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

OFFICE OF
PREVENTION, PESTICIDES, AND
TOXIC SUBSTANCES

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MEMORANDUM

~~July~~ AUG 19, 2009

Subject: Product Registration – Section 3 for the New Use of Chlorimuron-ethyl (DuPont CLASSIC® Herbicide) on DuPont Optimum® GAT® Herbicide Tolerant Corn and Soybeans.

To: James Tompkins, Risk Manager
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Through: Tom Bailey, PhD, Chief
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The Environmental Fate and Effects Division (EFED) has completed an ecological risk assessment of the sulfonylurea class herbicide chlorimuron-ethyl [ethyl 2-(4-chloro-6 methoxypyrimidin-2-ylcarbamoylsulfamoyl) benzoate], on DuPont Optimum® GAT® Herbicide tolerant corn and soybeans by ground and aerial application.

Attached is the EFED ecological risk assessment of chlorimuron-ethyl for these uses.

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ENVIRONMENTAL FATE AND EFFECTS SCIENCE CHAPTER

For

Product Registration for the New Use of Chlorimuron-ethyl (DuPont CLASSIC® Herbicide) (CAS#: 90982-32-4)
[ethyl 2-(4-chloro-6-methoxypyrimidin-2-ylcarbamoylsulfamoyl) benzoate]
US EPA PC Code: 128901

Proposed New Uses:
Ground (including air blast) and aerial application of chlorimuron-ethyl, a sulfonylurea class herbicide, on DuPont Optimum® GAT® herbicide tolerant corn and soybeans.

Formulation:
DuPont *Classic*® 25 WG (EPA Reg. No.: 352-436); 25% chlorimuron-ethyl

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I. Executive Summary

The E.I. DuPont De Nemours and Co., Inc. is seeking an amendment to an established tolerance for the herbicide chlorimuron-ethyl and its end-product *Classic*®, on Optimum® GAT® tolerant corn and soybean. Chlorimuron-ethyl (EPA Reg. No. 352-528) and *Classic*® (EPA Reg. No. 352-436) have previously been approved for use on soybeans, peanuts, and non-crop lands. Tolerances have been established under 40 CFR §180.429 for residues of the parent compound in/on peanuts and soybeans.

Chlorimuron-ethyl [ethyl 2-(4-chloro-6-methoxypyrimidin-2-ylcarbamoylsulfamoyl) benzoate] is a sulfonylurea class herbicide that inhibits acetolactate synthase in plants. The herbicide is a dispersible granule formulation that is mixed with water and sprayed for selective post emergence weed control of many broadleaf weeds and yellow nutsedge. According to the proposed supplemental labeling prepared by DuPont, the maximum amount of active ingredient that can be applied during the growing season is 4 oz. or 0.063 lbs. per acre. It is applied as an aqueous solution of water and surfactant using ground spraying and aerial techniques to control or suppress susceptible weeds and sedges.

Chlorimuron-ethyl has 6 major degradates, and no minor degradates. The major degradates include the demethylated parent, a "sulfonamide," and "pyrimidine-amine," saccharin, dechlorinated pyrimidine-amine, and demethylated pyrimidine-amine. EFED and HED have determined that these degradates do not pose a significant toxicological concern for terrestrial or aquatic animals or plants.

Chlorimuron-ethyl is expected to dissipate by metabolism in soil and transport in water by run-off, or leaching. The parent is not expected to be volatile

The labeled use of chlorimuron-ethyl has the potential to adversely affect non-target aquatic and terrestrial plants (listed species and non-listed species) from runoff and spray drift. The Agency's Level of Concern (LOC) is exceeded by up to three orders of magnitude for listed and non-listed terrestrial plant species. The aquatic plant RQ are 4.9 for non-vascular and 13.9 for vascular plants. The Agency's LOC for listed aquatic plant species is exceeded by up to 54X.

Non-target and non-listed plant RQs for spray drifts from aerial application range up to 125 and for spray drift from ground application up to 25. Non-target and non-listed plant RQs for chlorimuron residue runoffs from aerial application range up to 1375 and for runoff from ground application up to 1275. Non-target and non-listed plant RQs for chlorimuron residue runoffs from aerial application range up to 1375 and for runoff from ground application up to 1275.

AGDRIFT model predicts residues from aerial application at 995 feet to be 78.8X more than the most sensitive plant species tested. AGDRIFT model predicts residues from ground application at 995 feet to be 1.8X more than the most sensitive plant species tested. Nine out of 10 species tested in vegetative vigor study that may inhabit approximately 995 feet from use site will have their EC_{25} exceeded from aerial application use about 78.8X. This shows that a broad spectrum of non-target terrestrial plants may be sensitive to spray drift concentrations at 995 feet from site of application.

For aquatic non-target plants, AgDrift model predicts that there will be no LOC exceedances to non-listed and listed aquatic vascular plants from ground application of residues going into 3 or 6 feet water body depth at 300 feet or more away. Aerial application exceeds the Agency LOC for non-listed aquatic vascular plants by 1.1 to 22.3X and for listed species by 4.3 to 8.9X.

Irrigated waters containing residues of chlorimuron from runoff to surface waters or shallow groundwater has the potential to adversely affect non-targeted sensitive crops. If one-inch of chlorimuron contaminated water containing residues in concentrations estimated by PRZM-EXAMS modeling was irrigated on sensitive crops, the Agency's LOC for sensitive non-target plants will be exceeded by 26X.

Monitored water data suggests that if two inches of irrigated water at concentrations found in water that was monitored for chlorimuron residues was irrigated on sensitive crops, adverse effects may occur to the crop.

The labeled use of chlorimuron-ethyl does not exceed the Agency's chronic or acute Level of Concern (LOC) for beneficial insects, birds, mammals, aquatic invertebrates or fishes - listed or non-listed species.

II. Problem formulation

The purpose of problem formulation is to provide the foundation for the environmental fate and ecological risk assessment being conducted for chlorimuron-ethyl. It sets the objectives for the risk assessment, evaluates the nature of the problem, and provides a plan for analyzing the data and characterizing the risk (US Environmental Protection Agency, 1998).

A. Nature of Regulatory Action

The registrant, E.I. DuPont de Nemours and Company has submitted a tolerance petition for the establishment of tolerances on Optimum® GAT® tolerant corn and amend tolerances on Optimum® GAT® tolerant soybean. Chlorimuron-ethyl (EPA Reg. No. 352-528) and *Classic*® (EPA Reg. No. 352-436) have previously been approved for use on soybeans, peanuts, and non-crop lands. Tolerances have been established under 40 CFR §180.429 for residues of the parent compound in/on peanuts and soybeans at 0.02 ppm and 0.05 ppm, respectively.

B. Stressor Source and Distribution

1. Nature of the Chemical Stressor

Chlorimuron-ethyl [ethyl 2-(4-chloro-6-methoxypyrimidin-2-ylcarbamoylsulfamoyl) benzoate] is a sulfonylurea class herbicide that inhibits acetolactate synthase. Chlorimuron-ethyl is used for the post emergent control of certain weeds, such as buttercup and yellow nutsedge, and for the suppression of weeds such as purple aster and silverleaf.

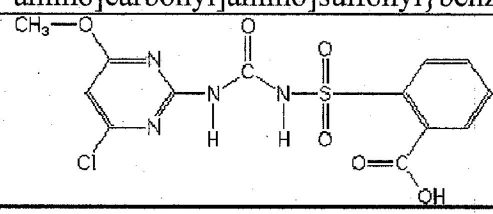
The expected major route of degradation is by metabolism in soil, with half-lives (for parent plus demethylated parent) of 75 to 112 days measured in sandy loam (Woodstown) and silt loam (Flanagan) soils. Terrestrial field dissipation studies in Delaware and North Carolina yielded dissipation half-lives from the soil surface of 6 to 27 days for the parent alone. Abiotic hydrolysis is as fast as soil metabolism at pH 5 (half-lives 17 to 27 days) but is stable at pH 7 and 9. Aqueous and soil photolysis were found not to be significant processes. Aerobic aquatic metabolism was not tested; anaerobic aquatic metabolism studies yielded half-lives of 2-3 weeks in a Florida sediment-water system, and 5-6 weeks in a Pennsylvania sediment-water system.

