg/kg bw/day (Table III-C16). Decreased ossification was also observed in offspring of rats, resulting in a developmental NOAEC of 10 mg/kg/day. Developmental effects were also observed for the degradates, DEA and DACT in rats at 100 ppm ai (fused sternebrae and poor ossification) and 500 ppm ai (embryo resorption and poor ossification), respectively. Based on the rat parental/offspring toxicity data from the reproduction study and assuming the maximum application rate; the chronic LOC was exceeded for all weight classes of mammals consuming short grasses, tall grasses, and broadleaf forage/small insects at both the maximum and mean predicted residue levels; and for 15 and 35 g mammals consuming fruit and large insects at the maximum predicted residue levels (Table IVA-5). Consequently,

there are potential risks to mammals following chronic exposure to propazine when used as directed on the label.

In order to evaluate potential chronic effects associated with acute exposure to propazine on a dose-related basis, the adjusted NOAEL is compared to predicted mammalian doses on food residues (EEC equivalent dose) for all weight classes and food types for which chronic RQs were exceeded at the application rate 1.2 lbs ai/A. Table IV-B7 summarizes this comparison. The dose-based EECs range from 25 times (15 g mammals consuming short grasses) to 5 times (1000 g mammals consuming tall grasses) the adjusted NOAELs. Keeping all parameters in the modeling scenarios the same and assuming that EECs are reduced linearly with application rate reduction, EFED conducted an analysis of the effect of rate reduction on chronic RQs for mammals. The chronic RQs for sorghum may be reduced to below the chronic LOC of 1.0 if the application rates are reduced by 83.3% to 0.13 lb ai/A.

Table IV-B 6. Comparison of Mammalian Chronic Toxicity Values with Predicted Doses on Food Residues[a]

Food type	Weight class (g)	1.2 lbs a.i./A	
		Dose-based EECs (mg/kg-bw)	Adjusted NOAEL (mg/kg-bw/day)
short grass	15	274.59	10.99
	35	189.78	8.89
	1000	44.0	3.85
tall grass	15	125.85	10.99
	35	86.98	8.89
	1000	20.17	3.85
broadleaf forage, small insects	15	154.45	10.99
	35	106.75	8.89
	1000	24.75	3.85

[a]NOAEL: 5 mg/kg-bw/day

Non-target Beneficial Invertebrates

EFED currently does not quantify risks to terrestrial non-target invertebrates. In an acute contact study with the honey bee, propazine was determined to be relatively non-toxic. At 96 hours, mortality was 2.47% at a dose of 96.69 µg/bee (Atkins et al. 1975). It is unlikely that there will be risks to pollinators and other beneficial insects at the proposed labeled rates.

b. Terrestrial Plants

Results of Tier II toxicity studies with monocots and dicots indicate that seedling emergence and vegetative vigor are severely impacted by exposure to propazine. Seedling emergence, based on shoot weight, was adversely impacted in monocots (onion) at an EC_{25} of 0.035 lb ai/A and in dicots (lettuce) with an EC_{25} of 0.016 lb ai/A. Vegetative vigor in monocots, based on shoot weight, was adversely impacted in monocots (wheat) at an EC_{25} of 0.046 lb ai/A and in dicots (cucumber) at an EC_{25} of 0.10 lb ai/A. The observed effects to monocots and dicots included stunting, chlorosis, necrosis, and plant death.

For the terrestrial use of propazine and the maximum application rate of 1.2 lbs a.i./A from aerial spray application, the acute risk LOC was exceeded for nonendangered monocots and dicots located in adjacent areas and in semi-aquatic areas primarily as a result of runoff; and for nonendangered monocots and dicots as a result of spray drift. Likewise, the acute risk LOC was exceeded for nonendangered monocots in semi-aquatic areas and nonendangered dicots in adjacent and semi-aquatic areas as the result of runoff from ground spray applications. For both ground and aerial spray application, the LOC was exceeded for endangered monocots and dicots located in adjacent and semi-aquatic areas primarily as a result of runoff (Table IVA-6). The endangered species LOC was exceeded for monocots and dicots in dry areas exposed to spray drift from both aerial and ground applications. Consequently, nonendangered and endangered monocots and dicots inhabiting dry and semi-aquatic areas adjacent to a treated field would be at risk for adverse effects to growth and development when exposed to propazine as a result of the labeled uses. A complete spray drift analysis for exposures to non-target terrestrial plants in terrestrial and semi-aquatic areas is provided in Section IV.B.3. The potential risk to endangered monocots and dicots will be discussed in greater detail in Section IV.B.6.

3. Spray Drift Analysis

The AgDRIFT model (Version 2.01) was used to refine the spray drift exposure estimate for terrestrial plants. Downwind spray drift distances from ground and aerial applications are estimated for possible use in mitigating risks for endangered terrestrial plants that grow in close proximity to agricultural and non-agricultural fields that may be treated with propazine. The model was used to estimate distances (in feet) required to dissipate spray drift to the most sensitive NOAEC/EC_{25} levels for monocot and dicot species in the seedling emergence and/or vegetative vigor studies. The standard toxicity level EFED uses for calculating risk quotients for non-endangered terrestrial plants is the EC_{25}. For endangered plants, the NOAEC (or EC_{05} if a NOAEC value is not available) is used. Seedling emergence endpoints are representative of exposure through soil to germinating plants, while vegetative vigor endpoints are representative of foliar exposure. The terrestrial plant measurement endpoints used in the model are specified in Table IVB-7.

Table IVB-7. Agdrift Input Parameters for Terrestrial Plant Measurement Endpoints				
Test Type/ Crop	**Most Sensitive Study Species**	**NOAEC (lb ai/A) /Fraction Applied[1]**	**EC_{25} (lb ai/A) / Fraction Applied[1]**	**Most sensitive parameter**
Seedling Emergence: Monocot	Onion	<0.01/<0.008	0.035/0.029	Shoot weight
Seedling Emergence: Dicot	Lettuce	0.0047/0.004	0.016/0.013	Shoot weight
Vegetative Vigor: Monocot	Wheat	0.02/0.017	0.046/0.038	Shoot weight
Vegetative Vigor: Dicot	Cucumber	<0.075/<0.063	0.1/0.083	Shoot weight

[1] The fraction of the application rate = NOAEC or the EC_{25}/maximum application rate of propazine (1.2 lb ai/A).

Because the label for propazine does not specify release height or droplet size for ground applications, the AgDRIFT model was run for all four scenarios (high boom and fine spray, low boom and fine spray, high boom and medium/coarse spray, and low boom and medium/coarse spray) to provide a range of distances (in feet) required to dissipate spray drift to the most sensitive NOAEC/EC_{25} levels. All droplet size descriptions are based on ASAE S-572 standard definitions. High and low boom heights are representative of 4 and 2 foot release heights, respectively. AgDRIFT outputs for ground boom applications estimate the 50^{th} and 90^{th} percentile of data collected from field trials. For this analysis, the 90^{th} percentile was used to provide protective dissipation distances. Available toxicity data indicate that the terrestrial plants are most sensitive to propazine via soil uptake rather than application of the herbicide directly to post-emergent foliage. Therefore, downwind spray drift distances based on the NOAEC and EC_{25} values derived from SE toxicity tests were utilized and are believed to be protective of both endangered and non-endangered terrestrial plants, respectively.

A summary of the results of the Tier 1 AgDRIFT modeling for ground and aerial application of propazine are presented in Tables IVB-8 and IVB-9. The tables summarize the downwind distances required to dissipate spray drift for endangered species (Table IVB-8 with the NOAEC levels) and non-endangered species (Table IVB-9 with the EC_{25} values) for both monocot and dicot terrestrial plant species and for both ground and aerial applications of propazine.

Modeled drift dissipation distances for endangered species, based on ground boom applications are expected to range from approximately >120 to 500 feet for very fine to fine droplet sizes and from >46 to 200 feet for fine to medium/coarse droplet sizes (the > values are due to the NOAEC value of <0.01). Over the range of modeled droplet sizes, the protective spray drift distances for endangered monocots range from >46 to >285 feet and for endangered dicots, 120 to 500 feet. Modeled dissipation distances for endangered monocots and dicots, based on aerial application of propazine, using the default fine to medium droplet sizes are uncertain because they exceed the 1,000 foot limit of the model. For medium to coarse droplet sizes, the expected dissipation distances are again uncertain because they range from >570 to >1000 feet (again, the value of > 570 feet is due to the NOAEC value of <0.01).

Modeled drift dissipation distances for non-endangered species, based on ground boom applications are expected to range from approximately 30 to 190 feet for very fine to fine droplet sizes and from 10 to 50 feet for fine to medium/coarse droplet sizes. Over the range of modeled droplet sizes, the protective spray drift distances for monocots range from 10 to 90 feet and for dicots, 26 to 190 feet. Modeled dissipation distances for non-endangered monocots and dicots, based on aerial application of propazine, using the default fine to medium droplet sizes are expected to range from 325 to 830 feet. For medium to coarse droplet sizes, the expected dissipation distances range from approximately 180 to 341 feet.

Table IVB-8. Summary of AgDRIFT Modeling Results for Endangered Plant Species

Crop	**Distance Required to Dissipate Spray Drift to NOAEC Levels for Ground Application (feet)**		**Distance Required to Dissipate Spray Drift to NOAEC Levels for Aerial Application (feet)**	
	Droplet Size		Droplet Size	
	Very Fine to Fine	Fine to Medium/Coarse	Fine to Medium	Medium to Coarse
Monocots (onion)	-	-	>1000	>571
Low Boom (20 inches)	>121	>46	N/A	N/A
High Boom (50 inches)	>285	>85	N/A	N/A
Dicots (lettuce)	-	-	>1000	>1000
Low Boom (20 inches)	263	118	N/A	N/A
High Boom (50 inches)	492	200	N/A	N/A

* The maximum dissipation distance from the edge of the field in the Tier I ground model is 1,000 feet.

Table IVB-9. Summary of AgDRIFT Modeling Results for Non-Endangered Plant Species

Crop	**Distance Required to Dissipate Spray Drift to EC_{25} Levels for Ground Application (feet)**		**Distance Required to Dissipate Spray Drift to EC_{25} Levels for Aerial Application (feet)**	
	Droplet Size		Droplet Size	
	Very Fine to Fine	Fine to Medium/Coarse	Fine to Medium	Medium to Coarse
Monocots (onion)	-	-	325	180
Low Boom (20 inches)	33	10	N/A	N/A
High Boom (50 inches)	89	20	N/A	N/A
Dicots (lettuce)	-	-	830	341
Low Boom (20 inches)	72	26	N/A	N/A
High Boom (50 inches)	187	46	N/A	N/A

* The maximum dissipation distance from the edge of the field in the Tier I ground model is 1,000 feet.

The current label provides appropriate information on spray drift management to guide the applicator while providing few specific requirements for minimizing spray drift. Given that some of the predicted spray drift distances are large, that there are associated uncertainties for aerial application of propazine and the fact that the NOAEC for monocots is not defined (i.e., it is a < value), if mitigation of risk is desired, then it is recommended that the label language for spray drift require specific spray drift mitigation measures (i.e., lower release heights, wind speed restrictions, and specification of spray droplet sizes).

4. Review of Incident Data

Incident reports submitted to EPA since approximately 1994 have been tracked by assignment of EIIS (Environmental Incident Information System) in an Incident Data System (IDS). There are no incident reports for propazine.

5. Endocrine Effects

In March 2002, based on the available weight-of-evidence, the Agency's Health Effects Division (HED) determined that atrazine, simazine, propazine, and their degradates, DEA, DIA, and DACT can be grouped by a common mechanism of toxicity for neuroendocrine effects (disruption of the hypothalamic-pituitary-gonadal (HPG) axis). Based on these effects in mammals and endocrine effects in other taxonomic groups with the above triazine-containing pesticides and degradates, propazine and its degradates may be classified as potential endocrine disruptors. 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 was a scientific basis 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, propazine may be subjected to additional screening and/or testing to better characterize effects related to endocrine disruption.

6. Federally Threatened and Endangered (Listed) Species Concerns

a. 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 conservatively assumes that listed species within those broad groups are co-located 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. Section II.A.4 of this risk assessment presents the pesticide use sites that are used to establish initial collocation of species with treatment areas.

If the assumptions associated with the screening-level action area result in RQs that are below the listed species LOCs, a "no effect" determination conclusion is made with respect to listed species in that taxa, and no further refinement of the action area is necessary. Furthermore, RQs below the listed species LOCs for a given taxonomic group indicate no concern for indirect effects upon listed species that depend upon the taxonomic group covered by the RQ as a resource. However, in situations where the screening assumptions lead to RQs in excess of the listed species LOCs for a given taxonomic group, a potential for a "may affect" conclusion exists and may be associated with direct effects on listed species belonging to that taxonomic group or may extend to indirect effects upon listed species that depend upon that taxonomic group as a resource. In such cases, additional information on the biology of listed species, the locations of these species, and the locations of use sites and could be considered along with available information on the fate and transport properties of the pesticide to determine the extent to which screening assumptions regarding an action area apply to a particular listed organism. These subsequent refinement steps could consider how this information would impact the action area for a particular listed organism and may potentially include areas of exposure that are downwind and downstream of the pesticide use site.