Chlorimuron-ethyl has 6 major degradates and no minor degradates. The major degradates include the demethylated parent, a "sulfonamide," and "pyrimidine-amine," saccharin, dechlorinated pyrimidine-amine, and demethylated pyrimidine-amine. The demethylated parent, saccharin, sulfonamide and pyrimidine-amine each remained at greater than 10% of applied radioactivity at the end of some of the aerobic soil metabolism studies (one year), and were major degradates in the field dissipation studies.

In the environment, parent chlorimuron-ethyl is very mobile in soil, with K_d values of <0.03 (sandy loam), 0.28 (silt loam), and >1.6 (silt loam). The parent is not expected to be volatile, with a reported vapor pressure of 1.5E-5 mm Hg. In soil column leaching studies using phenyl-ring labeled parent, saccharin and the sulfonamide were observed at up to 28% and 4.3%, respectively, of the applied radiation in the leachate. Saccharin has K_{oc} values of 4.6 to 15.5, indicating that it is mobile (MRID 45012638). Overall, chlorimuron-ethyl is expected to dissipate by metabolism in soil and transport to surface and groundwater by run-off and/or leaching.

A summary of the physical/chemical properties of chlorimuron-ethyl, including measured parameters, values, and data sources is presented in Table 1.

Table 1. Selected Physical and Chemical Properties of Chlorimuron-ethyl

Common Name	Chlorimuron-ethyl
Chemical Name	Ethyl 2-{[[[(4-Chloro-6-methoxypyrimidin-2-yl) amino]carbonyl]amino]sulfonyl}benzoate
Structure	

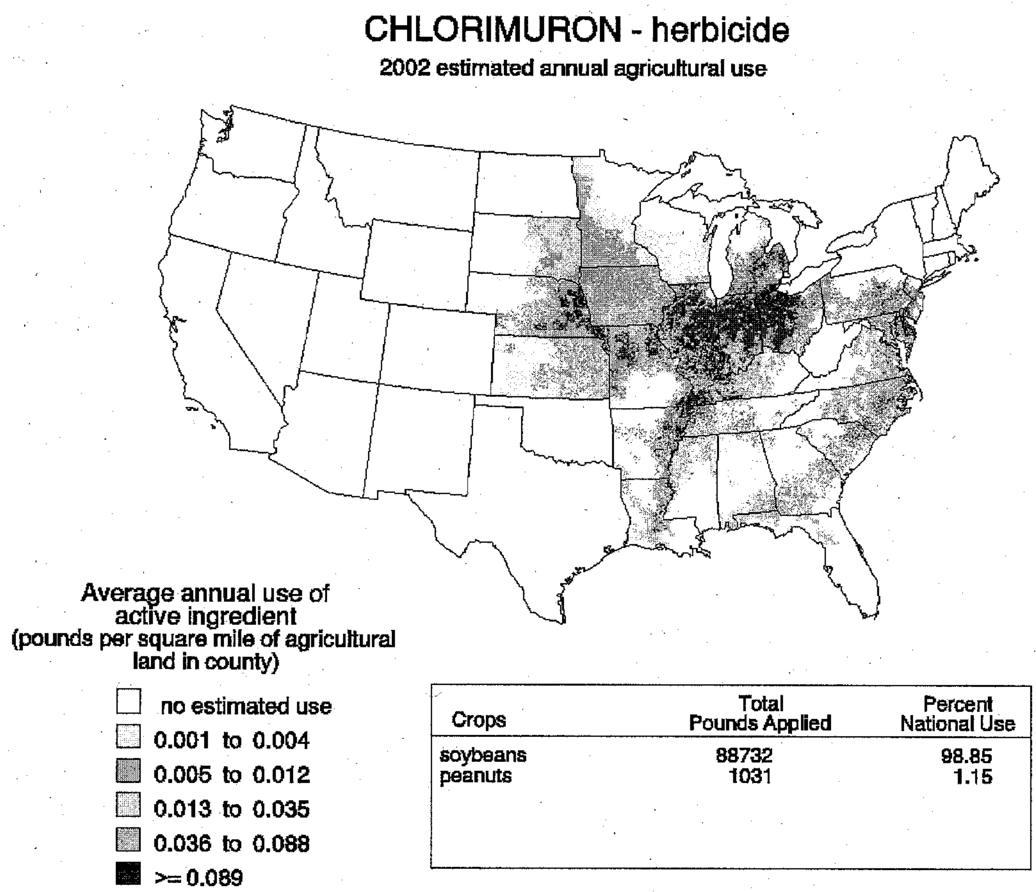
Pesticide Type	Herbicide - acetolactate synthase inhibitor
Chemical Class	Sulfonylurea
CAS Number	90982-32-4
Empirical Formula	$C_{13}H_{11}ClN_4O_6S$
Molecular Mass (g/mol)	414.83
Vapor Pressure at 25° C	1.5E-5 mm Hg
Henry's Law Constant at 20° C	7.48E-14
Solubility in Water (mg/l) at pH 7	1200
K_{ow}	1.3
pKa at 25° C	4.2

2. Overview of Pesticide Usage

Chlorimuron-ethyl is a dispersible granule formulation that is mixed with water and sprayed for selective weed control of many annual grasses and broadleaf weeds. According to the proposed supplemental labeling prepared by DuPont, the maximum amount of active ingredient that can be applied during the growing season is 4 oz. product (0.063 lbs ai/A). It is applied in an aqueous solution of water and surfactant using ground and aerial spraying techniques. Applications may be made pre-plant, pre-emergence, post-emergence, and/or post harvest.

A national map showing the estimated poundage of chlorimuron used in 2002 by county is presented in Figure 1. The map was downloaded from the U.S. Geological Survey (USGS), National Water Quality Assessment Program (NAWQA) website. (http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m4008). Note that the values are for soybean and peanuts only, and do not reflect the amount of herbicide applied to corn crops.

Figures 2 and 3 present the number of acres per US county for corn and soybean, respectively, planted in 2008.



Crops	Total Pounds Applied	Percent National Use
soybeans	88732	98.85
peanuts	1031	1.15