For this risk assessment for propazine, a "no effect" determination cannot be made for any species because both aquatic and terrestrial plants are affected by propazine under the proposed uses and all other species may be indirectly affected from effects to aquatic and/or terrestrial plants.

b. Taxonomic Groups Potentially at Risk

The preliminary risk assessment for endangered species indicates that propazine exceeds the Endangered Species LOCs for the specified use scenario for the following taxonomic groups:

- aquatic vascular plants at the maximum application rate by ground and aerial spray application,
- aquatic non-vascular plants at the maximum application rate by ground and aerial spray application (although none are listed as endangered, there may be concerns for other taxa with obligate relationships with these species),
- non-target terrestrial plants – endangered monocots and dicots adjacent to treated areas and in semi-aquatic areas at the application rate by ground and aerial spray application; endangered monocots and dicots in dry areas exposed to spray drift by both aerial and ground application at the application rate,
- Listed mammals (chronic exposure) at the maximum application rate by ground and aerial spray application,
- Listed freshwater invertebrates (chronic exposure) at the maximum application rate by ground and aerial spray application,
- AgDrift model predicts LOC exceedances for *listed* plant species at distances of more than 1000 feet for aerial application and up to148 feet for ground applications from the edge of the field,
- AgDrift model predicts exceedances of LOC for *listed* terrestrial plant species inhabiting ponds and wetlands exposed from spray drift due to agricultural use at distances up to 100 feet from areas treated via aerial applications. Likewise, the model predicts LOC exceedances for *listed* aquatic plants inhabiting wetlands exposed from spray drift at distances of zero up to 62 feet from treated areas as the result of aerial spray applications.

Table IVB-10 summarizes the listed species at risk associated with either direct or indirect effects following application of propazine at the requested rates.

Concerns For Federally Listed as Endangered and/or Threatened Species

Table IVB-10. Listed species risks associated with direct or indirect effects due to applications of propazine on sorghum

Listed Taxon	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants - monocots	Yes	Yes through effects to pollinators (mammals; uncertain with birds, reptiles, terrestrial-phase amphibians)
Terrestrial and semi-aquatic plants - dicots	Yes	Yes through effects to pollinators (mammals; uncertain with birds, reptiles, terrestrial-phase amphibians)
Terrestrial invertebrates	No for terrestrial insects; unknown for other terrestrial invertabrates (insufficient data)	Yes through effects to terrestrial and aquatic plants (food and habitat)
Birds	Possible: no chronic avian data; sublethal effects in acute studies coupled with similar effects in mammalian reproduction study increase uncertainty for birds.	Yes through effects to terrestrial and aquatic plants (food and habitat), mammals, freshwater invertebrates)
Terrestrial-phase amphibians	Possible: no acute or chronic data and no chronic avian data	Yes through effects to terrestrial and aquatic plants (food and

Table IVB-10. Listed species risks associated with direct or indirect effects due to applications of propazine on sorghum

Listed Taxon	Direct Effects	Indirect Effects
	(see comment for birds)	habitat), mammals, freshwater invertebrates)
Reptiles	Possible: no acute or chronic data and no chronic avian data (see comment for birds)	Yes through effects to terrestrial and aquatic plants (food and habitat), mammals, freshwater invertebrates)
Mammals	Yes with chronic exposure.	Yes through effects to terrestrial and aquatic plants, mammals, freshwater invertebrates.
Aquatic non-vascular plants*	Yes	No
Aquatic vascular plants	Yes	No
Freshwater fish	Unknown with acute exposure (no acute data); No after chronic exposure.	Yes through effects to terrestrial plants (stream quality), aquatic plants (food and habitat) and freshwater invertebrates (food)
Aquatic-phase amphibians	Unknown with acute exposure (no acute data); using chronic data on fish as surrogate – No after chronic exposure.	Yes through effects to terrestrial plants (stream quality), aquatic plants (food and habitat) and freshwater invertebrates (food)
Freshwater crustaceans	Using data on daphnia as surrogate – No after acute exposure and Yes after chronic exposure.	Yes through effects to terrestrial plants (stream quality), aquatic plants (food and habitat) and other freshwater invertebrates (food).
Mollusks	No after acute exposure; Using chronic data on crustaceans as surrogate - No after chronic exposure.	Yes through effects to terrestrial plants (stream quality) and aquatic plants (food and habitat).
Marine/estuarine fish	Unknown: no acute data No after chronic exposure.	Yes through effects to terrestrial plants (tributary/estuary quality) and aquatic plants (food and habitat)
Marine/estuarine crustaceans	No after acute and/or chronic exposure.	Yes through effects to terrestrial plants (tributary/estuary quality), aquatic plants (food and habitat) and other marine/estuarine invertebrates (food)

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

1. Discussion of Risk Quotients

The Agency's LOCs for aquatic vascular plants, non-target terrestrial plants, mammals and freshwater invertebrates are exceeded for the use of propazine as outlined in previous sections. Should estimated exposure levels occur in proximity to listed resources, the available screening level information suggests a potential concern for direct effects on listed species within these taxonomic groups listed above associated with the use of propazine as described in Section II.A.4. The registrant must provide information on the proximity of Federally listed aquatic vascular plants, non-target terrestrial plants,

mammals and freshwater invertebrates to the propazine use sites. This requirement may be satisfied in one of three ways: 1) having membership in the FIFRA Endangered Species Task Force (Pesticide Registration [PR] Notice 2000-2); 2) citing FIFRA Endangered Species Task Force data; or 3) independently producing these data, provided the information is of sufficient quality to meet FIFRA requirements. The information will be used by the OPP Endangered Species Protection Program to develop recommendations to avoid adverse effects to listed species.

2. Probit Dose Response Relationship

A probit dose response analysis was performed for toxicity studies for which slopes with 95% confidence intervals were available (only marine invertebrates (mysid shrimp)). The probit slope response relationship is evaluated to calculate the chance of an individual event corresponding to the listed species acute LOCs. The analysis uses the EFED spreadsheet IECv1.1.xls, developed by Ed Odenkirchen (6/22/04). It is important to note that the IEC model output can go as high as 1×10^{16} or as low as 1×10^{-16} in estimating the event probability. This cut-off is a limit in the Excel spreadsheet environment and is not to be interpreted as an agreed upon upper or lower bound threshold for concern for individual effects in any given listed species.

Estuarine/Marine Invertebrates: Based on an assumption of a probit dose response relationship with a mean estimated slope of 2.0, the corresponding estimated chance of individual mortality associated with the listed species LOC of 0.05 the acute toxic endpoint for estuarine/marine invertebrates is ~1 in 2.16×10^2. It is recognized that extrapolation of very low probability events is associated with considerable uncertainty in the resulting estimates. To explore possible bounds to such estimates, the upper and lower values for the mean slope estimate (2.94 – 9.11) were used to calculate upper and lower estimates of the effects probability associated with the listed species LOC. These values are ~1 in 1.53×10^4 and >1 in 1×10^{16}, respectively.

3. Data Related to Under-represented Taxa

Effects data on under-represented taxonomic groups were not submitted by the Registrant. In addition, effects data from other analyzed sources (ECOTOX Database, PAN Database) were not obtained for this screening risk assessment.

4. Implications of Sublethal Effects

Sublethal effects (reduced food consumption and weight loss) were observed in the acute avian studies. These effects were observed at levels higher than the estimated terrestrial EECs and thus may be observed at the proposed use rates. Chronic studies were available for aquatic fish and invertebrates and for mammals. The chronic LOC was exceeded for freshwater invertebrates. Chronic exposure of propazine to freshwater invertebrates produces adverse effects to growth at 0.091 ppm ai. These growth effects may result in adverse effects to the populations of invertebrates thus potentially impacting other dependent trophic levels. Chronic RQs exceeded the chronic LOC for

mammals in all weight classes (15 g, 35 g, and 1000g) for consumption of short grasses, tall grasses and broadleaf forage/small insects at the application rate modeled and maximum and mean predicted residue levels; and for 15 and 35 g mammals for consumption of fruit and large insects at the application rate and maximum predicted residue levels. In a 3-generation reproduction study with rats, propazine produced decreased body weights in males and females at doses of 50 mg/kg/day with a NOAEL of 5 mg/kg/day (MRID 000414-09). The growth-related effects observed in these studies may lead to a potential concern for impacts to populations of mammals consuming feed items contaminated with propazine and to the predators that feed on them.

c. Indirect Effects Analysis

The Acute and Endangered Species LOCs for non-target monocots and dicots were exceeded for plants located adjacent to treated areas, in semi-aquatic areas, and by drift for the scenarios analyzed. The guideline terrestrial plant studies indicate direct adverse effects to seedling emergence and vegetative vigor, as well as non-lethal effects including stunting, chlorosis, necrosis and plant death. The LOC for endangered species was exceeded for freshwater vascular plants for runoff/drift from ground and aerial spray applications to sorghum. In the guideline aquatic vascular plant studies, concentrations as low as 0.10 mg/L resulted in inhibition of plant growth and reduction of frond count. Damage to non-target plants may be sufficient to prevent the plant from competing successfully with other plants for resources and water. Endangered plant species may be especially impacted by exposure to propazine because of the impact of the loss of a few individuals to the population. Consequently, there is a potential concern for listed species with either broad or narrow dependencies on impacted plant species/populations/communities for habitat, feeding or cover requirements. In terrestrial and shallow-water aquatic communities, plants are the primary producers upon which the succeeding trophic levels depend. If the available plant material is impacted due to the effects of propazine, this may have negative effects not only on the herbivores, but throughout the food chain. Also, depending on the severity of impacts to the plant communities [i.e., forests, wetlands, ecotones (edge and riparian habitats)], community assemblages and ecosystem stability may be altered (i.e. reduced bird populations in edge habitats; reduced riparian vegetation resulting in increased light penetration and temperature in aquatic habitats, loss of cover and food for fish).

The chronic LOC for mammals was exceeded in all weight classes for selected food categories. Plants dependent upon mammals for pollination and birds, other mammals, reptiles and terrestrial amphibians dependent upon small mammals for food may be impacted by decreasing mammal populations. Similarly, the chronic LOC for freshwater invertebrates was exceeded with the proposed propazine application rates and uses. Birds, amphibians, reptiles, mammals, fish and other aquatic invertebrates may be impacted by decreasing freshwater invertebrate populations.

d. Critical Habitat

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

The screening-level risk assessment has identified potential concerns for indirect effects on listed species for those organisms dependant upon aquatic vascular and non-vascular plants, terrestrial plants and terrestrial plants growing in semi-aquatic areas, mammals and freshwater invertebrates. In light of the potential for indirect 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 the pesticide. Then EPA would determine whether use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA does not permit use of either analytical approach to make a definitive identification of species that are potentially impacted indirectly or critical habitats that is potentially impacted directly by the use of the pesticide. EPA and the Service(s) are working together to conduct the necessary analysis.

This screening-level risk assessment for critical habitat provides a listing of potential biological features that, if they are constituent elements of one or more critical habitats, would be of potential concern. These correspond to the taxa identified above as being of potential concern for indirect effects and include the following: mammals, freshwater invertebrates, aquatic vascular and non-vascular plants, terrestrial plants and terrestrial plants growing in semi-aquatic areas. This list should serve as an initial step in problem formulation for further assessment of critical habitat impacts outlined above, should additional work be necessary.

e. Co-occurrence Analysis

Since there are potential direct and/or indirect effects on all taxa, LOCATES was run for all taxonomic groups. The LOCs for terrestrial monocots, dicots and aquatic plants as well as chronic LOCs for freshwater invertebrates and mammals were exceeded;

consequently a potential concern arises for species with both narrow (i.e., species that are obligates or have very specific habitat or feeding requirements) and general dependencies (i.e., cover type requirements). Information from LOCATES, as presented in Table IV-B10 below, indicates that for propazine, a number of potentially affected species of plants, mammals and freshwater invertebrates appear to be co-located with pesticide use areas. Consequently, there may be a concern for potential indirect effects to listed species dependent upon mammals that consume feed items contaminated with propazine residues and freshwater invertebrates that live in propazine contaminated water such as predatory birds, fish, amphibians, reptiles and mammals. In addition, there may be a potential concern for indirect effects related to plants that require mammals for pollination or seed dispersal and for animals that require terrestrial and/or aquatic vegetation for food, habitat and/or stream quality.

Table IV-B 11 Unique Taxa Count by State for Sorghum

Colorado, New Mexico, Kansas, Nebraska, Oklahoma, Texas, South Dakota, Arizona, California, North Carolina, Maryland, Louisiana, Mississippi, Arkansas, Tennessee, Kentucky, Missouri, Illinois

	Amphibian	Arachnid	Bird	Bivalve	Crustacea	Dicot	Ferns	Fish	Gastropod	Insect	Lichen	Mammal	Marine	Monocot	Reptile
Counties:	32	8	763	147	27	206	1	294	7	69	5	414	7	71	54
States:	4	2	18	10	8	15	1	18	6	13	1	18	1	13	8
Species:	11	11	28	51	13	118	1	58	9	20	1	29	1	18	14

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

1. Uncertainties, assumptions, and limitations associated with models

Aquatic Models

Extrapolating the risk conclusions from the standard pond scenario modeled by PRZM/EXAMS 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 physicochemical properties (pH, redox conditions, etc.) of the standard farm pond 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 farm pond represents a well mixed, static water body. Because the farm pond 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 farm pond provides an environmental condition for accumulation of persistent pesticides. The assumption of uniform mixing does not account for stratification due to thermoclines (e.g., seasonal stratification in deep water bodies). Additionally, the physical construct of the standard runoff scenario assumes a watershed:pond area ratio of 10. This ratio is recommended to maintain a sustainable pond in the Southeastern United States. The use of higher watershed:pond 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:pond ratio.

The standard pond scenario assumes that 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 pond 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.

There are limited monitoring studies for propazine in freshwater environments and no studies in marine environments; therefore, the exposure of aquatic species to propazine is based entirely on the modeled data. The output of models such as PRZM/EXAMS is dependent upon the quality of the environmental fate input parameters. No aquatic dissipation studies are available, and an assumption regarding the half-life of propazine in aqueous bodies such as lakes, ponds, etc. had to be made from laboratory data on the aerobic soil degradation half-life. Future monitoring studies and aquatic dissipation field studies would be useful in order to determine how well the modeled results fit measured levels of propazine in aquatic environments following its application to sorghum at appropriate rates.

Terrestrial Models

The data available to support the terrestrial exposure assessment for propazine are substantially complete, with the exception of a foliar dissipation study, which is an input variable for modeling of risks to birds and mammals (i.e.,T-REX). The terrestrial modeling was conducted using a default foliar half-life value of 35 days. Use of this default value could overestimate the foliar half-life for propazine, higher terrestrial EECs, and risk. However, it should be noted that because the EEC represents the concentration immediately following a direct application, the foliar half-life variable is only influential for scenarios involving multiple applications.

As discussed earlier in the exposure section of this document, the Agency relies on the work of Fletcher et al. (1994) for setting the assumed pesticide residues in wildlife dietary items. The Agency believes that these residue assumptions reflect a realistic upper-bound residue estimate, although the degree to which this assumption reflects a specific percentile estimate is difficult to quantify. It is important to note that the field measurement efforts used to develop the Fletcher estimates of exposure involve highly varied sampling techniques. It is entirely possible that much of these data reflect residues averaged over entire above ground plants in the case of grass and forage sampling. Depending upon a specific wildlife species' foraging habits, whole aboveground plant samples may either underestimate or overestimate actual exposure.

The acute and chronic characterizations 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.

For the terrestrial organism risk assessment, the EECs on food items generated using T-REX may be compared directly with dietary toxicity data or converted to an oral dose to calculate chronic dose-based RQs, as is the case for small mammals. The screening-level risk assessment for propazine uses upper bound predicted residues as the measure of exposure. For mammals, the residue concentration is converted to daily oral dose based on the fraction of body weight consumed daily as estimated through mammalian allometric relationships. Converting to the oral dose-based chronic RQs from the reported mammalian dietary chronic endpoint allows EFED to evaluate the risk to different size-classes of mammals with varying feeding habits. However, this extrapolation method for generating dose-based chronic RQs for smaller animals based on dietary-based data for larger animals, may also increase uncertainty in this risk assessment.

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.

2. Uncertainties, assumptions, and limitation associated with exposure scenarios

Screening-level risk assessments for spray applications of pesticides consider dietary exposure alone. Other potential routes of exposure to propazine for terrestrial organisms 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). A simple first approximation of soil concentration of pesticide from spray application shows that ingestion of soil at an incidental rate of up to 15% of the diet would not increase dietary exposure.

Inhalation exposure

The screening risk assessment does not consider inhalation exposure. Such exposure may occur through three potential sources: (1) spray material in droplet form at the time of application (2) vapor phase pesticide volatilizing from treated surfaces, and (3) airborne particulate (soil, vegetative material, and pesticide dusts).

Available data suggest that inhalation exposure at the time of application is not an appreciable route of exposure for birds. According to research on mallards and bobwhite quail, respirable particle size in birds (particles reaching the lung) is limited to a maximum diameter of 2 to 5 microns. The spray droplet spectra covering the majority of

pesticide application situations (AgDRIFT model scenarios for very-fine to coarse droplet applications) suggests that less than 1% of the applied material is within the respirable particle size.

Theoretically, inhalation of pesticide's active ingredient in the vapor phase may be another source of exposure for some pesticides under some exposure situations. However, volatilization of propazine from water and soil surfaces is not expected; therefore, inhalation should not be an important exposure pathway.

The impact from exposure to dusts contaminated with the pesticide cannot be assessed generically because soil properties (chemical and physical), which impact the estimation of such exposures are highly site-specific.

Dermal Exposure

The screening assessment does not consider dermal exposure, except as it is indirectly included in calculations of RQs based on lethal doses per unit of pesticide treated area. 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.

Data which address dermal exposure of wildlife to pesticides in a quantitative fashion 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.

Drinking Water Exposure

The exposure of a target organism to a pesticide's active ingredient may be the result of consumption of surface water, groundwater or consumption of the pesticide in dew or other water on the surfaces of treated vegetation or in puddled water on treated fields. For the active ingredients of a pesticide there is a potential to dissolve in runoff and puddles on the treated field may contain the chemical. However, propazine exhibits limited solubility; consequently, the potential for drinking water exposure should be reduced.

3. Uncertainties, assumptions, and limitation associated with the toxicity data

Species Selection and Sensitivity

There are a number of areas of uncertainty in the terrestrial and the aquatic organism risk assessments that could potentially cause an underestimation of risk. Use of toxicity data on representative species does not provide information on the potential variability in susceptibility to acute and chronic exposures. For screening terrestrial risk assessments, a generic bird or mammal is assumed to occupy either the treated field or adjacent areas receiving the pesticide at a rate commensurate with the treatment rate on the field. The actual habitat requirements of any particular terrestrial species are not considered, and 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.

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

Surrogates were used to predict potential risks for species with no data (i.e., reptiles and amphibians). It was assumed that the use of surrogate effects data is sufficiently conservative to apply to the broad range of species within taxonomic groups. If other species are more or less sensitive to propazine than the surrogates, risks may be under- or overestimated, respectively.

Age class and sensitivity of effects thresholds

Scientists generally recognize that the age of the test organism may have a significant effect on the observed sensitivity to a toxicant. In a screening-level assessment of acute toxicity in fish, data are collected on juveniles weighing 0.1 to 5 grams. For aquatic invertebrates, the recommended acute testing is performed on 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 ducks tested at 5-10 days of age and quail at 10-14 days of age.

Testing of juveniles may overestimate the toxicity of direct acting pesticides in adults. As juvenile organisms do not have fully developed metabolic systems, they may not possess the ability to transform and detoxify xenobiotics equivalent to the older/adult organism. 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.

4. Uncertainties and assumptions associated with gaps in environmental fate and toxicity data

The following data gaps and uncertainties were identified with respect to the submitted ecotoxicity effects data:

$ Acute risks for freshwater fish were not characterized because the submitted study was determined to be invalid based on solubility issues. The acute freshwater invertebrate study was also determined to be supplemental. A high degree of uncertainty exists for the freshwater toxicity data for propazine until it can be shown that the results reflect that the tests were conducted up to the limit of solubility. An acceptable study will improve the certainty of the risk assessment.

$ Chronic risk to avian species was not characterized because no studies with the TGAI were submitted.

- Current data are not available to assess potential risk of propazine degradates to aquatic fish and invertebrates and terrestrial plants.

- Dermal contact and soil ingestion pathways for terrestrial mammals and birds were not evaluated because these routes of exposure are not considered in deterministic risk assessments. Data which address dermal exposure of wildlife to pesticides in a quantitative fashion are extremely limited. The Agency is actively pursuing modeling techniques to account for dermal exposure via direct application and by incidental contact.

- Risks to semiaquatic wildlife via consumption of pesticide-contaminated fish were not evaluated. However, given that bioaccumulation of propazine is expected to be low, ingestion of fish by piscivorus wildlife is not likely to be of concern.

- Risks to top-level carnivores were not evaluated due to a lack of data for these receptors. Ingestion of grass, plants, fruits, insects, and seeds by terrestrial wildlife was considered; however, consumption of small mammals and birds by carnivores was not evaluated. In addition, food chain exposures for aquatic receptors (i.e., fish consumption of aquatic invertebrates and/or aquatic plants) were also not considered. However, propazine's low K_{ow} suggests that it is not likely to bioaccumulate.

- Fate studies indicate propazine is persistent and mobile raising concerns about the impact on groundwater and surface water. The field dissipation studies that have been submitted are considered unacceptable or supplemental resulting in a significant uncertainty for this transport pathway. To address this uncertainty studies are needed to comprehensively ascertain the mobility of propazine and its degradates under field conditions.

- No aerobic aquatic metabolism data is available for use in this assessment. An assumption was made that the aerobic aquatic metabolism half life is twice the aerobic soil metabolism half life. This represents an uncertainty in the assessment and additional data on the specific behavior of propazine in aerobic aquatic systems would be needed to eliminate this uncertainty.

V. Literature Cited

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Appendix A. Propazine 4L Label

Appendix B. Environmental Fate Studies

Hydrolysis (161-1, MRID 436898-02, Study Status: Acceptable).
Ring-labeled [^{14}C]-propazine [6-chloro-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine; radiochemical purity 98.4%, specific activity 104.4 μCi/mg] was added to aqueous buffered solutions of pH 5 (0.1 M acetate), pH 7 (0.1 M phosphate), or pH 9 (0.01 M borate) at a concentration of 5 ppm. The [^{14}C]-propazine stock solutions were prepared in toluene and added to autoclaved buffered solutions. Acetonitrile was added as a co-solvent at a concentration of 1%. Aliquots of the solutions were radioassayed to confirm that the [^{14}C]-propazine was completely in solution. The sample flasks were incubated in the dark at 25 ± 0°C. Triplicate samples were removed for analysis after 0, 1, 3, 7, 14, 21, and 30 days of incubation. Aliquots of the 0- and 30-day samples were tested for sterility using trypticase soy and potato dextrose agar plates.

Total recovered radioactivity ranged from 97.8 - 107.5% (mean 100.7 ± 2.5%) for the pH 5 samples; 98.4 - 106.6% (mean 102.2 ± 2.5%) for the pH 7 samples; and 96.9 - 106.4% (mean 102.3 ± 2.7%) for the pH 9 samples. Propazine showed no evidence of decline in the pH 5, 7, or 9 buffer solutions (Tables V-VII). At the end of the 30-day incubation period, recovered propazine levels comprised approximately 103% of the initial radioactivity in all buffer solutions, with no degradates in excess of 1.5% of the applied. The plot of propazine concentration with time showed no evidence of decline over the study. The slope was not significantly >0. While volatiles were not trapped, the material balances suggest that volatile losses were not significant. Results of the study indicate that hydrolysis is not a major avenue of environmental degradation for propazine.

Photodegradation in Water (161-2, MRIDs 001537-09, 441848-05)
MRID 441848-05 (Study Status: Acceptable)
DER not available at date of publication

MRID 001537-09 (Study Status: Supplemental)
Propazine was photolytically stable in aqueous solutions (2.5 ppm propazine; further characterization not provided) when exposed to natural sunlight for up to 17 days, less than the one-month time period specified for photolysis studies. In a second part of the study, propazine degraded under artificial light (source not specified) with a half life of 24 hr. However, greater than 50% of the applied radioactivity was not accounted for in the material balance. These studies were considered supplemental and do not completely satisfy the environmental fate requirements for the aqueous photolysis of propazine.

Photodegradation on Soil (161-3, MRIDs 441848-06, Study Status: Acceptable)
DER not available at date of publication

Photodegradation in Air (161-4)
No Study

Aerobic Soil Metabolism (162-1, MRIDs 441848-07 and 001537-12,

MRID 441848-07
DER not available at date of publication (Study Status: Acceptable)

MRID 001537-12 (Study Status: Acceptable)
Propazine, applied to a nonsterile loamy sand soil (9% clay, 86% sand; 2.2% organic C; pH 5.6) at a rate of 10 ppm, degraded with a half-life of 12 to 24 weeks (calculated half-life was 15 weeks) under dark incubation at 25°C. The major degradate, hydroxy-propazine [2-hydroxy-4,6-bis(isopropylamino)-s-triazine], comprised 14% of the applied radioactivity after 12 weeks and 31% after 52 weeks. Unextractable residues accounted for an additional 35% at 12 weeks and 58% after 52 weeks.

In sterilized loamy sand soil (method of sterilization was not indicated), propazine degraded with a half-life of 8 to 12 weeks. Hydroxy-propazine comprised 16% of the applied radioactivity after 12 weeks while unextracted residues accounted for 31%.

The shorter half-life in the sterile soil may have resulted from alterations in soil properties due to sterilization or may indicate that factors other than microorganisms, such as surface catalysis, may play a role in the degradation of propazine.

Anaerobic Soil Metabolism (162-2, MRIDs 001537-13, Study Status: Acceptable)
In an acceptable study propazine degraded with a half-life of 8 weeks in a nonsterile loamy sand soil which was incubated anaerobically after 4 weeks of aerobic incubation. Propazine declined from 77% to 36% of the applied after 8 weeks while the major degradate, hydroxy-propazine increased to 12%. Unextracted residues comprised 50% of the applied after 8 weeks of anaerobic incubation.

Anaerobic Aquatic Metabolism (162-3)
No Study

Aerobic Aquatic Metabolism (162-4)
No Study

Leaching - Adsorption/Desorption (163-1, MRIDs 001529-97, 436898-03, 496898-04, 442873-13)
MRID 001529-97 (Study Status: Acceptable)
DER not available at date of publication
In that study, propazine was highly mobile, with Freundlich K_d values for adsorption/desorption of 0.34/6.09 for loamy sand, 1.14/3.78 for sandy loam, 2.69/16.8 for loam, and 3.19/44.7 for clay loam. The adsorption K_{oc} values were 65 for clay loam, 83 for loamy sand, 123 for sandy loam, and 158 for loam.

MRID 436898-03 (Study Status: Acceptable)
The mobility of propazine and/or its degradates, applied at a rate of 5 ppm to four soils and aged for 30 days, varied with soil type and, possibly, column packing. An average of 2% (sandy

loam) to 19% (sand) of the applied radioactivity was collected in the leachate. While the majority of the applied radioactivity remained in the 0-6 cm soil sections, ranging from 52% (loam) to 84% (sandy loam), radioactive residues were detected in each of the column sections, indicating a redistribution of the aged propazine residues during the leaching process. Propazine was the only ^{14}C-residue identified in the leachate fractions and was the dominant residue in the 0-6 cm column sections.

A supplemental study (MRID 001537-14) reviewed for the 1987 EAB Science Chapter also found that the aged propazine residues were mobile (33% leached in sand soil) to slightly mobile (4% leached in loam soil).

A second adsorption/desorption study (MRID 001529-97) that was found acceptable in the 1987 EAB document also found that propazine was highly mobile. The Freundlich K_d values for adsorption/desorption were 0.34/6.09 for loamy sand, 1.14/3.78 for sandy loam, 2.69/16.8 for loam, and 3.19/44.7 for clay loam. The adsorption K_{oc} values were 65 for clay loam, 83 for loamy sand, 123 for sandy loam, and 158 for loam.