Figure 1. Chlorimuron-ethyl Use in Pounds Per Square Mile in US Counties

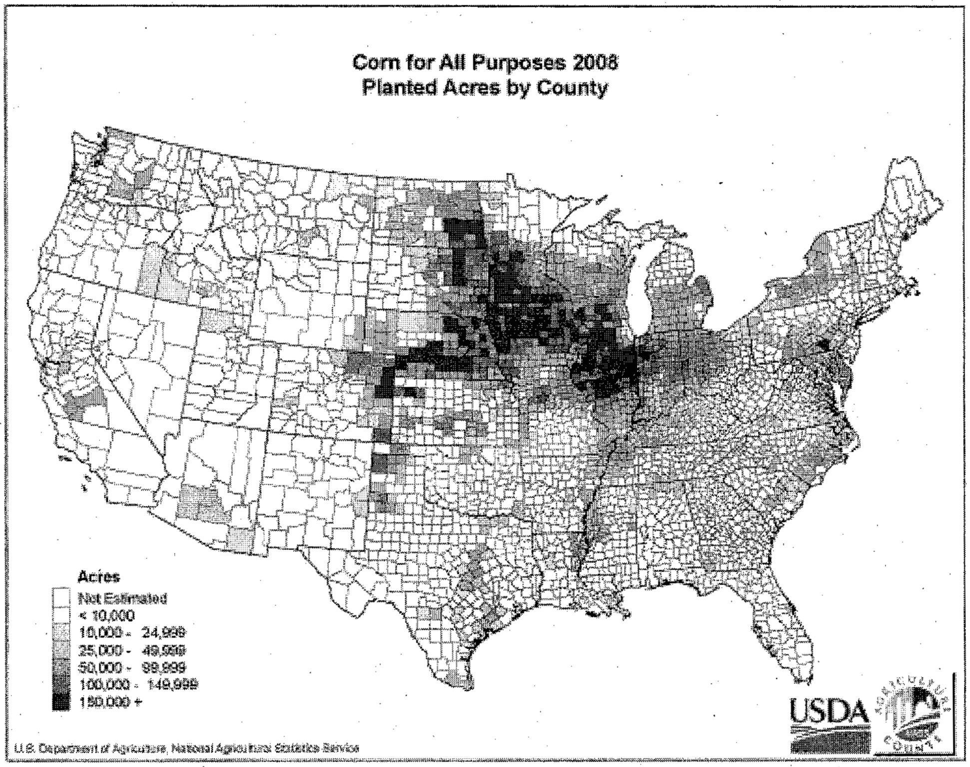


Figure 2. Acres of Corn Planted Per US County

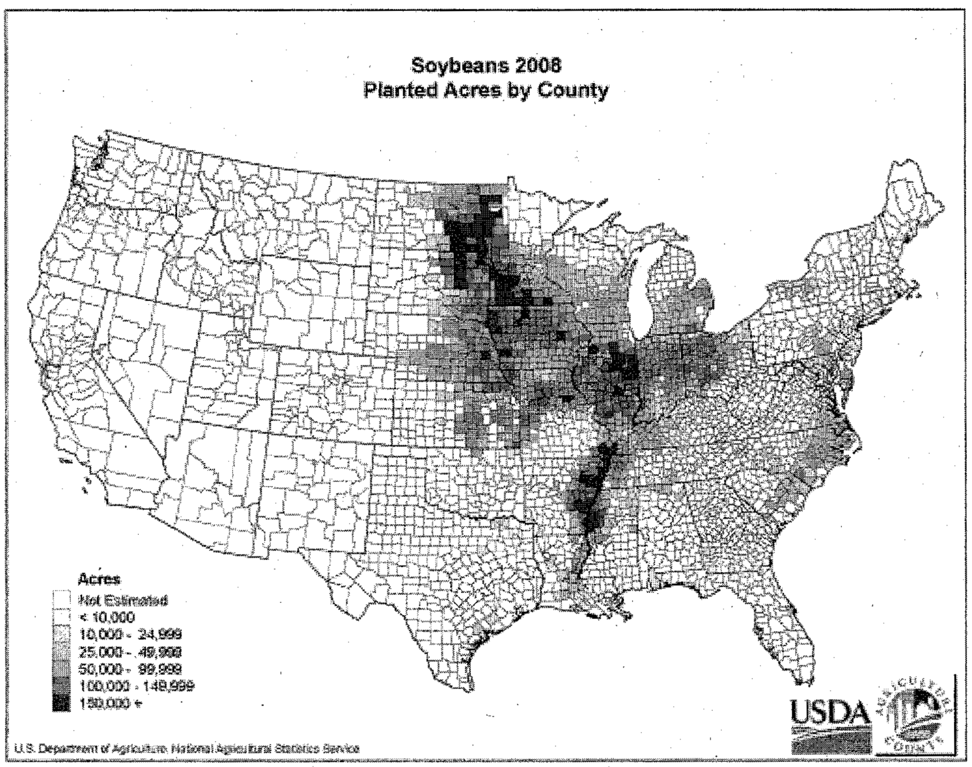


Figure 3. Acres of Soybean Planted Per US County

C. Receptors

1. Aquatic and Terrestrial Effects

Aquatic receptors may be exposed to chlorimuron-ethyl via run-off and spray drift loading into surface waters. As use sites may occur in locations adjacent or near estuarine/marine systems, receptors potentially include both freshwater and estuarine/marine aquatic animals (*i.e.*, fish and invertebrates, and aquatic-phase amphibians) and plants. Based on submitted studies, chlorimuron-ethyl is slightly toxic or practically non-toxic to fish and aquatic invertebrates. However, submitted studies indicate that chlorimuron-ethyl is very toxic to algae and vascular aquatic plants and practically non-toxic to diatoms. Effects are described in more detail in Appendix A of this document.

Terrestrial receptors that may be exposed to chlorimuron-ethyl include terrestrial and semi-aquatic wildlife (*i.e.*, mammals, birds, reptiles, and terrestrial-phase amphibians) and terrestrial plants. Because chlorimuron-ethyl is a herbicide, and designed to be toxic to plants, it is important to evaluate the toxic effects to non-target plant species. Adverse effects to both monocots and dicots were observed in the literature and more details about the studies can be found in the effects section and in Appendix A. Based on submitted studies, chlorimuron-ethyl is practically non-toxic to birds, reptiles, amphibians, and beneficial insects on an acute basis.

Consistent with the process described in the Overview Document (US EPA, 2004), this risk assessment uses a surrogate species approach in its evaluation of chlorimuron-ethyl. Toxicological data generated from surrogate test species, intended to be representative of broad taxonomic groups, are used to extrapolate to potential effects on a variety of species (receptors) included under these taxonomic groupings.

Table 2 provides a summary of the taxonomic groups and the surrogate species tested to help understand potential acute ecological effects of pesticides to these non-target taxonomic groups. In addition, the table provides a preliminary overview of the potential acute toxicity of chlorimuron-ethyl by providing the acute toxicity classifications.

Table 2. Taxonomic Groups, Test Species Evaluated for Assessing Potential Ecological Effects and Acute Toxicity Classification for Assessing Risks of Chlorimuron-ethyl to Non-target Organisms.

Taxonomic Group	Example(s) of Surrogate Species	Acute Toxicity Classification
Birds[1]	Mallard duck (*Anas platyrhynchos*) Bobwhite quail (*Colinus virginianus*)	Practically non-toxic Practically non-toxic
Mammals	Laboratory rat (*Rattus norvegicus*)	Practically non-toxic
Insects	Honey bee (*Apis mellifera L.*)	Practically non-toxic
Freshwater fish[2]	Bluegill sunfish (*Lepomis macrochirus*) Rainbow trout (*Oncorhynchus mykiss*)	Slightly toxic to fish
Freshwater invertebrates	Water flea (*Daphnia magna*)	Practically non-toxic
Estuarine/marine fish	Sheepshead minnow *(Cyprinodon variegatues)*	No data available
Estuarine/marine invertebrates	Mysid shrimp *(Americamysis bahia)*	No data available

	Eastern oyster (*Crassostrea virginica)*	No data available
Terrestrial plants[3]	Monocots – corn (*Zea mays*) Dicots – soybean (*Glycine max*)	Phytotoxic to plants at very low concentrations
Aquatic plants and algae	Duckweed (*Lemna gibba*) Green algae (*Selenastrum capricornutum*); Bluegreen algae (*Anabaena flos-aquae*) Freshwater diatom (*Navicula pelliculosa*); Marine diatom (*Skeletonema costatum*)	Phytotoxic to duckweed and algae at very low concentrations (EC50 = 0.77 ppb for green algae and 0.27 ppb for duckweed)

[1] Birds represent surrogates for terrestrial-phase amphibians and reptiles.
[2] Freshwater fish may be surrogates for aquatic-phase amphibians.
[3] 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.

In addition, chronic studies submitted indicate that chlorimuron-ethyl may cause some reproductive and growth effects on birds and mammals and on aquatic invertebrates and fish.

2. Ecosystems Potentially at Risk

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

Aquatic ecosystems potentially at risk include water bodies adjacent to, or down stream from, the treated field and might include impounded bodies such as ponds, lakes and reservoirs, or flowing waterways such as streams or rivers. For uses in coastal areas, aquatic habitat also includes marine ecosystems, including estuaries.

D. Assessment Endpoints

Assessment endpoints represent the actual environmental value that is to be protected, defined by an ecological entity (species, community, or other entity) and its attribute or characteristics (US EPA, 1998). For chlorimuron-ethyl, the ecological entities may include the following: birds, mammals, freshwater fish and invertebrates, estuarine/marine fish and invertebrates, terrestrial plants, insects, and aquatic plants and algae. The attributes for each of these entities may include growth, reproduction, and survival. (See Table 3 in Section II.F.2, the Analysis Plan, for further discussion.)

E. Conceptual Model

For a pesticide to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a pesticide moves in the environment from a source to an ecological receptor. For an ecological 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.

A conceptual model provides a written description and visual representation of the predicted relationships between chlorimuron-ethyl, potential routes of exposure, and the predicted effects for the assessment endpoint. A conceptual model consists of two major components: risk hypotheses and a conceptual diagram (US EPA, 1998).

1. Risk Hypotheses

Although transport of the compound through runoff and/or erosion is likely to be limited by low application rates, chlorimuron-ethyl is mobile and is expected to be transported to surface and groundwater by run-off or leaching. Laboratory and field studies indicate that chlorimuron-ethyl will persist for sufficient periods (days to weeks) to be available for transport off-site.

Chlorimuron-ethyl is very toxic to sensitive non-target plants. When used in accordance with the label, chlorimuron-ethyl may move off-site of application by spray drift and/or runoff. This may result in potential risk to the survival, growth, and reproduction of terrestrial non-target plants inhabiting adjacent or nearby acreage to the site of application. Potential risk to non-target aquatic plants may also result from spray drift and runoff carrying residues from sites treated with chlorimuron-ethyl.

Chlorimuron-ethyl is practically non-toxic to birds and mammals on an acute exposure basis. As a result, direct risk to terrestrial animals is expected to be low.

The compound can move to surface waters adjacent to application sites by spray drift and/or runoff where it may affect both vascular and nonvascular aquatic plants. Chlorimuron-ethyl is slightly toxic or practically nontoxic to aquatic animals on an acute exposure basis. Acute effects to fish and invertebrates may not be a concern due to very low exposure resulting from a low application rate and the low acute toxicity to aquatic animals. Indirect effects on aquatic and terrestrial animals may occur through the loss of primary plant productivity and habitat. The primary concern of risk from chlorimuron-ethyl appears to be to aquatic and terrestrial plants.

Since chlorimuron-ethyl is very phytotoxic to plants and leaches into ground water, irrigation from shallow ground water aquifers may adversely impact non-target crops.

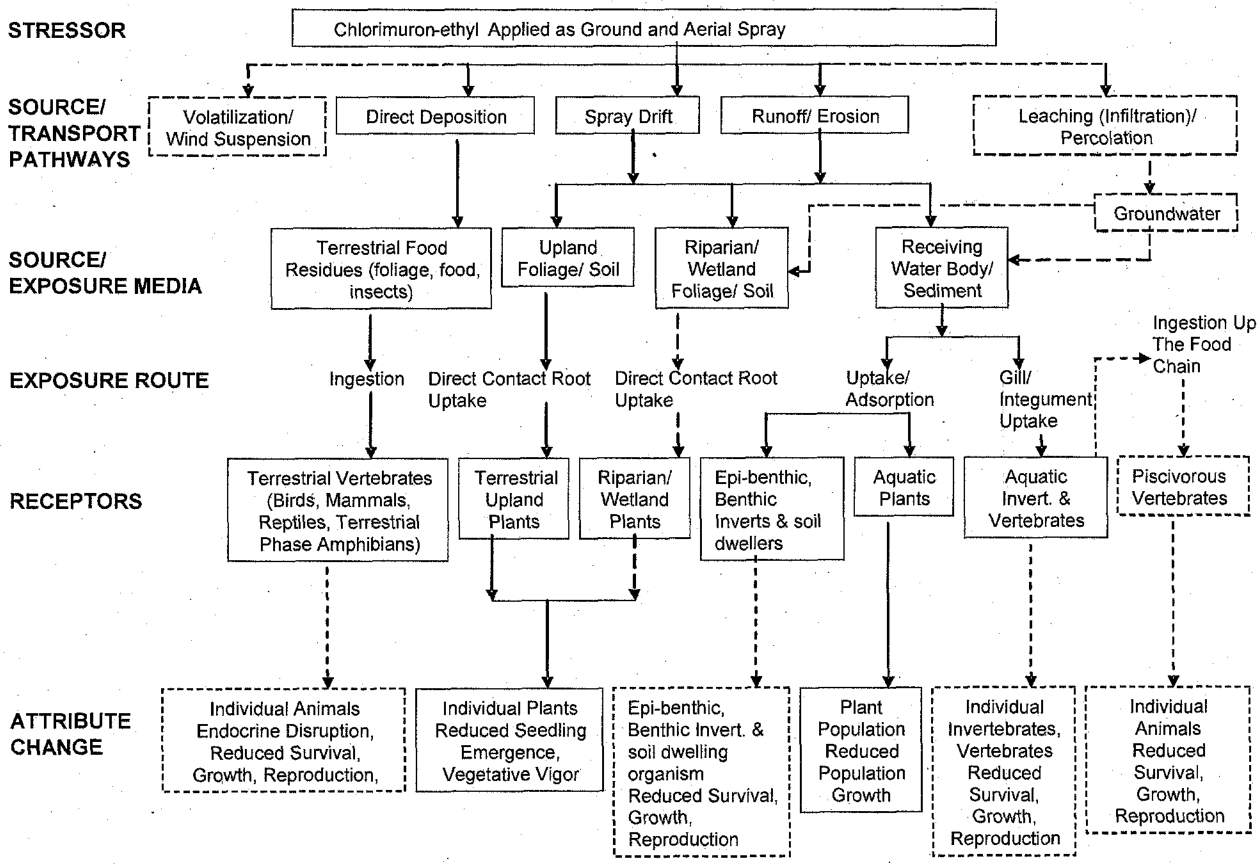
Chronic toxicity studies indicate some chronic effects to birds and mammals. Chronic effects to birds and mammals may occur from exposure to chlorimuron-ethyl.

2. Conceptual Diagram

The potential exposure pathways and effects of chlorimuron-ethyl on terrestrial and aquatic environments are depicted in Figure 4. Solid arrows depict the most likely routes of exposure and effects; dashed lines depict potential routes of exposure that are not considered likely for chlorimuron-ethyl.

Figure 4 depicts the potential exposure of aquatic plants and animals through the most likely route of exposure, *i.e.*, spray drift and runoff. Depending on the extent of spray drift contamination, plants in aquatic environments will likely be affected. Because chlorimuron-ethyl is slightly to practically nontoxic to aquatic animals on an acute basis and rate of application is very low, minimal adverse effects are anticipated to aquatic animals. Chronic effects are not anticipated to aquatic animals because the low application rates will not result in sufficient exposure to be a concern to aquatic animals.

Because adverse effects to non-target terrestrial and aquatic plants can be expected, terrestrial and aquatic animals may be indirectly affected through the reductions in primary productivity and habitat.



Note: Solid lines represent major and dashed lines represent minor routes of exposure

Figure 4. Conceptual Model Depicting Potential Risks to Aquatic and Terrestrial Animals and Plants from the Use of Chlorimuron-Ethyl

Analysis Plan

This analysis plan identifies the approach, methods, specific models, information, and data that will be used to estimate and evaluate risks from uses of chlorimuron-ethyl based on the conceptual model and risk hypotheses described in Section II.D.

1. Conclusions from Previous Risk Assessments

In March 1985, and February 1986, the Ecological Effects Branch (EEB) of the Hazard Evaluation Division completed Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 3 and new chemical reviews, respectively, for use of chlorimuron-ethyl on soybeans.[1] These reviews concluded that minimal risks exist for non-target organisms exposed to the herbicide. In June 1989, EEB completed a similar review for the proposed use of chlorimuron-ethyl on peanut crops.[2] This review concluded that adverse effects, both acute and chronic, are unlikely to occur to non-target terrestrial and aquatic animals. Non-target plants may also be at potential risk.

In September 2004 the Health Effects Division completed a human health risk assessment for chlorimuron-ethyl as part of the Tolerance Reassessment Eligibility Decision (TRED) Process.[3] The report concluded that there was reasonable certainty that no harm to any human population or subgroup would result from exposure to chlorimuron-ethyl when considering dietary (including both food and drinking water) exposure from applications of the pesticide to soybeans, peanuts and non-crop lands.

In July 2007 EFED completed a Tier 1 drinking water assessment[4] of chlorimuron-ethyl and the demethylated-parent (a major metabolite) for use on cranberries and subgroup 13H berries. In that assessment usage rates were limited to 0.063 lb. a.i./A. The FIRST and SciGrow models were used to generate expected environmental concentrations (EECs) in surface and groundwater, respectively. For the proposed label use rates, the FIRST model predicted raw surface drinking water acute and chronic exposure concentrations of 5.7 ppb and 2.4 ppb, respectively. The SciGrow model predicted an acute and chronic groundwater exposure concentration of 1.76 ppb. These EECs were comparable to those calculated in an April 2004 DWA for use on soybeans, peanuts and non-crop land. In that assessment, drinking water concentrations were 5.4 ppb (acute) and 2.3 ppb (chronic) for surface water. The acute and chronic groundwater concentration was 2.2 ppb.