In addition, that study found that the major degradate, hydroxy-propazine [2-hydroxy-4,6-bis(isopropylamino)-s-triazine], was less mobile than propazine. The Freundlich K_d values for adsorption/desorption of 1.13/3.42 for loamy sand, 2.94/5.53 for sandy loam, 31.8/56.8 for loam, and 106/143 for clay loam. The adsorption K_{oc} values were 276 for loamy sand, 359 for sandy loam, 1871 for loam, and 2163 for clay loam.

MRID 496898-04 (Study Status: Acceptable)
Sand, sandy loam, loam, and silty clay soil samples were collected from the surface horizons of soils in Fayette and Madison Counties, KY. A 24-hour equilibration period was selected for the definitive study. The material balance for the individual replications in the definitive study ranged from 89.5 to 100.7%. The percentage of applied radioactivity adsorbed on the soils decreased with increasing concentration of propazine in the aqueous solution, from 39.0% to 31.4% for the sandy loam sample, 41.0% to 34.8% for the sand, 39.4% to 32.6% for the loam, and 43.3% to 32.0% for the silty clay. Similarly, the percentage of the adsorbed radioactivity that was desorbed also decreased with increasing initial propazine concentration, from 32.6% to 26.9% for the sandy loam sample, 19.9% to 12.0% for the sand, 37.6% to 35.0% for the loam, and 35.8% to 26.8% for the silty clay.

The Freundlich K_d values for adsorption/desorption of propazine were calculated to be 0.67/86.4 for sand, 1.28/11.9 for sandy loam, 1.30/27.0 for silty clay, and 1.35/6.7 for loam. The adsorption K_{oc} values, calculated by the equation (K_d /%organic C) x 100, were 78.7 for the loam, 96.0 for the silty clay, 127.6 for the sandy loam, and 268.4 for the sand. The calculated K_d and K_{oc} values indicate that propazine is highly to moderately mobile in soils.

The major degradate, hydroxy-propazine [2-hydroxy-4,6-bis(isopropylamino)-s-triazine], is less mobile than propazine, with Freundlich K_d values for adsorption/desorption of 1.13/3.42 for loamy sand, 2.94/5.53 for sandy loam, 31.8/56.8 for loam, and 106/143 for clay loam. The adsorption K_{oc} values were 276 for loamy sand, 359 for sandy loam, 1871 for loam, and 2163 for clay loam.

MRID 442873-13 (Study Status: Acceptable)
Sandy loam was collected in Fayette County, while sand, loam, and silty clay soil samples were collected in Madison County, Kentucky. The overall material balance of the applied radioactivity was 98.4±0.7% (mean ± % standard deviation). The material balance for the individual doses in the definitive study ranged from 92.7 to 104.3%. As the concentration of 2-hydroxy-propazine in the aqueous solution increased, the percentage of applied radioactivity absorbed on each soil sample decreased during the adsorption phase: 41.69 to 34.75% for sandy loam, 44.83 to 36.60% for sand, 58.59 to 51.42% for loam, and 75.92 to 67.26% for silty clay. However, the trend of decreasing absorbed radioactivity with increasing solution concentration was not observed during the desorption phase. Instead, the desorbed radioactivity generally increased with increasing solution concentration in 3 soils: 18.70 to 22.19% for sand, 16.26 to 22.19% for loam, and 12.00 to 14.52% fro silty clay. No specific trend could be deciphered for sandy loam.

The adsorption K_d values of 2-hydroxy-propazine were calculated to be 1.447 for sandy loam, 0.823 for sand, 1.334 for loam and 4.659 for silty clay. The desorption coefficients were 6.610 fro sandy loam, 4.167 for sand, 3.123 for loam, and 12.362 fro silty clay. The adsorption and desorption coefficients were then normalized to organic carbon content by multiplying K_d by (100% organic C) to yield K_{oc}. The adsorption K_{oc} values were 144.7 for sandy loam, 329.2 fro sand, 78.0 for loam and 342.6 for silty clay.

Laboratory Volatilization (163-2)
No Study

Field Dissipation (164-1, MRIDs 442873-14, 441848-09)
MIRD 442873-14 (Study Status: Supplemental)
After application, propazine dissipated rapidly with two reported half-live: 7.2 days for a period of 1 to 21 days and 58.2 days for a period of 28 to 184 days. Residues of propazine were found in the 0-3, 3-6, and 6-9 inch depths during the first 14 days. After 21, 28, and 90 days, propazine was detected in the 0-3 and 3-6 inch depths. After 90 days, residues of propazine were found only in the 0-3 in depth. The three degradates of propazine that were detected in the soil samples included 2-amino-4-chloro-6-isopropylamino-s-traizine (DEA); 2,4-diamino-6-chloro-s-triazine (DAA); and 4,6-diissopropylamino-2-hydroxy-s-triazine or 2-hydroxyprpazine (OH-propazine).

MRID 441848-09 (Study Status: Supplemental)
The four submitted studies were either unacceptable or considered supplemental because of inadequate sampling depths (only the upper 12 inches were sampled), lack of freezer stability data (some samples were frozen for up to 3 years), and/or the presence of propazine in the control and treated plots prior to the start of the study. Supplemental data suggest that propazine, applied as a wettable powder at 2.4 to 4.8 lb a.i./A/yr, dissipated from the upper 6 inches with a half-life of <30 to 149 days in NY, <31 days in CA, and 60 to >357 days in NE. The degradates hydroxy-propazine, G-2873 [2-chloro-4,6-diamino-s-triazine], and G-30033 [2-chloro-4-amino-6-isopropylamino-s-triazine] were detected in one or more of the field studies (NY, CA, NE).

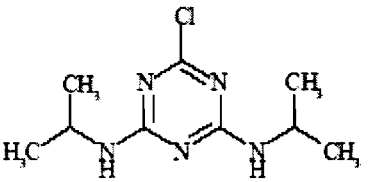
Aquatic Field Dissipation (164-2)

No Study

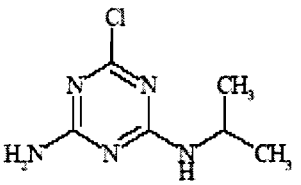
Small Scale Prospective Groundwater Monitoring (166-1)
No Study

Names and Chemical Structures of Propazine and Major Transformation Products

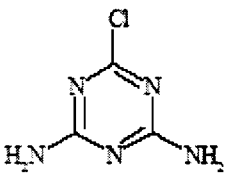
Propazine (Propazine 4L)
IUPAC Name: 6-chloro-N^2,N^4-di-isopropyl-1,3,5 triazine-2,4-diamine
CAS Name: 6-chloro-*N,N'*-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
CAS No: 139-40-2



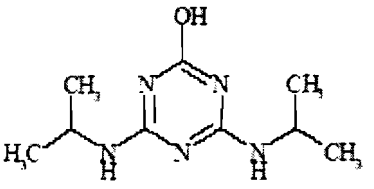
Propazine des-ethyl (G-30033)
IUPAC name: NA
CAS name: 2-amino-4-chloro-6-(1-methylethylamino)-s-triazine
CAS No: NA



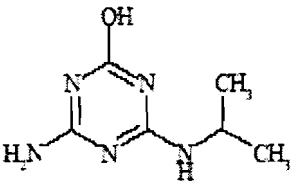
DACT (G-28273)
IUPAC name: NA
CAS name: 2,4-diamino-6-chloro-*s*-triazine
CAS No: NA



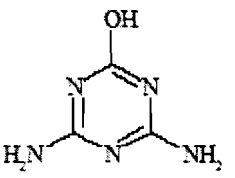
Propazine 2-hydroxy or 2-hydroxypropazine (G-S11526)
IUPAC name: NA
CAS name: 2-hydroxy-4,6-bis-(1-methylethylamino)-s-triazine
CAS No: NA



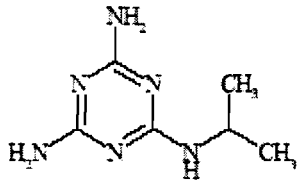
Desisopropyl hydroxypropazine
IUPAC name: NA
CAS name: 4-amino-2-hydroxy-6-isopropylaminotriazine
CAS No: NA



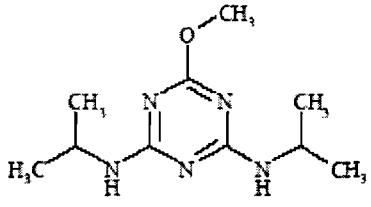
Ammeline (GS-17791)
IUPAC name: NA
CAS name: 2,4-diamino-6-hydroxy-*s*-triazine
CAS No: NA



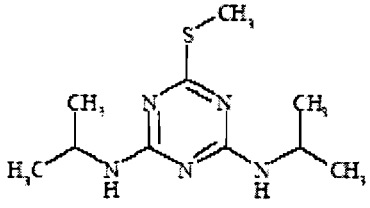
Triazine-methyl-triamine (CGA-101248)
IUPAC name: NA
CAS name: N-(1-methyl)-1,3,5-triazine-2,4,6-triamine
CAS No: NA



Prometon (G-31435)
IUPAC name: NA
CAS name: 2-methoxy-4,6-bis (1-methylethylamino)-*s*-triazine
CAS No: NA



Propazine-2-methyl-sulfinyl (GS-16141)
IUPAC name: NA
CAS name: 2,4-bis (1-methylethylamino)-6-methylsulfinyl-*s*-triazine
CAS No: NA



Appendix C. Aquatic Exposure Model and Results (PRZM/EXAMS)

Kansas Sorghum Crop Scenario
Aerial Spray Application of Propazine 4L

stored as kssorpropaerial2.out
Chemical: Propazine
PRZM environment: KSsorghumC.txt modified Satday, 12 October 2002 at 15:57:00
EXAMS environment: pond298.exv modified Thuday, 24 July 2003 at 10:02:00
Metfile: w13996.dvf modified Wedday, 3 July 2002 at 09:04:44
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	9.051	9.009	8.844	8.727	8.589	5.038
1962	22.23	22.12	21.91	21.29	20.77	14.43
1963	22.47	22.41	22.25	21.79	21.39	18.65
1964	24.63	24.56	24.31	23.69	23.23	19.99
1965	27.32	27.26	27.01	26.47	25.96	22.38
1966	29.18	29.13	28.79	27.98	27.4	24.04
1967	34.22	34.12	33.73	33.06	32.44	27.52
1968	32.13	32.04	31.79	31.23	30.83	28.39
1969	34.3	34.21	34	33.22	32.55	28.88
1970	37.24	37.16	36.92	36.35	35.71	30.96
1971	47.89	47.76	47.23	46.42	45.55	37.28
1972	39.22	39.12	38.71	38.66	38.51	36.41
1973	42.67	42.58	42.06	41.13	40.47	35.83
1974	41.02	40.92	40.5	40.15	39.49	35.55
1975	37.35	37.28	37.17	36.54	35.95	33.08
1976	36.22	36.13	35.77	35.01	34.47	31.12
1977	45.24	45.08	44.76	44.07	43.18	35.54
1978	49.66	49.49	49	48.3	47.37	40.48
1979	41.99	41.9	41.52	41.13	40.84	38.55
1980	44.19	44.06	43.49	42.34	41.4	36.65
1981	48.64	48.5	47.98	46.92	45.95	39.23
1982	52.96	52.89	52.54	51.41	50.42	43.31
1983	48.18	48.1	47.84	46.96	46.08	41.81
1984	49.54	49.41	48.91	48.09	47.18	41.18
1985	46.55	46.43	45.98	45.19	44.6	40.65
1986	51.83	51.69	51.13	49.91	49	42.28
1987	47.42	47.28	46.86	46.28	45.45	41.41
1988	46.01	45.87	45.38	44.3	44.1	40.12
1989	42.15	42.06	41.67	41.33	40.85	37.89
1990	50.26	50.12	49.56	48.43	47.47	40.3