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[1] Memorandum from Thomas M. Armitage, Ecological Effects Branch, Hazard Evaluation Division to Robert Taylor, Registration Division; Subj: New Chemical Registration Standard for DPX-F6025, Dupont Classic Herbicide, September 7, 1986.
[2] Memorandum from James W. Ackerman, Environmental Fate and Effects Branch to Robert Taylor, Registration Division; Subj: Classic (DFX-F6025), June 20, 1989.
[3] US Environmental Protection Agency. 2004. Report of the Food Quality Protection Act (FQPA) Tolerance Reassessment Progress and Risk Management Decision (TRED) for Chlorimuron-ethyl. Office of Prevention, Pesticides, and Toxic Substances. September 22, 2004.
[4] EFED Memo to Daniel Rosenblatt, Registration Division. July 2007. Subj: Tier 1 Drinking Water Assessment for Chlorimuron-ethyl Use on Cranberry and Low-growing Berry Subgroup 13H; Except Strawberry

In December 2008, EFED completed a risk assessment for an IR-4 tolerance petition for the application of chlorimuron-ethyl on cranberries and other low-growing berries in subgroup 13H (except strawberries) by ground application. In that assessment EFED concluded that the labeled use of chlorimuron-ethyl had the potential to adversely affect non-target aquatic and terrestrial plants, listed species and non-listed species, from runoff and spray drift. The Agency's Level of Concern (LOC) was exceeded by up to three orders of magnitude for listed and non-listed plant species. The aquatic plant RQ were 1.6 for non-vascular and 4.5 for vascular plants. The non-target terrestrial plant runoff RQs ranged from 80 to 1,279 for non-listed species and from 402 to 18,273 for listed species. The non-target terrestrial plant spray drift RQs ranged from 26.8 to 60.9 for non-listed species and from 134 to 870 for listed species.

In addition EFED noted that irrigated waters containing residues of chlorimuron from runoff to surface waters or shallow groundwater had the potential to adversely affect non-targeted sensitive crops and that the predicted RQ for one inch of contaminated irrigated water on non-targeted crops was 8.4. EFED further noted that the labeled use of chlorimuron-ethyl did not exceed the Agency's chronic or acute Level of Concern (LOC) for beneficial insects, birds, mammals, aquatic invertebrates or fishes - listed or non-listed species.

In June 2009, EFED completed a drinking water assessment of CLASSIC and its active ingredient chlorimuron-ethyl for aerial spray application on OPTIMUM®GAT® tolerant field corn and soybeans for pre-emergence and post-emergence control of certain annual grass and broadleaf weeds. The acute estimated environmental concentrations (EECs) in surface water, as predicted by the FIRST model, ranged from 10.67 (soybeans) to 11.98 (corn) ppb. The chronic EECs in surface water ranged from 4.47 (soybeans) to 5.02 (corn) ppb. The groundwater EEC as predicted by the SCI-GROW model was 6.99 ppb.

2. Preliminary Identification of Data Gaps

Although there are no toxicity data for estuarine/marine animals, there is a very low value to obtaining additional toxicity data on estuarine/marine animals.

A total of 20 registrant-submitted studies are available for assessing the potential effects of chlorimuron-ethyl and its major metabolites on non-target organisms. A preliminary data screen indicated that the ecological effect studies meet basic guideline requirements and based on the preliminary screen, no data gaps have been identified initially for terrestrial and freshwater aquatic plants and animals; however, no data are submitted on the toxicity of chlorimuron-ethyl to estuarine/marine fish and invertebrates. Missing data include the following:

- Estuarine/marine fish acute toxicity - OPPTS Guideline 850.1075 (OPP Guideline 72-3)
- Mysid acute toxicity - OPPTS Guideline 850.1035 (OPP Guideline 72-3)

- Oyster acute toxicity - OPPTS Guideline 850.1025 (OPP Guideline 72-3)

To the extent the crop profile demonstrates that the product may be used in the vicinity of estuary/marine environments, these data may be recommended as a condition of registration. Although there is some uncertainty due to lack of estuarine toxicity data, it is known that sulfonylureas as a group are usually not very toxic to animals; that freshwater animal toxicity studies on chlorimuron-ethyl indicate at worst a slightly toxic classification to freshwater fish and invertebrates; and that the application rate of chlorimuron-ethyl is very low. Therefore, there is a very low value to obtaining additional toxicity data on estuarine animals.

3. Measures of Effect and Exposure

This section describes the tools and methods used to conduct the analysis of the potential risks associated with the use of chlorimuron-ethyl. Each assessment endpoint requires one or more measures of ecological effect. Ecological effects are measurable changes in the attribute of an assessment endpoint in response to a stressor, such as the Bobwhite quail acute oral LD_{50}. The assessment also requires measures of exposure. These are estimated environmental concentrations (EECs) and are evidence of stressor existence and movement in the environment and their contact or co-occurrence with the assessment endpoint.

Table 3 lists the measures of environmental exposure and ecological effects used to assess the potential risks of chlorimuron-ethyl to non-target organisms. The methods used to assess the risk are consistent with those outlined in the document "Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs".

Table 3. Measures of Ecological Effects and Exposure for Chlorimuron-ethyl

Assessment Endpoint		Surrogate Species and Measures of Ecological Effect[1]	Measures of Exposure
Birds[2]	Survival	Bobwhite acute oral LD_{50} Bobwhite and mallard subacute dietary LC_{50}	Maximum residues on food items (foliar)
	Reproduction and growth	Bobwhite and mallard 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[3]	Survival	Rainbow trout and bluegill sunfish acute LC_{50} (no valid study available)	Peak EEC[4]
	Reproduction and growth	Fathead minnow chronic (early life-stage) NOAEC and LOAEC	60-day average EEC[4]
Freshwater invertebrates	Survival	Water flea (and other freshwater invertebrates) acute EC_{50}	Peak EEC[4]
	Reproduction and growth	Water flea chronic (life cycle) LOAEC	21-day average EEC[4]
Estuarine/marine fish	Survival	Sheepshead minnow acute LC_{50} (no study available)	Peak EEC[4]
	Reproduction and growth	Sheepshead minnow chronic (early life-stage) NOAEC and LOAEC	60-day average EEC[4]
Estuarine/marine invertebrates	Survival	Eastern oyster acute EC_{50} and mysid acute LC_{50}	Peak EEC[4]
	Reproduction and growth	Mysid chronic NOAEC and LOAEC	21-day average

Assessment Endpoint		Surrogate Species and Measures of Ecological Effect[1]	Measures of Exposure
			EEC[4]
Terrestrial plants[5]	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

[1] If species listed in this table represent most commonly encountered species from registrant-submitted studies, risk assessment guidance indicates most sensitive species tested within taxonomic group are to be used for baseline risk assessments.
[2] Birds represent surrogates for amphibians (terrestrial phase) and reptiles.
[3] Freshwater fish may be surrogates for amphibians (aquatic phase).
[4] One in 10-year return frequency.
[5] Four species of two families of monocots - 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.

a. Measures of Exposure

Methods used to determine exposure concentrations of a pesticide in various media are ideally a function of the environmental fate and physicochemical properties, the application method, and the existence of reliable monitoring data that are considered representative of the proposed use sites. In the absence of available monitoring data, risk assessments may rely solely on the results of environmental exposure modeling to estimate exposures in terrestrial and aquatic systems.

Initial factors that will be considered for estimating exposure concentrations are presented in **Error! Reference source not found.**

Table 4. Factors That Potentially Affect the Exposure of Receptors to Chlorimuron-ethyl

Consideration	Chlorimuron-ethyl-Specific Data	Conclusion
Monitoring data	Surface water monitoring data are available, as well as limited drinking water treatment data	Aquatic exposure assessment will rely primarily on estimated exposure concentrations generated by modeling, however, comparison with existing monitoring data will be made to validate modeling results
Degradation products	Chlorimuron-ethyl has 6 major degradates, and no minor degradates.	Toxicological concerns of degradates are insignificant
Sorption to soil	Kd values are low	The chemical is mobile and likely to move off-site
Log Kow	Chemical is moderately partitioned to water	Chemical will be predominantly in water Bioaccumulation is not expected to be an issue.
Vapor Pressure	Vapor pressure is low	Chemical is not expected to be volatile
Application method	Ground spray application Aerial spray application	Exposure will be primarily on foliage, animals and plants, and soil in the immediate vicinity of treated areas. Runoff from impervious surfaces into water bodies expected.

i. Estimating Exposure in Terrestrial Systems

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 organisms, 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. Application methods of chlorimuron-ethyl for soybean and corn include ground and aerial spray application for agricultural uses.

Non-target plants are exposed to residues of chlorimuron-ethyl from runoff and/or spray drift from use sites (soybean and corn). In addition, chlorimuron-ethyl may go into surface water bodies or shallow aquifers as a result of runoff and/or leaching from use sites. Contaminated irrigation waters containing chlorimuron-ethyl residues may be applied onto sensitive non-targeted crops.