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	52.96	52.89	52.54	51.41	50.42	43.31
0.0645161290322581		51.83	51.69	51.13	49.91	49	42.28
0.0967741935483871		50.26	50.12	49.56	48.43	47.47	41.81
0.129032258064516	49.66	49.49	49	48.3	47.37	41.41
0.161290322580645	49.54	49.41	48.91	48.09	47.18	41.18
0.193548387096774	48.64	48.5	47.98	46.96	46.08	40.65
0.225806451612903	48.18	48.1	47.84	46.92	45.95	40.48
0.258064516129032	47.89	47.76	47.23	46.42	45.55	40.3
0.290322580645161	47.42	47.28	46.86	46.28	45.45	40.12
0.32258064516129	46.55	46.43	45.98	45.19	44.6	39.23
0.354838709677419	46.01	45.87	45.38	44.3	44.1	38.55
0.387096774193548	45.24	45.08	44.76	44.07	43.18	37.89

```
0.419354838709677 44.19 44.06 43.49 42.34 41.4  37.28
0.451612903225806 42.67 42.58 42.06 41.33 40.85 36.65
0.483870967741936 42.15 42.06 41.67 41.13 40.84 36.41
0.516129032258065 41.99 41.9  41.52 41.13 40.47 35.83
0.548387096774194 41.02 40.92 40.5  40.15 39.49 35.55
0.580645161290323 39.22 39.12 38.71 38.66 38.51 35.54
0.612903225806452 37.35 37.28 37.17 36.54 35.95 33.08
0.645161290322581 37.24 37.16 36.92 36.35 35.71 31.12
0.67741935483871  36.22 36.13 35.77 35.01 34.47 30.96
0.709677419354839 34.3  34.21 34    33.22 32.55 28.88
0.741935483870968 34.22 34.12 33.73 33.06 32.44 28.39
0.774193548387097 32.13 32.04 31.79 31.23 30.83 27.52
0.806451612903226 29.18 29.13 28.79 27.98 27.4  24.04
0.838709677419355 27.32 27.26 27.01 26.47 25.96 22.38
0.870967741935484 24.63 24.56 24.31 23.69 23.23 19.99
0.903225806451613 22.47 22.41 22.25 21.79 21.39 18.65
0.935483870967742 22.23 22.12 21.91 21.29 20.77 14.43
0.967741935483871 9.051 9.009 8.844 8.727 8.589 5.038

0.1   50.2  50.057      49.504      48.417      47.46 41.77
                        Average of yearly averages:   32.9649333333333

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: kssorpropaerial2
Metfile:    w13996.dvf
PRZM scenario:    KSsorghumC.txt
EXAMS environment file: pond298.exv
Chemical Name:    Propazine
Description Variable Name     Value Units Comments
Molecular weight  mwt   230   g/mol
Henry's Law Const.      henry 1.02e-9     atm-m^3/mol
Vapor Pressure    vapr  2.9e-8      torr
Solubility  sol   8.6   mg/L
Kd    Kd          mg/L
Koc   Koc   125   mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 960   days  Halfife
Anaerobic Aquatic Metabolism  kbacs 112   days  Halfife
Aerobic Soil Metabolism asm   480   days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  1.344 kg/ha
Application Efficiency: APPEFF      .95   fraction
Spray Drift DRFT  .05   fraction of application rate applied to pond
Application Date  Date  10-5  dd/mm or dd/mmm or dd-mm or dd-mmm
Record 17:  FILTRA
      IPSCND
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Kansas Sorghum Crop Scenario
Ground Spray Application of Propazine 4L

stored as kssorpropground.out
Chemical: Propazine
PRZM environment: KSsorghumC.txt modified Satday, 12 October 2002 at 15:57:00
EXAMS environment: pond298.exv modified Thuday, 24 July 2003 at 10:02:00
Metfile: w13996.dvf modified Wedday, 3 July 2002 at 09:04:44
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day		60 Day	90 Day	Yearly
1961	6.834	6.801	6.673	6.533	6.46	3.758	
1962	18.62	18.53	18.34	17.83	17.4	11.75	
1963	17.33	17.29	17.18	16.88	16.6	14.84	
1964	18.9	18.84	18.65	18.14	17.77	15.3	
1965	20.79	20.75	20.58	20.12	19.75	17	
1966	22.17	22.13	21.87	21.21	20.78	18.12	
1967	26.92	26.84	26.52	25.93	25.45	21.23	
1968	24.29	24.23	24.01	23.55	23.24	21.69	
1969	26.26	26.2	26.02	25.43	24.92	21.9	
1970	28.93	28.87	28.64	28.15	27.68	23.9	
1971	39.79	39.67	39.21	38.5	37.78	30.38	
1972	31.08	31.05	30.94	30.71	30.52	29.39	
1973	34.28	34.21	33.78	33.02	32.49	28.65	
1974	32.41	32.33	32.01	31.77	31.28	28.33	
1975	28.72	28.67	28.52	28.05	27.57	25.71	
1976	27.34	27.28	27.01	26.43	26.01	23.66	
1977	36.84	36.71	36.38	35.9	35.19	28.29	
1978	41.59	41.5	40.96	40.48	39.71	33.47	
1979	33.66	33.63	33.51	33.26	33.07	31.4	
1980	35.68	35.58	35.11	34.13	33.4	29.47	
1981	40.39	40.27	39.83	38.99	38.19	32.27	
1982	44.76	44.69	44.42	43.47	42.64	36.42	
1983	39.71	39.64	39.38	38.73	38.01	34.8	
1984	41.32	41.21	40.79	40.2	39.46	34.2	
1985	38.31	38.21	37.84	37	36.59	33.61	
1986	43.51	43.39	42.91	41.87	41.11	35.3	
1987	39.34	39.23	38.91	38.37	37.7	34.44	
1988	38.14	38.03	37.62	36.58	36.22	33.13	
1989	33.71	33.63	33.37	33.1	32.8	30.79	
1990	41.82	41.7	41.22	40.31	39.52	33.2	

Sorted results

Prob.	Peak	96 hr	21 Day		60 Day	90 Day	Yearly
0.032258064516129	44.76	44.69	44.42	43.47	42.64	36.42	
0.0645161290322581		43.51	43.39	42.91	41.87	41.11	35.3
0.0967741935483871		41.82	41.7	41.22	40.48	39.71	34.8
0.129032258064516	41.59	41.5	40.96	40.31	39.52	34.44	
0.161290322580645	41.32	41.21	40.79	40.2	39.46	34.2	
0.193548387096774	40.39	40.27	39.83	38.99	38.19	33.61	
0.225806451612903	39.79	39.67	39.38	38.73	38.01	33.47	
0.258064516129032	39.71	39.64	39.21	38.5	37.78	33.2	
0.290322580645161	39.34	39.23	38.91	38.37	37.7	33.13	
0.32258064516129	38.31	38.21	37.84	37	36.59	32.27	
0.354838709677419	38.14	38.03	37.62	36.58	36.22	31.4	
0.387096774193548	36.84	36.71	36.38	35.9	35.19	30.79	

```
0.419354838709677 35.68 35.58 35.11 34.13 33.4  30.38
0.451612903225806 34.28 34.21 33.78 33.26 33.07 29.47
0.483870967741936 33.71 33.63 33.51 33.1  32.8  29.39
0.516129032258065 33.66 33.63 33.37 33.02 32.49 28.65
0.548387096774194 32.41 32.33 32.01 31.77 31.28 28.33
0.580645161290323 31.08 31.05 30.94 30.71 30.52 28.29
0.612903225806452 28.93 28.87 28.64 28.15 27.68 25.71
0.645161290322581 28.72 28.67 28.52 28.05 27.57 23.9
0.67741935483871  27.34 27.28 27.01 26.43 26.01 23.66
0.709677419354839 26.92 26.84 26.52 25.93 25.45 21.9
0.741935483870968 26.26 26.2  26.02 25.43 24.92 21.69
0.774193548387097 24.29 24.23 24.01 23.55 23.24 21.23
0.806451612903226 22.17 22.13 21.87 21.21 20.78 18.12
0.838709677419355 20.79 20.75 20.58 20.12 19.75 17
0.870967741935484 18.9  18.84 18.65 18.14 17.77 15.3
0.903225806451613 18.62 18.53 18.34 17.83 17.4  14.84
0.935483870967742 17.33 17.29 17.18 16.88 16.6  11.75
0.967741935483871 6.834 6.801 6.673 6.533 6.46  3.758

0.1   41.797      41.68 41.194      40.463      39.691      34.764
                              Average of yearly averages:   26.5466

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: kssorpropground
Metfile:    w13996.dvf
PRZM scenario:    KSsorghumC.txt
EXAMS environment file: pond298.exv
Chemical Name:    Propazine
Description Variable Name     Value Units Comments
Molecular weight  mwt   230   g/mol
Henry's Law Const.      henry 1.02e-9     atm-m^3/mol
Vapor Pressure    vapr  2.9e-8      torr
Solubility  sol   8.6   mg/L
Kd    Kd          mg/L
Koc   Koc   125   mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 960   days  Halfife
Anaerobic Aquatic Metabolism  kbacs 112   days  Halfife
Aerobic Soil Metabolism asm   480   days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  1.344 kg/ha
Application Efficiency: APPEFF      .99   fraction
Spray Drift DRFT  .01   fraction of application rate applied to pond
Application Date  Date  10-5  dd/mm or dd/mmm or dd-mm or dd-mmm
Record 17:  FILTRA
      IPSCND
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Texas Sorghum Crop Scenario
Aerial Spray Application of Propazine 4L

stored as txsorpropaerial.out
Chemical: Propazine
PRZM environment: TXsorghumC.txt modified Satday, 12 October 2002 at 17:29:00
EXAMS environment: pond298.exv modified Thuday, 24 July 2003 at 10:02:00
Metfile: w13958.dvf modified Wedday, 3 July 2002 at 09:06:24
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day		60 Day		90 Day		Yearly
1961	6.805	6.776	6.686	6.45	6.336	3.85			
1962	14.84	14.77	14.52	13.96	13.56	9.491			
1963	13.18	13.13	12.95	12.82	12.59	10.92			
1964	14.31	14.25	14.04	13.76	13.53	11.19			
1965	41.58	41.47	40.74	39.36	38.26	25.68			
1966	42.1	41.95	41.4	40.15	39.25	32.82			
1967	33.32	33.22	32.9	31.96	31.49	28.69			
1968	48.06	47.87	47.2	45.62	44.54	34.66			
1969	46.82	46.66	46.12	44.74	43.63	37.11			
1970	58.2	57.98	57.22	55.34	53.91	42.69			
1971	41.95	41.89	41.63	41.07	40.64	37.22			
1972	104	104	103	99.16	96.42	67.01			
1973	73.09	73	72.63	71.83	71.15	64.45			
1974	78.86	78.56	77.35	74.79	73	60.98			
1975	60.18	60.06	59.55	58.22	57.16	52.88			
1976	64.81	64.59	64.07	62.23	60.8	50.92			
1977	48.08	48.02	47.81	47.31	46.87	42.93			
1978	70.02	69.73	68.98	67.01	65.27	50.04			
1979	87.73	87.42	86.11	83.21	81.12	65.28			
1980	72.42	72.24	71.72	69.67	67.97	61.1			
1981	58.54	58.37	57.93	57.09	55.98	50.13			
1982	60.96	60.74	59.87	57.91	56.39	47.31			
1983	71.54	71.26	70.52	68.36	66.68	53.51			
1984	51.79	51.72	51.46	50.87	50.36	45.48			
1985	37.53	37.43	37.05	36.64	36.28	33.21			
1986	103	102	101	96.86	94.4	64.85			
1987	73.35	73.16	72.45	71	69.64	64.61			
1988	54.95	54.81	54.25	53.33	52.54	48.76			
1989	64.51	64.34	63.56	61.65	60.19	48.69			
1990	80.04	79.7	78.38	75.61	73.56	58.22			