(1) Dietary Residues – Ingestion Route to Mammals and Birds

A concern with chlorimuron-ethyl is that birds and mammals may be exposed shortly after application through oral or dietary exposure to vegetative plant material or insects when foraging in the treated fields for nesting material or food. Therefore, for chlorimuron-ethyl spray applications, estimation of pesticide concentrations in wildlife food items focuses on quantifying possible dietary ingestion of residues on vegetative matter and insects. The EFED terrestrial exposure model T-REX (T-REX, Version 1.3.1, Dated July 7, 2007) is used to estimate exposure and risks in conservative scenarios to avian species for four forage food types and to mammalian species for five forage food types for spray applications of chlorimuron-ethyl. Input values for avian and mammalian toxicity as well as chemical application and foliar dissipation half-life data are required to run the model. The model provides estimates of exposure concentrations and risk quotients (RQs). Specifically, the model provides estimates of concentrations (upper-bound and mean) of chemical residues on the surface of different types of foliage and insects that may be dietary sources of exposure to avian, mammalian, reptilian, or terrestrial-phase amphibian receptors. The surface residue concentration (ppm) is estimated by multiplying the application rate (pounds active ingredient per acre) by a value specific to each food item. These values (termed the Hoerger-Kenaga estimates) along with a more detailed discussion of the methodology implemented by T-REX, are presented in Appendix B.

By comparing estimated concentrations to acute and chronic toxicity reference values, acute and chronic RQs are calculated. The EECs on food items may be compared directly with dietary toxicity data or converted to an oral dose. The residue concentration can be converted to a daily oral dose based on the fraction of body weight consumed daily as estimated through allometric relationships; for both birds and mammals, three weight categories (or sizes) were considered. The screening-level risk assessment for chlorimuron-ethyl uses upper-bound predicted residues as the measure of exposure. Summaries of the predicted residues of chlorimuron-ethyl that may be expected to occur on selected avian or mammalian food items immediately following application for representative maximum use scenarios are presented in Table 5.

(2) Spray Drift and Runoff – Non-Target Plants

TerrPlant is used by EFED as a Tier 1 model for screening level assessments of pesticides. The purpose of this model is to provide estimates of exposure to terrestrial plants from single pesticide applications. The model does not consider exposures to plants from multiple pesticide applications. TerrPlant derives pesticide EECs in runoff and in drift. RQs are developed for non-listed and listed species of monocots and dicots inhabiting dry and semi-aquatic areas.

TerrPlant incorporates two similar conceptual models for depicting dry and semi-aquatic areas of terrestrial habitats. For both models, a non-target area is adjacent to the target area. Pesticide exposures to plants in the non-target area are estimated to receive runoff and spray drift from the target area. For a dry area adjacent to the treatment area, runoff exposure is estimated as sheet runoff. Sheet runoff is the amount of pesticide in water that runs off of the soil surface of a target area of land which is equal in size to the non-target area (1:1 ratio of areas). For semi-aquatic areas, runoff exposure is estimated as channel runoff. Channel runoff is the amount of pesticide that runs off of a target area 10 times the size of the non-target area (10:1 ratio of areas). Exposures through runoff and spray drift are then compared to measures of survival and growth (e.g. effects to seedling emergence and vegetative vigor) to develop RQ values. A more detailed discussion of the TerrPlant results, are presented in Appendix C.

(3) Irrigation and Surface Water Exposure to Non-Target Plants

Chlorimuron-ethyl residues can either runoff into adjacent water bodies and/or leach into shallow groundwater aquifers where the water can later be used irrigation onto sensitive non-target crops. With a highly phytotoxic chemical as chlorimuron-ethyl, it would be reasonable to assume potential risk to non-target crops from irrigated water contaminated with chlorimuron-ethyl residues. Therefore, a mathematical calculation will be made for estimating the EEC of irrigated water.

ii. Estimating Exposure in Aquatic Systems

(1) Surface Water Concentrations

The Office of Pesticide Programs (OPP) standard Pesticide Root Zone Model/ Exposure Analysis Modeling System (PRZM/EXAMS) using appropriate crop use scenarios will be used to model the estimated environmental concentrations (EECs)in surface waters from the application of chlorimuron-ethyl methyl on OPTIMUM® GAT® tolerant corn and soybean .

PRZM is used to simulate pesticide transport as a result of runoff and erosion from a standardized crop scenario and EXAMS estimates environmental fate and transport of pesticides in surface waters. A standard PRZM crop scenario, which consists of location-specific soils, weather, and cropping practices, will be used in the simulations to represent labeled uses of chlorimuron-ethyl. The Mississippi Corn and Soybean crop scenarios were selected as being the most representative of conditions under which OPTIMUM® GAT® tolerant corn and soybeans are grown. These scenarios were developed to represent high-end exposure sites in terms of vulnerability to runoff and erosion and subsequent off-site transport of pesticide. This model system will be used to estimate acute (annual instantaneous peak) and chronic (21 and 60 day weighted average annual peaks for aquatic invertebrates and fish, respectively) residue levels of the dissolved pesticide active ingredient in surface water from runoff and spray drift. EECs derived from model results will be used to derive initial RQs. Model results will be compared with existing surface water monitoring data.

(2) Groundwater Concentration

Groundwater EECs will be predicted using the ***S***creening ***C***oncentration ***I***n ***GRO***und ***W***ater (SCI-GROW) model. The model provides an exposure value which is used to determine the potential risk to the environment and to human health from drinking water contaminated with the pesticide. The SCI-GROW estimate is based on environmental fate properties of the pesticide (aerobic soil degradation half-life and linear adsorption coefficient normalized for soil organic carbon content), the maximum application rate, and existing data from small-scale prospective ground-water monitoring studies at sites with sandy soils and shallow ground water.

Pesticide concentrations estimated by SCI-GROW represent conservative or high-end exposure values because the model is based on ground-water monitoring studies which were conducted by applying pesticides at maximum allowed rates and frequency to vulnerable sites (i.e., shallow aquifers, sandy, permeable soils, and substantial rainfall and/or irrigation to maximize leaching). In most cases, a large majority of the use areas will have ground water that is less vulnerable to contamination than the areas used to derive the SCI-GROW estimate. For this reason, it is not appropriate to use SCI-GROW concentrations for national or regional exposure estimates.

(3) Ingestion Route – Food Chain (Bioaccumulation)

No studies have been submitted regarding the potential for bioaccumulation in terrestrial mammals, but based on the K_{ow} value of 1.3 (Chemical Fact Sheet for: Chlorimuron-ethyl, USEPA)), bioaccumulation is unlikely.

b. Measures of Effects

Measures of effect are obtained from a suite of registrant-submitted guideline studies conducted with a limited number of surrogate species. The test species are not intended to be representative of the most sensitive species but rather are selected based on their ability to thrive under laboratory conditions. The acute measures of effect routinely used for listed and non-listed animals in screening level assessments are the LD_{50}, LC_{50} or EC_{50}, depending on taxa. LD stands for "Lethal Dose", and LD_{50} is the amount of a material, given all at once, that is estimated to cause the death of 50% of a group of test organisms. LC stands for "Lethal Concentration" and LC_{50} is the concentration of a chemical that is estimated to kill 50% of a sample population. EC stands for "Effective Concentration" and the EC_{50} is the concentration of a chemical that is estimated to produce some measured effect in 50% of the test population. Endpoints for chronic measures of exposure for listed and non-listed animals are the NOAEL or NOAEC. NOAEL stands for "No Observed-Adverse-Effect-Level" and refers to the highest tested dose of a substance that has been reported to have no harmful (adverse) effects on a test population. The NOAEC (*i.e.*, "No-Observed-Adverse-Effect-Concentration") is the highest test concentration at which none of the observed results were statistically different from the control. For non-listed plants, only acute exposures are assessed (*i.e.*, EC_{25} for terrestrial plants and EC_{50} for aquatic plants). For listed terrestrial plants the Agency uses the EC_{05} or NOAEC.