Sorted results

Prob.	Peak	96 hr	21 Day		60 Day		90 Day		Yearly
0.032258064516129	104	104	103	99.16	96.42	67.01			
0.0645161290322581		103	102	101	96.86	94.4	65.28		
0.0967741935483871		87.73	87.42	86.11	83.21	81.12	64.85		
0.129032258064516	80.04	79.7	78.38	75.61	73.56	64.61			
0.161290322580645	78.86	78.56	77.35	74.79	73	64.45			
0.193548387096774	73.35	73.16	72.63	71.83	71.15	61.1			
0.225806451612903	73.09	73	72.45	71	69.64	60.98			
0.258064516129032	72.42	72.24	71.72	69.67	67.97	58.22			
0.290322580645161	71.54	71.26	70.52	68.36	66.68	53.51			
0.32258064516129	70.02	69.73	68.98	67.01	65.27	52.88			
0.354838709677419	64.81	64.59	64.07	62.23	60.8	50.92			
0.387096774193548	64.51	64.34	63.56	61.65	60.19	50.13			

```
0.419354838709677 60.96 60.74 59.87 58.22 57.16 50.04
0.451612903225806 60.18 60.06 59.55 57.91 56.39 48.76
0.483870967741936 58.54 58.37 57.93 57.09 55.98 48.69
0.516129032258065 58.2  57.98 57.22 55.34 53.91 47.31
0.548387096774194 54.95 54.81 54.25 53.33 52.54 45.48
0.580645161290323 51.79 51.72 51.46 50.87 50.36 42.93
0.612903225806452 48.08 48.02 47.81 47.31 46.87 42.69
0.645161290322581 48.06 47.87 47.2  45.62 44.54 37.22
0.67741935483871  46.82 46.66 46.12 44.74 43.63 37.11
0.709677419354839 42.1  41.95 41.63 41.07 40.64 34.66
0.741935483870968 41.95 41.89 41.4  40.15 39.25 33.21
0.774193548387097 41.58 41.47 40.74 39.36 38.26 32.82
0.806451612903226 37.53 37.43 37.05 36.64 36.28 28.69
0.838709677419355 33.32 33.22 32.9  31.96 31.49 25.68
0.870967741935484 14.84 14.77 14.52 13.96 13.56 11.19
0.903225806451613 14.31 14.25 14.04 13.76 13.53 10.92
0.935483870967742 13.18 13.13 12.95 12.82 12.59 9.491
0.967741935483871 6.805 6.776 6.686 6.45  6.336 3.85

0.1   86.961      86.648      85.337      82.45 80.364      64.826
                        Average of yearly averages:   43.4893666666667

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: txsorpropaerial
Metfile:    w13958.dvf
PRZM scenario:    TXsorghumC.txt
EXAMS environment file: pond298.exv
Chemical Name:    Propazine
Description Variable Name     Value Units Comments
Molecular weight  mwt   230   g/mol
Henry's Law Const.      henry 1.02e-9     atm-m^3/mol
Vapor Pressure    vapr  2.9e-8      torr
Solubility  sol   8.6   mg/L
Kd    Kd          mg/L
Koc   Koc   125   mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 960   days  Halfife
Anaerobic Aquatic Metabolism  kbacs 112   days  Halfife
Aerobic Soil Metabolism asm   480   days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  1.344 kg/ha
Application Efficiency: APPEFF      .95   fraction
Spray Drift DRFT  .05   fraction of application rate applied to pond
Application Date  Date  01-5  dd/mm or dd/mmm or dd-mm or dd-mmm
Record 17:  FILTRA
      IPSCND
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Texas Sorghum Crop Scenario
Ground Spray Application of Propazine 4L

stored as txsorpropground.out
Chemical: Propazine
PRZM environment: TXsorghumC.txt modified Satday, 12 October 2002 at 17:29:00
EXAMS environment: pond298.exv modified Thuday, 24 July 2003 at 10:02:00
Metfile: w13958.dvf modified Wedday, 3 July 2002 at 09:06:24
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	4.561	4.542	4.481	4.321	4.204	2.516
1962	11.21	11.15	10.96	10.51	10.2	6.823
1963	8.273	8.249	8.147	8.009	7.917	7.313
1964	8.535	8.504	8.379	8.306	8.227	6.94
1965	36.61	36.5	35.83	34.55	33.56	21.51
1966	36.6	36.47	35.99	34.9	34.1	28.58
1967	27.42	27.34	27.11	26.31	25.83	24.07
1968	42.44	42.26	41.66	40.24	39.22	30.07
1969	40.92	40.78	40.32	39.12	38.16	32.48
1970	52.81	52.6	51.91	50.18	48.87	38.22
1971	37.99	37.93	37.7	37.19	36.8	32.52
1972	101	100	99.43	95.79	93.11	63.63
1973	70.49	70.41	70.05	69.28	68.62	60.86
1974	74.22	73.94	72.8	70.38	68.63	57.22
1975	54.7	54.58	54.15	52.98	52.34	48.69
1976	59.49	59.29	58.79	57.11	55.79	46.6
1977	44.11	44.06	43.86	43.4	43	38.21
1978	64.87	64.6	63.83	62.03	60.41	45.75
1979	83.5	83.2	81.94	79.15	77.15	61.6
1980	67.4	67.24	66.75	64.86	63.27	57.29
1981	53.13	52.98	52.63	51.82	50.84	45.95
1982	55.68	55.47	54.68	52.88	51.49	43.09
1983	66.68	66.42	65.76	63.74	62.16	49.52
1984	48.24	48.18	47.94	47.38	46.91	41.14
1985	33.21	33.17	33	32.62	32.31	28.39
1986	99.16	98.67	97.29	93.49	91.01	61.42
1987	68.84	68.75	68.36	67.5	66.84	61.14
1988	50.67	50.6	50.33	49.74	49.26	44.6
1989	59.46	59.31	58.57	56.76	55.43	44.59
1990	75.53	75.21	73.95	71.33	69.39	54.57

Sorted results

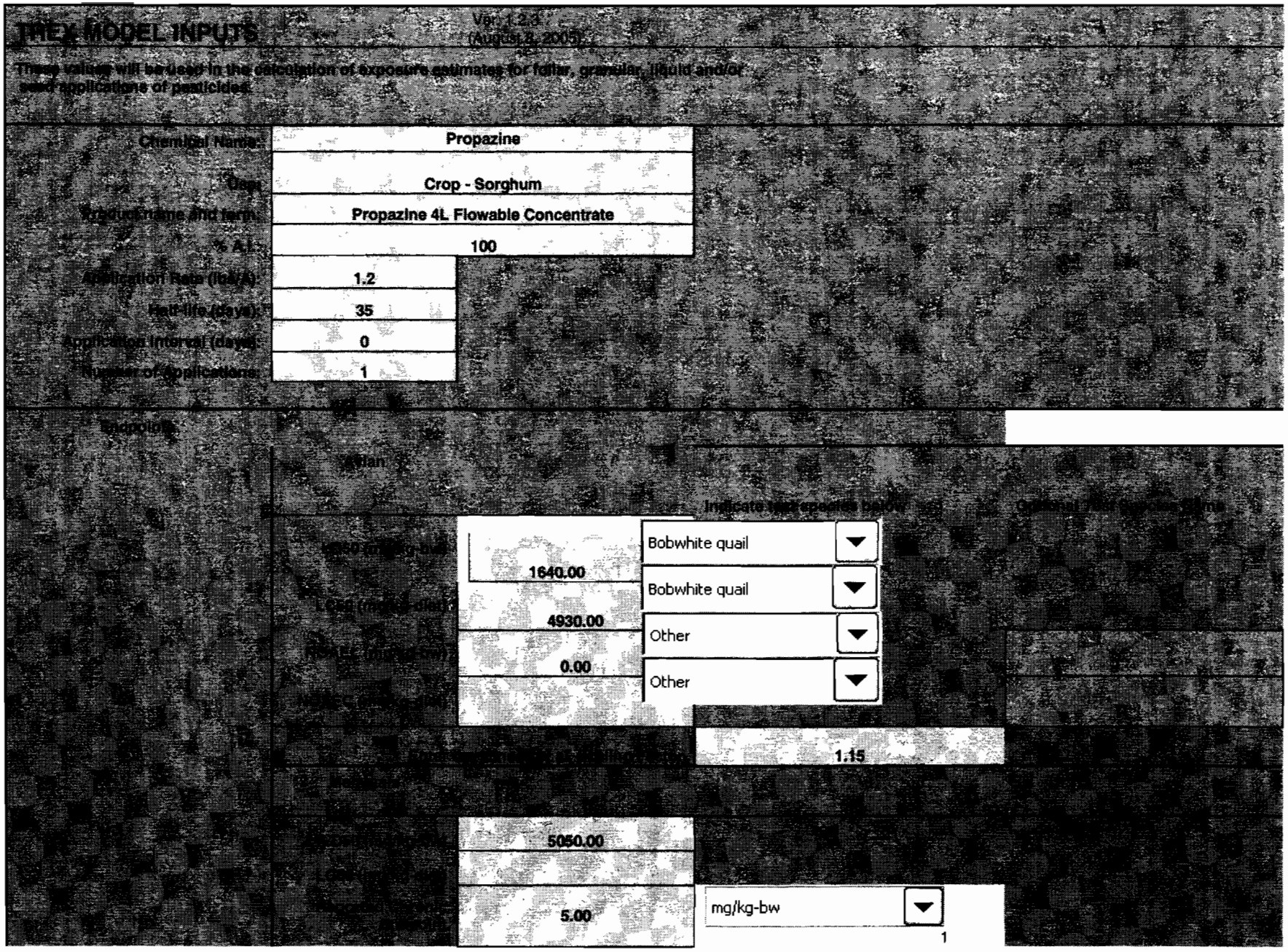
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	101	100	99.43	95.79	93.11	63.63
0.0645161290322581		99.16	98.67	97.29	93.49	91.01	61.6
0.0967741935483871		83.5	83.2	81.94	79.15	77.15	61.42
0.129032258064516	75.53	75.21	73.95	71.33	69.39	61.14
0.161290322580645	74.22	73.94	72.8	70.38	68.63	60.86
0.193548387096774	70.49	70.41	70.05	69.28	68.62	57.29
0.225806451612903	68.84	68.75	68.36	67.5	66.84	57.22
0.258064516129032	67.4	67.24	66.75	64.86	63.27	54.57
0.290322580645161	66.68	66.42	65.76	63.74	62.16	49.52
0.32258064516129	64.87	64.6	63.83	62.03	60.41	48.69
0.354838709677419	59.49	59.31	58.79	57.11	55.79	46.6
0.387096774193548	59.46	59.29	58.57	56.76	55.43	45.95

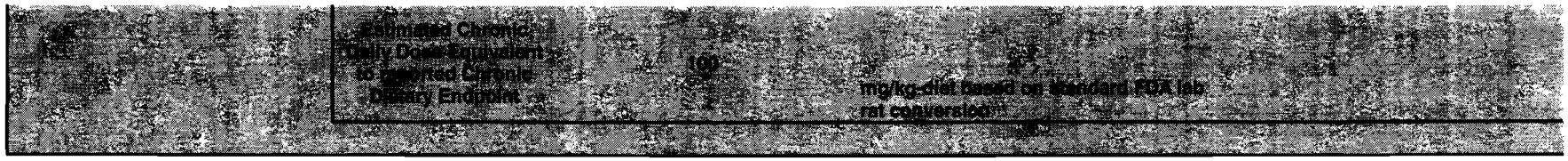
```
0.419354838709677 55.68 55.47 54.68 52.98 52.34 45.75
0.451612903225806 54.7  54.58 54.15 52.88 51.49 44.6
0.483870967741936 53.13 52.98 52.63 51.82 50.84 44.59
0.516129032258065 52.81 52.6  51.91 50.18 49.26 43.09
0.548387096774194 50.67 50.6  50.33 49.74 48.87 41.14
0.580645161290323 48.24 48.18 47.94 47.38 46.91 38.22
0.612903225806452 44.11 44.06 43.86 43.4  43    38.21
0.645161290322581 42.44 42.26 41.66 40.24 39.22 32.52
0.67741935483871  40.92 40.78 40.32 39.12 38.16 32.48
0.709677419354839 37.99 37.93 37.7  37.19 36.8  30.07
0.741935483870968 36.61 36.5  35.99 34.9  34.1  28.58
0.774193548387097 36.6  36.47 35.83 34.55 33.56 28.39
0.806451612903226 33.21 33.17 33    32.62 32.31 24.07
0.838709677419355 27.42 27.34 27.11 26.31 25.83 21.51
0.870967741935484 11.21 11.15 10.96 10.51 10.2  7.313
0.903225806451613 8.535 8.504 8.379 8.306 8.227 6.94
0.935483870967742 8.273 8.249 8.147 8.009 7.917 6.823
0.967741935483871 4.561 4.542 4.481 4.321 4.204 2.516

0.1   82.703  82.401  81.141  78.368      76.374      61.392
                      Average of yearly averages:   39.5100666666667

Inputs generated by pe4.pl - 8-August-2003
Data used for this run:
Output File: txsorpropground
Metfile:    w13958.dvf
PRZM scenario:    TXsorghumC.txt
EXAMS environment file: pond298.exv
Chemical Name:    Propazine
Description Variable Name     Value Units Comments
Molecular weight  mwt   230   g/mol
Henry's Law Const.      henry 1.02e-9     atm-m^3/mol
Vapor Pressure    vapr  2.9e-8      torr
Solubility  sol   8.6   mg/L
Kd    Kd          mg/L
Koc   Koc   125   mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 960   days  Halfife
Anaerobic Aquatic Metabolism  kbacs 112   days  Halfife
Aerobic Soil Metabolism asm   480   days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  1.344 kg/ha
Application Efficiency: APPEFF      .99   fraction
Spray Drift DRFT  .01   fraction of application rate applied to pond
Application Date  Date  01-5  dd/mm or dd/mmm or dd-mm or dd-mmm
Record 17:  FILTRA
      IPSCND
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Appendix D. T-REX Model and Results


TREX MODEL INPUTS
Ver. 1.2.3
(August 9, 2005)
These values will be used in the calculation of exposure estimates for foliar, granular, liquid and/or seed applications of pesticides.
Chemical Name:
Propazine
Use:
Crop - Sorghum
Product name and form:
Propazine 4L Flowable Concentrate
% A.I.:
100
Application Rate (lbs/A):
1.2
Half-life (days):
35
Application Interval (days):
0
Number of Applications:
1
Bobwhite quail
1640.00
Bobwhite quail
4930.00
Other
0.00
Other
1.15
5050.00
5.00
mg/kg-bw
1


Estimated Chronic
Daily Dose Equivalent
to Reported Chromic
Dietary Endpoint
100
mg/kg-diet based on standard FDA lab
rat conversion

Upper Bound Kenaga Residues
For RQ Calculation

Chemical Name:	Propachlor
Use:	Corn, Sorghum
Formulation:	Propachlor 4L Flowable Concentrate
Application Rate:	4.2 lbs AI/Acre
Number:	2 Applications
Application Interval:	0 days
Maximum # Apps / Year:	1
Length of Simulation:	1 year

Endpoints

Bobwhite quail		LD50 (mg/kg-bw)	
Bobwhite quail		LC50 (mg/kg-diet)	
	0	NOAEL (mg/kg-bw)	
	0	NOAEC (mg/kg-diet)	0.00

Mammals		LD50 (mg/kg-bw)	500.00
			0.00
			0.00
			100.00

	288.00
	132.00
	162.00
	18.00

Avian Results

Avian Classes	Body Weight (g)	Ingestion (Fish) (g ww/day)	Ingestion (Plant) (g/day)	% body wgt consumed	Kow (Log Kow)
Small	20	6	23	144	2.28E-02
Mid	100	28	85	85	6.40E-03
Large	1000	56	251	25	2.81E-01

Avian Body Weight (g)	Adjusted LD50 (mg/kg-bw)
20	1181.50
100	1809.07
1000	2124.62

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	Small 20g	Mid 100 g	Large 1000 g
Short Grass	328.00	187.04	83.74
Tall Grass	150.33	85.73	38.38
Broadleaf plants/small insects	184.50	105.21	47.10
Fruits/pods/seeds/large insects	20.50	11.69	5.23

Dietary-based EECs (mg/kg-diet)	Avian Body Wgts		
	Small 20g	Mid 100 g	Large 1000 g
Short Grass	0.28	0.12	0.04
Tall Grass	0.13	0.06	0.02
Broadleaf plants/small insects	0.16	0.07	0.02
Fruits/pods/seeds/large insects	0.02	0.01	0.00

Toxicity Values	
Acute	Chronic
0.06	#DIV/0!

Tall Grass	0.03	#DIV/0!
Broadleaf plants/sm insects	0.03	#DIV/0!
Fruits/pods/seeds/lg insects	0.00	#DIV/0!

Mammalian Results

Mammalian Class	Body Weight	Ingestion (Fdry) (g dwt/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FIR (kg-diet/day)
Herbivore/ Insectivore	15	3	18	98	1.43E-02
	35	5	23	66	2.31E-02
	1000	31	153	15	1.58E-01
Grainivore	15	3	3	21	3.15E-03
	35	5	5	15	5.25E-03
	1000	31	34	3	3.50E-02

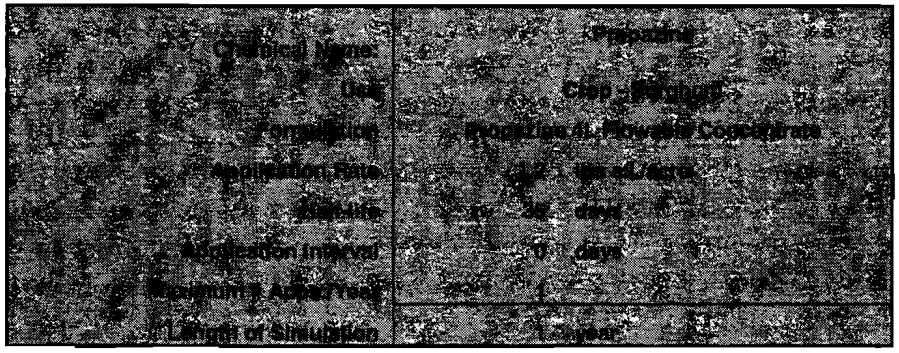
Mammalian Class	Body Weight	Ingestion (Fdry) (g dwt/day)	Ingestion (Fwet) (g/day)	FIR (kg-diet/day)
Herbivore/ Insectivore	15			
	35			
	1000			
Grainivore	15			
	35			
	1000			

Diet-Based EECs (ug/g) for	Mammalian Herbivore/ Insectivore			Mammalian Grainivore		
	15 g	35 g	1000 g	15 g	35 g	1000 g
Short Grass	274.59	189.78	44.00			
Tall Grass	125.85	86.98	20.17			
Broadleaf plants/sm insects	154.45	106.75	24.75			
Fruits/pods/seeds/lg insects	17.16	11.86	2.75	3.81	2.64	0.61

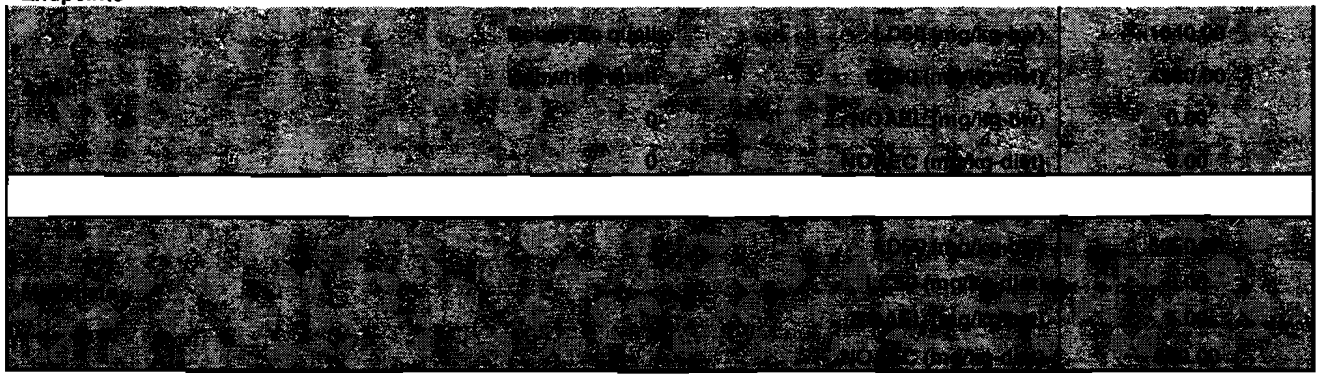
Dose-based RQs (Dose-based EEC/LD50 or NOAEL)	15 g mammal		35 g mammal		1000 g mammal	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Short Grass	0.02	24.99	0.02	21.34	0.01	11.44
Tall Grass	0.01	11.45	0.01	9.78	0.01	5.24
Broadleaf plants/sm insects	0.01	14.06	0.01	12.01	0.01	6.44
Fruits/pods/lg insects	0.00	1.56	0.00	1.33	0.00	0.72
Seeds (granivore)	0.00	0.35	0.00	0.30	0.00	0.16

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	Mammal RQs	
	Acute	Chronic
Short Grass	#DIV/0!	2.88
Tall Grass	#DIV/0!	1.32
Broadleaf plants/sm insects	#DIV/0!	1.62
Fruits/pods/seeds/lg insects	#DIV/0!	0.18

Mean Kenaga Residues



Endpoints



	102.00
	43.20
	54.00
	8.40

Avian Results

Small	20	114	1161.50
Mid	100	96	1504.11
Large	1000	29	2124.62

Dose-based EEC (mg/kg-bw)	Avian Classes and Body Weights		
	small 20 g	mid 100 g	large 1000 g
Short Grass	116.28	66.30	29.58
Tall Grass	49.25	28.08	12.53
Broadleaf plants/sm insects	61.56	35.10	15.66
Fruit/pods/lg insects	9.58	5.46	2.44

Dose-based RQs (dose-based EEC/LD50)	Avian Acute RQs		
	20 g	100 g	1000 g
Short Grass	0.10	0.04	0.01
Tall Grass	0.04	0.02	0.01
Broadleaf plants/sm insects	0.05	0.02	0.01
Fruit/pods/lg insects	0.01	0.00	0.00

	RQs	
	Acute	Chronic
Short Grass	0.02	#DIV/0!
Tall Grass	0.01	#DIV/0!
Broadleaf plants/sm insects	0.01	#DIV/0!
Fruit/pods/lg insects	0.00	#DIV/0!

Propazine **Crop - Sorghum** **Mean Kenaga Residues**

Mammalian Results

	15	95	11089.04		10.99
Herbivores/	35	64	8990.31		8.89
Insectivores	1000	15	3894.26		3.85
	15	21	11089.04		10.99
Granivores	35	15	8990.31		8.89
	1000	3	3894.26		3.85

Dose-based EEC (mg/kg-bw)	Mammalian Classes and Body weight					
	Herbivores/ insectivores			Granivores		
	15 g	35 g	1000 g	15 g	35 g	1000 g
Short Grass	96.90	67.32	15.30			
Tall Grass	41.04	28.51	6.48			
Broadleaf plants/small insects	51.30	35.64	8.10			
Fruits/pods/seeds/large insects	7.98	5.54	1.26	1.76	1.26	0.25

Dose-based (mg/kg-bw) EEC (LD50 or NOAEL)	15 g mammal		35 g mammal		1000 g mammal	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Short Grass	0.01	8.82	0.01	7.57	0.00	3.98
Tall Grass	0.00	3.73	0.00	3.21	0.00	1.68
Broadleaf plants/small insects	0.00	4.67	0.00	4.01	0.00	2.11
Fruits/pods/seeds/large insects	0.00	0.73	0.00	0.62	0.00	0.33
Arthropods	0.00	0.16	0.00	0.14	0.00	0.07

	Acute	Chronic
	#DIV/0!	1.02
	#DIV/0!	0.43
	#DIV/0!	0.54
	#DIV/0!	0.08

Appendix E. TerrPlant Model and Results

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

Chemical: Propazine 4L

Input Values	
Application Rate (lb a.i./acre)	1.2
Runoff Value (0.01, 0.02, or 0.05 if chemical solubility <10, 10-100, or >100 ppm, respectively)	0.01
Minimum Incorporation Depth (inches)	0
Seed Emerg Monocot EC25 (lb a.i./acre)	0.035
Seed Emerg Dicot EC25 (lb a.i./acre)	0.016
Veg Vigor Monocot EC25 (lb a.i./acre)	0.046

Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)

Application Method	Total Loading to Adjacent Areas (EEC = Sheet Runoff +Drift)	Total Loading to Semi-aquatic Areas (EEC = Channelized Runoff + Drift)	DRIFT EEC (for ground: application rate x 0.01) (for aerial: application rate x 0.05)
Ground Unincorp.	0.0240	0.1320	0.0120
Ground Incorp	0.0240	0.1320	0.0120
Aerial, Airblast, Spray Chemigation	0.0720	0.1800	0.0600

Risk Quotients (RQs) for NON-GRANULAR formulation applications

Emergence RQs, Adjacent Areas RQ = EEC/Seedling Emergence EC25		Emergence RQs, Semi-aquatic Areas RQ = EEC/Seedling Emergence EC25		Drift RQs RQ = Drift EEC/Most Sensitive EC25	
Monocot	Dicot	Monocot	Dicot	Monocot	Dicot
0.69	1.50	3.77	8.25	0.34	0.75
0.69	1.50	3.77	8.25	0.34	0.75
2.06	4.50	5.14	11.25	1.71	3.75

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

Chemical: Propazine 4L

	Input Values
Veg Vigor Dicot EC25 (lb a.i./acre)	**0.1**

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

Chemical: Propazine 4L

	Input Values
Application Rate (lb a.i./acre)	1.2
Runoff Value (0.01, 0.02, or 0.05 if chemical solubility <10, 10-100, or >100 ppm, respectively)	0.01
Minimum Incorporation Depth (inches)	0
Seed Emerg Monocot EC05 or NOAEC (lb a.i./acre)	<0.01
Seed Emerg Dicot EC05 or NOAEC (lb a.i./acre)	0.0047
Veg Vigor Monocot EC05 or NOAEC (lbs a.i./acre)	0.02

Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)			
Application Method	Total Loading to Adjacent Areas (EEC = Sheet Runoff + Drift)	Total Loading to Semi-aquatic Areas (EEC = (Channelized Runoff + Drift)	DRIFT EEC (for ground: application rate x 0.01) (for aerial: application rate x 0.05)
Ground Unincorp.	0.0240	0.1320	0.0120
Ground Incorp	0.0240	0.1320	0.0120
Aerial, Airblast, Spray Chemigation	0.0720	0.1800	0.0600

Risk Quotients (RQs) for NON-GRANULAR formulation applications					
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/Most Sensitive EC05 or NOAEC	
Monocot	Dicot	Monocot	Dicot	Monocot	Dicot
>2.40	5.11	>13.20	28.09	>1.20	2.55
>2.40	5.11	13.20	28.09	>1.20	2.55
>7.20	15.32	>18.00	38.30	>6.00	12.77

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

Chemical: Propazine 4L

	Input Values
Veg Vigor Dicot EC05 or NOAEC (lb a.i./acre)	<0.075

Appendix F. Ecological Effects Data

71-1 Avian Acute Oral

Bobwhite Quail. MRID 442873-01 (Core). Propazine was tested in a single oral gavage study with bobwhite quail (5/sex/dose at nominal concentrations of 0, 0 (vehicle control), 260, 430, 720, 1200 or 2000 mg/kg bw with a 14-day observation period). Propazine was determined to be slightly toxic to bobwhite quail with an LD_{50} of >1,640 mg ai/kg, the highest dose tested when corrected for % active ingredient. At the 1200 mg/kg dose level, only 4 females were tested. Transient decreases in body weight and food consumption were observed at 430 mg/kg bw and above. The NOAEL was determined to be 244 mg ai/kg due to weight loss up to 72 hours after treatment. The study is scientifically sound and fulfills the guideline requirements.

71-2 Avian Subacute Dietary

Bobwhite Quail. MRID 442873-02 (Core). In an 8-day dietary study, propazine was determined to be slightly toxic to bobwhite quail with an LC_{50} >4,930 ppm ai (nominal concentration). A NOAEL was not determined. Diminished feed consumption, slow growth, and cannibalism is attributed to a possible chemical-induced anorexia. The study is scientifically sound and fulfills guideline requirements.

Mallard. MRID 442873-03 (Core). In an 8-day dietary study, propazine was determined to be practically non-toxic to mallard ducklings with an LC_{50} >5,140 ppm ai (nominal concentration). A NOAEL was not determined. Feed consumption rates and resultant growth indicated a chemically-induced anorexia. The study is scientifically sound and fulfills guideline requirements.

72-1 Freshwater Fish Acute

Bluegill Sunfish. MRID 442873-04 (Invalid). In a 96-hour flow-through test, the reported LC_{50} and NOAEL of >4.5 mg ai/L may overestimate the toxicity due to the limited solubility of propazine. Precipitate in the higher treatment levels raises a question of actual exposure and bioavailability. Erratic swimming behavior in fish treated with 1.0 and 1.8 mg/L of propazine may represent a compound-related affect in treatments where propazine was freely soluble. The study is not scientifically sound and does not meet guideline requirements.

72-2 Freshwater Invertebrate Acute

Daphnia. MRID 442873-05 (Uncertain). In a 48-hour flow-through test, propazine was determined to be moderately toxic to daphnids with an EC_{50} of >5.32 ppm ai (mean measured concentration). The NOAEC was determined to be 5.32 ppm ai. The study is scientifically sound but does not fulfill guideline requirements because daphnids were not exposed up to 100 ppm ai. If it can be shown that the test was conducted up to the limit of solubility, the study may be upgraded to acceptable. This study was originally classified as supplemental; however, it was reevaluated in 2005 and is awaiting EFED validation.

72-3b Estuarine/Marine Invertebrate Acute

Eastern Oyster. MRID 442873-06 (Uncertain). In a 96-hour flow-through test, propazine was determined to be practically non-toxic to the eastern oyster at the limit of water solubility with an EC_{50} of >3.72 mg ai/L (mean measured concentration). The NOAEC was determined to be 3.72 mg ai/L. No significant adverse effects were observed on shell deposition. The study is

scientifically sound and fulfills guideline requirements. This study was originally classified as invalid due to limited solubility of propazine; however, it was reevaluated in 2006 and EFED established the reported values (classification awaiting EFED validation).

Saltwater Mysid. MRID 441848-01 (Acceptable). In a 96-hour static test, propazine was determined to be moderately toxic to saltwater mysid with an LC_{50} of 4.20 ppm ai (mean measured concentration), based on mortality and sublethal effects. The NOAEC was determined to be 0.586 ppm ai. The study is scientifically sound and fulfills guideline requirements.

72-4a Freshwater Fish Early Life Stage

Fathead Minnow. MRID 442873-07 (Supplemental). In an early life-stage flow-through test, propazine produced significant reduction in length. The NOAEL was determined to be 0.72 mg ai/L). The MATC was calculated at 0.938 mg ai/L. The study is scientifically sound, but does not fulfill guideline requirements since both pH and hardness exceeded recommended levels potentially affecting solubility.

72-4b Freshwater Invertebrate Life Cycle

Daphnia. MRID 443276-02 (Core). In a life cycle flow-through test, the NOAEC and LOAEC were determined to be 0.047 ppm ai mg/L and 0.091 ppm ai, respectively, based on growth measured in terms of length (mm) and weight (g). The study is scientifically sound and fulfills guideline requirements.