Consistent with EPA test guidelines, the registrant has provided a suite of ecological effect data that comply with good laboratory testing requirements. The endpoints are typically derived from registrant-submitted studies which have undergone review and were classified as "acceptable" (conducted under guideline conditions and considered to be scientifically valid) or "supplemental" (conditions deviated from guidelines but the results are considered to be scientifically valid). For more details on study classification system used and study guidelines, see USEPA 2004.

c. Listed (Endangered or Threatened) Species

The measures of effect used for non-listed animal species are same as the measures of effect used for listed animal species taxonomic groups. The measures of effect for terrestrial and aquatic plants are different for non-listed and listed species. For listed terrestrial plants the measure of effect desired is the EC_{05} or NOAEC for vegetative vigor and the EC_{05} or NOAEC for seedling emergence. For aquatic plants, the measure of effect preferred is the EC_{05} or NOAEC for area under the curve or biomass.

d. Incident Data Review

EPA maintains an incident database system (Ecological Incident Information System or EIIS) to track and evaluate accidental kills associated with pesticide use. The likelihood that a particular pesticide caused the incident is classified as highly probable, probable, possible, or unlikely, based on the information contained in the incident report. If there are incidents this information will be reviewed and considered in conjunction with the degree to which the LOCs were exceeded in addition to information on sales, and use of the pesticide, local use practices, and monitored levels in the environment to determine whether the predicted effect based on labeled use of the product, is likely to occur or not.

III. Analysis

This section examines the two primary components of risk, exposure and effects, and their relationships between each other and ecosystem characteristics. The objective is to predict the ecological responses to chlorimuron-ethyl pesticide application under the most likely exposure scenarios. This analysis provides the basis for estimating and describing ecological risks presented in Section IV (Risk Characterization).

A. Exposure Characterization

1. Environmental Fate and Transport Characterization

Chlorimuron-ethyl is a dispersible granular formulation to be mixed with water and sprayed for selective post emergent control of many annual grasses, broadleaf weeds, and nutsedge. According to the label the maximum amount of active ingredient that can be applied is 0.063 lbs/acre per growing season.

As noted in the Problem Formulation section, chlorimuron-ethyl has six major degradates and no minor degradates. Based on best available information noted in the problem formulation, EFED believes that these degradates do not pose a significant toxicological concern to animals because of the mode of action of sulfonylurea herbicides of which chlorimuron-ethyl is a member.

The parent is expected to dissipate by metabolism in soil and transport in surface and groundwater by run-off, or leaching. These properties suggest that non-target aquatic and terrestrial organisms may be at risk when EECs exceed their respective EC_{50}s.

2. Measures of Aquatic Exposure

a. Aquatic Exposure Modeling

The estimated concentrations of chlorimuron-ethyl in surface water were estimated using PRZM/EXAMS modeling system.

The appropriate PRZM/EXAMS input parameters were selected from the environmental fate data submitted by the registrant, data contained in EPA archives, and data from other sources referenced in the literature. These parameters were selected in accordance with US EPA-OPP EFED water model parameter selection guidelines[5]. PRZM/EXAMS modeling was done using the proposed maximum label rate for DuPont CLASSIC® of 4 oz./acre (0.07 kg/ha) per growing season. Model input parameters are listed in **Error! Reference source not found.**. Aerial applications were modeled because EFED feels that this method of application will yield the more conservative results.

[5] USEPA, 2002. Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides, Version 2.3, February 28, 2002.

Table 5. Surface Water Exposure Inputs for PRZM/EXAMS for Chlorimuron-ethyl on OPTIMUM® GAT® Tolerant Corn and Soybeans

Input variable (Units)	Input value and calculations	Source of data
Crop name	Corn/Soybean	Proposed label submitted by registrant.
Application rate (kg/ha)	0.07	Proposed label submitted by registrant.
Max. No. of applications/year	1	Proposed label submitted by registrant.
Incorporation depth	0.0	Proposed label submitted by registrant
Application efficiency	0.95	Guidance for selecting Input Parameters in modeling the environmental fate and transport of pesticides, 2002[4].
Spray drift fraction	0.05	Guidance for selecting Input Parameters in modeling the environmental fate and transport of pesticides, 2002.
Aerobic soil met. Half-life (d)	106	MRID 131580, 145402
K_d	1.6	
K_{oc} (mL/g)	2.5	MRID 145778, 143120, 15446, 154440
Henry's Law Const. (atm.m^3/mole)	7.48×10^{-14}	MRID 43896401
Aerobic Aquatic half-life (d)	212	Guidance for selecting Input Parameters in modeling the environmental fate and transport of pesticides, 2002. In the absence of data the aquatic half-life is 2x the soil half-life.
Anaerobic Aquatic half-life (d)	21	No data available; Anaerobic soil metabolism half-life 2X; Guidance for selecting Input Parameters in modeling the environmental fate and transport of pesticides, 2002.
Aquatic Photolysis half-life (d)	stable (enter 0)	MRID 145779, 154438
Hydrolysis half-life (d)	Stable (enter 0)	MRID 131580
MWT (g/mole)	414.8	Calculated from structure
Solubility @ 25 ^{0}C (mg/L)	1200	One-liner database
Vapor pressure (torr)	1.5×10^{-5}	MRID 43896401

A summary of the PRZM/EXAMS output is presented in Table 6. Complete details are provided in Appendix D.

Table 6. Summary of PRZM/EXAMS Output Screening-Level EECs for the Mississippi Corn and Soybean Modeled Scenario

Crop Scenario	Application Rate (kg/ha)	No. of Applications	90th Percentile of 30 Years of Output					
			Peak EEC (ppb)	96-hr EEC (ppb)	21-day EEC (ppb)	60-day EEC (ppb)	90-day EEC (ppb)	Yearly EEC (ppb)
Mississippi Corn	0.07	1	3.75	3.73	3.67	3.53	3.39	2.13
Mississippi Soybean	0.07	1	1.74	1.73	1.70	1.62	1.54	1.08

The Sci-Grow model predicted a groundwater concentration of 2.39 ppb. This estimated exposure represents potential chlorimuron-ethyl concentrations in shallow groundwater that is subsequently used for irrigation water on crops.

b. Aquatic Exposure Monitoring and Field Data

The US Geological Survey (USGS), reports that chlorimuron-ethyl has been detected in the drinking water facilities at four locations (see Table 7). The data show the percent of the total number of samples in which the herbicide was detected and the maximum concentration observed at that location. The reported concentrations are less than those predicted by the PRZM/EXAMS model.

Table 7. Detection Frequency and Maximum Concentration of Chlorimuron-ethyl at Four Drinking Water Facilities

Reservoir Location	Concentration at Water-supply Intake		Concentration at Reservoir Outflow Site		Concentration of Treated Effluent	
	Detection %	Max Conc. (ppb)	Detection %	Max Conc. (ppb)	Detection %	Max Conc. (ppb)
Indianapolis Water Co., IN	-	-	-	-	5	0.04
Higginsville Reservoir, MO	11	0.018	10	0.026	-	-
East Fork Lake, OH	47	0.05	36	0.021	-	-
Lake Mitchell, SD	5	0.021	11	0.023	9	0.026

Source: USGS Open file report 01-456 (Pesticides in Selected Water-Supply Reservoirs and Finished Drinking Water, 1999-2000: Summary of results from a Pilot Monitoring Program)

The National Water-Quality Assessment (NAWQA) Program database was searched for the latest surface and groundwater monitoring results for chlorimuron-ethyl. Chlorimuron-ethyl has been monitored for in 42 states where there have been 82 incidences where the herbicide has been found to be above detection limits. In these incidences the concentrations have ranged from 0.010 to 0.870 ppb. These reported concentrations are also less than those predicted by the PRZM/EXAMS and SCI-GROW models in this assessment.

3. Measures of Terrestrial Exposures

a. Terrestrial Exposure Modeling for Birds and Mammals

In order to assess risk to terrestrial birds and mammals, estimated environmental concentrations (EECs) on food items following product application are compared to LC_{50} values to assess risk by the Risk Quotient (RQ) method. Estimates of maximum and average residue levels (EECs) of chlorimuron-ethyl on avian food items were based on output from the TREX Model. The model estimates RQs for small (10g), medium (100g), and large (1000g) birds.

b. Terrestrial Exposure Modeling for Non-Target Plants

TERRPLANT Model inputs are shown in Tables 8a for ground application and 8b for aerial application. Model results for exposure of off-site terrestrial plants in dry upland areas and in low-lying semi-aquatic areas are presented in Tables 9a (ground application), 9b (aerial application) and the plant survival and growth data used to estimate RQ are presented in Table 10.

Table 8a. Input parameters used to derive EECs from ground application

Input Parameter	Symbol	Value	Units
Application Rate	A	**0.0625**	**lb ai/A**
Incorporation	I	**1**	none
Runoff Fraction	R	**0.05**	none
Drift Fraction	D	**0.01**	none

Table 8b. Input parameters used to derive EECs from aerial application

Input Parameter	Symbol	Value	Units
Application Rate	A	**0.0625**	**lb ai/A**
Incorporation	I	**1**	none
Runoff Fraction	R	**0.05**	none
Drift Fraction	D	**0.05**	none

Table 9a. EECs for chlorimuron-ethyl from ground application. Units in lb ai/A.