72-4c Estuarine/Marine Fish Life Cycle

Sheepshead Minnow. MRID 441848-02 (Uncertain). In a 36-day chronic flow-through test, propazine was determined to affect embryo survival and hatching success in early life-stage sheepshead minnow with an NOAEC of 1.34 mg ai/L (mean measured concentration). The LOAEC was determined to be 2.59 mg ai/L. The study is scientifically sound and meets guideline protocols. This study was reevaluated in 2006 and EFED disagreed with the study author's conclusion and modified the results (classification awaiting EFED validation).

72-4d Estuarine/Marine Invertebrate Life Cycle

Saltwater Mysid. MRID 441848-03 (Supplemental). In a 28-day life cycle test under flow-through conditions, propazine produced significant effects on growth (dry weight, combined and separate sexes) and reproduction. The NOAEC and LOAEC were 0.269 and 0.706 ppm ai (mean measured concentrations), respectively. The study is scientifically sound; however, since second-generation mysids were not maintained for at least 4 days and observed for survival, development and behavior, the study does not fulfill guideline requirements.

81-1 Acute Mammalian Oral

Rat. MRID 434741-01 (Core). In an acute oral study, propazine was determined to have be practically non-toxic (Toxicity Category IV) to rats with an LD_{50} of >5050 mg/kg. The study is scientifically sound and fulfills guideline requirements.

83-3 Mammalian Developmental

Rat. MRID 001502-42 (Core). In a developmental toxicity study with Sprague-Dawley rats, propazine produced maternal and developmental toxicity. The maternal NOAEL was 10 mg/kg/day (LOAEL = 100 mg/kg/day) based upon decreased body weights and food consumption. Salivation was also reported at doses ≥500 mg/kg/day. The developmental NOAEL was 10 mg/kg/day (LOAEL = 100 mg/kg/day) based on decreased ossification. This study is scientifically sound and fulfills guideline requirements.

Rabbit. MRID 441534-01 (Core). In a developmental toxicity study with New Zealand White rabbits, propazine produced maternal toxicity. No developmental toxicity was observed. The maternal NOAEL was 10 mg/kg/day (LOAEL = 50 mg/kg/day) based upon decreased defecation and decreased body weight gain and food consumption. This study is scientifically sound and fulfills guideline requirements.

83-4 Mammalian Reproduction

Rat. MRID 0004141-09 (Core). In a 3-generation reproduction study, propazine produced parental/offspring toxicity with a NOAEL of 5 mg/kg/day (100 ppm) and the LOAEL of 50 mg/kg/day (1000 ppm) based upon body weight decrements in males and females. No reproductive toxicity was observed; consequently, the NOAEL was ≥50 mg/kg/day (≥1000 ppm) and the LOAEL was >50 mg/kg/day (>1000 ppm). This study is scientifically sound and fulfills guideline requirements.

122-2 Aquatic Plant Algae

Blue-green algae. MRID 442873-12 (Core). In a Tier II toxicity test with *Anabaena flos-aquae*, the 7 day EC_{50} for cell density was 0.18 ppm ai (NOAEC = 0.068 ppm ai). The study is scientifically sound and fulfills the guideline requirements.

Green algae. MRID 442873-08 (Core). In a Tier II toxicity test with *Selenastrum capricornutum*, the 7 day EC_{50} for cell density was 0.029 ppm ai (NOAEC = 0.012 ppm ai). The study is scientifically sound and fulfills the guideline requirements.

Marine diatom. MRID 442873-11 (Core). In a Tier II toxicity test with *Skeletonema costatum*, the 7 day EC_{50} for cell density was 0.025 ppm ai (NOAEC = 0.017 ppm ai). The study is scientifically sound and fulfills the guideline requirements.

Diatom. MRID 442873-10 (Core). In a Tier II toxicity test with *Navicula pelliculosa*, the 7 day EC_{50} for cell density was 0.0248 ppm ai (NOAEC = 0.0065 ppm ai). The study is scientifically sound and fulfills the guideline requirements.

123-1(a) Seedling Emergence - Tier II

Monocots (5 species) and Dicots (6 species). MRID 441848-04 (Uncertain). In a Tier II seedling emergence study, percent emergence, shoot weight and shoot length were affected in all species tested (cabbage, corn, cucumber, lettuce, oats, onion, ryegrass, radish, soybean, tomato and wheat) with shoot weight being the most sensitive parameter tested. Onion was the most sensitive monocot species (EC_{25} 0.035 lb ai/A, NOAEC <0.010 lb ai/A) and lettuce was the most sensitive dicot species (EC_{25} 0.016 lb ai/A, NOAEC <0.0047 lb ai/A). With the exception of corn and ryegrass, all species exhibited phytotoxic effects, including chlorosis, necrosis, stunting

and mortalities. This study was reevaluated in 2006 and additional statistical analyses were performed (classification awaiting EFED validation).

123-1(b) Vegetative Vigor - Tier II

Monocots (5 species) and Dicots (6 species). MRID 441848-04 (Uncertain). In a Tier II vegetative vigor study, shoot weight and shoot height were affected in all species tested (cabbage, cucumber, lettuce, oats, onion, ryegrass, radish, soybean, tomato and wheat), with the exception of corn. Shoot weight was the most sensitive parameter tested with wheat being the most sensitive monocot species (EC_{25} 0.046 lb ai/A, NOAEC <0.020 lb ai/A). Cucumber was the most sensitive dicot species (EC_{25} 0.010 lb ai/A, NOAEC <0.075 lb ai/A). With the exception of tomato and soybean, all species exhibited phytotoxic effects, including chlorosis, necrosis, stunting and mortalities. This study was reevaluated in 2006 and additional statistical analyses were performed (classification awaiting EFED validation).

123-2 Aquatic Plant Acute

Duckweed. MRID 442873-09 (Core). In a Tier II toxicity test with *Lemna gibba*, the 7 day EC_{50} for cell density was 0.10 ppm ai (NOAEC = 0.022 ppm ai). The study is scientifically sound and fulfills the guideline requirements.

141-1 Acute Contact Toxicity Test to Honey Bees

In an acute contact study with the honey bee, propazine was determined to be relatively non-toxic. At 96 hours, mortality was 2.47% at a dose of 96.69 µg/bee (Atkins et al. 1975). A bell-jar vacuum duster was used to apply the pesticide, mixed with a pyrolite dust diluent and given to the test bees. Dosages of the dust were weighed, bees were aspirated into dusting cages and treated, and then bees were transferred into holding cages. Observations were recorded at 12, 24, 48, 72 and 96 hours. The study was scientifically sound and showed that propazine is relatively non-toxic to honey bees. The study fulfills the guideline requirement for an acute contact toxicity test on honey bees.

Appendix G. The Risk Quotient Method and Levels of Concern

The risks to terrestrial and aquatic organisms are determined based on a method by which risk quotients (RQs) are compared with levels of concern (LOCs). This method provides an indication of a chemical's potential to cause an effect in the field from effects observed in laboratory studies, when used as directed. Risk quotients are expressed as the ratio of the estimated environmental concentration (EEC) to the species-specific toxicity reference value (TRV):

$$RQ = \frac{EEC}{TRV}$$

Units for EEC and TRV should be the same (e.g., µg/L or ppb). The RQ is compared to the LOC as part of a risk characterization. Acute and chronic LOCs for terrestrial and aquatic organisms are given in recent Agency guidance (EPA, 2004) and summarized in the table below.

Level of concern (LOC) by risk presumption category (U.S. EPA 2004).

Risk Presumption	RQ	LOC
	Mammals and Birds	
Acute Risk [a]	EEC[b]/LC_{50} or LD_{50}/sqft[c] or LD_{50}/day [d]	0.5
Acute Restricted Use [e]	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day (or LD_{50} <50 mg/kg)	0.2
Acute Endangered Species [f]	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEC	1
	Aquatic Animals	
Acute Risk	EEC[g]/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	
Acute Risk	EEC[h]/EC_{50}	1
Acute Endangered Species	EEC[g]/EC_{05} or NOAEC	1

[a]Potential for acute toxicity for receptor species if RQ > LOC (EPA, 2004).
[b]Estimated environmental concentration (ppm) on avian/mammalian food items
[c]mg/ft^2
[d]mg of toxicant consumed per day
[e]Potential for acute toxicity for receptor species, even considering restricted use classification, if RQ > LOC (EPA, 2004).
[f]Potential for acute toxicity for endangered species of receptor species if RQ > LOC (EPA, 2004).
[g]EEC = ppb or ppm in water
[h]EEC = lbs a.i./A

The LOCs are criteria used by OPP to indicate potential risk to non-target organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on non-target organisms. LOCs currently address the following risk presumption categories: (1) acute - potential for acute risk to non-listed species; regulatory action may be warranted in addition to restricted use classification, (2) acute restricted use - potential for acute risk to non-listed species; however, risk may be mitigated through restricted use classification, (3) acute endangered species - potential for

acute risk to endangered species; regulatory action may be warranted, and (4) chronic risk - potential for chronic risk; regulatory action may be warranted. Currently, due to lack of modeling applications, 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.

For acute studies on taxa where no effects were observed at any concentration level, the RQs are not calculated and a qualitative discussion is provided in the Risk Description section. For acute studies on taxa where an LC_{50}/LD_{50} is not established due to insufficient mortality but some mortality was observed in the study, again, the RQs are not calculated and the study is discussed further in the Risk Description section.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from the results of required studies. Examples of ecotoxicity values derived from the results of short-term laboratory studies that assess acute effects are: (1) LC_{50} (fish) (2) LD_{50} (birds and mammals) (3) EC_{50} (aquatic plants and aquatic invertebrates) and (4) EC_{25} (terrestrial plants). An example of a toxicity test effect level derived from the results of long-term laboratory study that assesses chronic effects is: NOAEC (No Observed Adverse Effect Level; birds, fish and aquatic invertebrates).

Appendix H. Data Requirements

TABLE H-1. Environmental Fate Data Requirements for Propazine				
Guideline #	**Data Requirement**	**MRID #**	**Study Classification**	**Are more data needed?**
161-1	Hydrolysis	436898-02	Acceptable	No
161-2	Photodegradation in Water	441848-05 001537-09	Acceptable Supplemental	No
161-3	Photodegradation on Soil	441848-06	Acceptable	No
161-4	Photodegradation in Air	No Study		
162-1	Aerobic Soil Metabolism	441848-07 001537-12	Acceptable Acceptable	No
162-2	Anaerobic Soil Metabolism	001537-13	Acceptable	No
162-3	Anaerobic Aquatic Metabolism	No Study		Yes
162-4	Aerobic Aquatic Metabolism	No Study		Yes
163-1	Leaching-Adsorption/Desorption	436898-03 436898-04 442873-13 001529-97	Acceptable Acceptable Acceptable Acceptable	No
163-2	Laboratory Volatility	No Study		
163-3	Field Volatility	No Study		
164-1	Terrestrial Field Dissipation	442873-14 441848-09 001537-15 001537-16 001537-17 001537-18	Supplemental Supplemental Unacceptable Unacceptable Unacceptable Unacceptable	Yes
164-2	Aquatic Field Dissipation	No Study		
165-4	Accumulation in Fish	44184812	Avaiting final EFED review	??
165-5	Aquatic non-target organism	No Study		
166-1	Ground Water- small scale prospective	No Study		

TABLE H-2. Ecological Toxicity Data Requirements for Propazine				
Guideline #	**Data Requirement**	**MRID #**	**Classification**	**Are more data needed?**
71-1	Avian acute oral LD_{50} (bobwhite quail)	442873-01	Core	Yes
71-1	Avian acute oral LD_{50} (mallard duck)	N/A	N/A	Yes
71-2	Avian subacute dietary LC_{50} (bobwhite quail) (mallard duck)	442873-02 442873-03	Core Core	No
71-4	Avian reproduction (bobwhite quail) (mallard duck)	N/A		Yes
72-1	Freshwater fish acute LC_{500} (rainbow trout) (bluegill sunfish)	N/A 442873-04	-- Invalid	Yes
72-2	Freshwater invertebrate acute EC_{50} (daphnia)	442873-05	*Awaiting final EFED review*	??
72-3a	Estuarine/marine fish acute LC_{50} (sheepshead minnow)	N/A		Yes
72-3b	Estuarine/marine invertebrate acute EC_{50} (eastern oyster) (mysid)	442873-06 441848-01	*Awaiting final EFED review* Acceptable	??
72-4a	Freshwater fish early life stage (fathead minnow)	442837-07	Supplemental	Yes
72-4b	Freshwater invertebrate life cycle (daphnia)	443276-02	Core	No
72-4c	Estuarine/marine fish life cycle (sheepshead minnow)	441848-02	*Awaiting final EFED review*	??
72-4d	Estuarine/marine invertebrate life cycle (mysid)	441848-03	Supplemental	Yes
72-5	Freshwater fish full life cycle	N/A		
72-7	Aquatic Field Study	N/A		
81-1	Acute mammalian oral LD_{50} (rat)	434741-01	Acceptable	No
82-1(a)	Mammalian Subchronic	N/A		
83-3	Mammalian Developmental (rat) (rabbit)	001502-42 441534-01	Acceptable Acceptable	No
83-4	Mammalian Reproduction (rat)	000414-09	Acceptable	No
123-1(a)	Seedling Emergence - Tier II	441848-04	*Awaiting final EFED review*	??
123-1(b)	Vegetative Vigor - Tier II	441848-04	*Awaiting final EFED review*	??
122-2	Aquatic plant algae (green algae) (blue-green algae) (diatom) (marine diatom)	442873-08 442873-12 442873-10 442873-11	Core Core Core Core	No

TABLE H-2. Ecological Toxicity Data Requirements for Propazine				
Guideline #	**Data Requirement**	**MRID #**	**Classification**	**Are more data needed?**
123-2	Aquatic plant acute EC_{50} (duckweed)	442873-09	Core	No
141-1	Acute honey bee contact LD_{50}	N/A		Yes
141-2	Honey Bee Residue on Foliage	N/A		Depends upon results of 141-1

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