Description	Equation	EEC
Runoff to dry areas	(A/I)*R	0.003125
Runoff to semi-aquatic areas	(A/I)*R*10	0.03125
Spray drift	A*D	0.000625
Total for dry areas	((A/I)*R)+(A*D)	0.00375
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.031875

Table 9b. EECs for chlorimuron-ethyl from aerial application. Units in lb ai/A.

Description	Equation	EEC
Runoff to dry areas	(A/I)*R	0.003125
Runoff to semi-aquatic areas	(A/I)*R*10	0.03125
Spray drift	A*D	0.003125
Total for dry areas	((A/I)*R)+(A*D)	0.00625
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.034375

Table 10. Plant survival and growth data used for RQ derivation. Units are in lb ai/A.

	Seedling Emergence		Vegetative Vigor	
Plant type	**EC_{25}**	**NOAEC**	**EC_{25}**	**NOAEC**
Monocot	**1.1E-05**	**0.5E-05**	**4.3E-05**	**2.0E-05**
Dicot	**2.5E-05**	**0.8E-05**	**3.3E-05**	**1.0E-05**

c. Contaminated Irrigation Water on Sensitive Non-Targeted Crops

The following calculation and assumptions are used to estimate the ground water or surface water concentration in overhead irrigation water that would result in sufficient exposure to cause adverse effects on non-target plants (vegetative vigor EC_{25} value):

62.36 lb water/ft^3 x 43,560 ft^2/acre x 0.0835 ft depth (one inch) =
226,820 lb water irrigated/acre

The above calculation assumes that one inch of irrigation water is used. The amount of water required to irrigate an acre with one inch of water is 226,820 lbs. Assuming the vegetative vigor EC_{25} is **3.3E-05** lb ai/A, the concentration of chlorimuron-ethyl in one inch of irrigation water required to deliver this EC_{25} dose is:

(3.3E-05 lb ai/A) / 226,820 lb water/A] x 10^9 ppb= concentration of chlorimuron-ethyl in one inch of irrigation water (**0.145 ppb or 145.0 ppt**).

This is the amount of chlorimuron-ethyl in one inch of water that is needed for crops to be exposed to an equivalent of an EC_{25} for the most sensitive terrestrial plant.

B. Ecological Effects Characterization

In ecological risk assessments supporting Re-registration Eligibility Decisions, the effects characterization describes the types of effects a pesticide can have on aquatic or terrestrial organisms. This characterization is based on registrant-submitted regarding acute and chronic toxicity effects for various aquatic and terrestrial animals. Appendix A summarizes in detail the results of the registrant-submitted toxicity studies used to characterize effects for this risk assessment.

Based on the available data, chlorimuron-ethyl is classified as practically non-toxic to freshwater fish and freshwater invertebrates, but toxic to aquatic plants. Chlorimuron-ethyl is also classified as practically non-toxic to birds, insects, and mammals on an acute basis.

Monocots and dicots were found to be very sensitive in both seedling emergence and vegetative vigor studies. See Table 11 for the specific measurement endpoint values selected from available data for evaluating risks.

Table 11. Summary of Specific Measurement Endpoint Values Selected to Calculate RQs to Evaluate Risk for the Associated Assessment Endpoint

Assessment Endpoint	Measurement Endpoint	Selected Measurement Endpoint Value and Source				
		Species	Study Duration	Toxicity Value	Most Sensitive Endpoint	Source and Study Classification
Survival and Reproduction of Birds	Most sensitive avian acute oral toxicity, LD_{50} (single-dose)	Mallard Duck	Single Oral Dose, post 14 day	LD_{50} >2510 mg a.i./kg-bw	Mortality (none observed at highest dose)	00131577 Acceptable
	Most sensitive acute avian dietary toxicity	Bobwhite quail and Mallard Duck	8 d (5 d exposure, post 3 d)	LC_{50} >5,620 (ppm a.i.)	Mortality (none observed at highest concentration tested)	00131578 00132578 Acceptable
	Most sensitive avian reproductive toxicity NOAEC	Bobwhite quail	22 Weeks	NOAEL 180 (ppm a.i.)	14-day hatching survivors of both normal hatchings	43483701, 43476001 Acceptable

Assessment Endpoint	Measurement Endpoint	Selected Measurement Endpoint Value and Source				
		Species	**Study Duration**	**Toxicity Value**	**Most Sensitive Endpoint**	**Source and Study Classification**
					and egg set, percentage of egg set of eggs laid, increase in number of eggs cracked	
Survival and Reproduction of Terrestrial Mammals	Most sensitive acute oral toxicity, LD_{50} (single-dose)	Rat	Single oral dose	LD_{50} >5000 mg a.i./kg-bw/day	Mortality	40843203 Acceptable
	Most sensitive reproduction NOAEL	Rat		17 mg a.i./kg-bw/d (250 ppm a.i. dietary)	Reduced pup weight	00149580 Acceptable
Survival of Terrestrial Invertebrates and beneficial insects	Most sensitive acute contact LD_{50} (ug/bee)	Honey bee (*Apis mellifera*)	96 hr	12.5 ug/g per bee.	Mortality	00143124 Acceptable
Survival and reproduction of freshwater vertebrates (fishes, etc)	Most sensitive acute freshwater fish LC_{50}	Bluegill sunfish *(Lepomis macrochirus)*	96 hr LC_{50}	> 100 ppm a.i.	Mortality (none observed at highest concentration tested)	00143122 Acceptable
	Most sensitive freshwater fish early life stage or life cycle NOAEC	Rainbow trout *(Oncorhynchus mykiss)*	56 day Flow-thru	-NOEAC= 8.2 ppm a.i. LOAEC= 16 ppm ai	(Last day of hatching)	45017901 Acceptable
Survival and reproduction of freshwater invertebrates	Most sensitive acute freshwater invertebrate LC_{50} (or EC_{50})	Water flea, (*Daphnia magna*)	48 hr EC_{50}	>1000 ppm a.i.	Immobilization and mortality (no mortality observed at and below 1000 ppm a.i.)	143123 Acceptable
	Most sensitive aquatic invertebrate life cycle NOAEC	Water flea, (*Daphnia magna*)	21 day Static	106 ppm a.i. LOEC = 211 ppm ai	total length and dry weight	44459701 Acceptable
Survival and reproduction of marine/ estuarine vertebrates (fishes, etc)	Most sensitve acute marine/ estuarine vertebrate LC_{50}	Sheepshead minnow (*Cyprinodon variegatus*)	96 hr	No data available		
	Most sensitive marine/estuarine fish early life stage or life cycle NOAEC	Sheepshead minnow (*Cyprinodon variegatus*)	56 day	No data available		
Survival and reproduction of marine/estuarine invertebrates	Most sensitive marine/estuarine acute mollusk shell deposition or embryo larval EC_{50}	Eastern oyster (*Crassostrea virginica*) embryo larval study	48 hr	No data available		
	Most sensitive marine/estuarine acute invertebrate LC_{50}	Mysids (*Mysidopsis bahia*)	48 hour	No data available		

Assessment Endpoint	Measurement Endpoint	Selected Measurement Endpoint Value and Source				
		Species	Study Duration	Toxicity Value	Most Sensitive Endpoint	Source and Study Classification
	Most sensitive marine/estuarine life cycle invertebrate NOAEC	Mysids (*Mysidopsis bahia*)	21 day	No data available		
Reduced biomass and growth rate of aquatic plants	Most sensitive vascular plant biomass and area under curve NOAEL(1) and EC_{50}	Duckweed (*Lemna gibba*)	14 day static	EC_{50} 0.26 ppb a.i. NOAEC 0.07 ppb a.i.	Frond number	43913401 Acceptable
	Most sensitive nonvascular plant biomass and growth rate NOAEL(1) and EC_{50}	Green algae (*Selenastrum capricornutum*)	5 days static	EC_{50} 0.77 ppb a.i. NOAEC 0.28 ppb ai	Biomass	43945501 Acceptable
Reduced survival of terrestrial plants	Most sensitive monocot seedling emergence NOAEL(1) and EC_{25}	Onion	21-Day	EC_{25} 1.1E-05 lbs a.i./A NOAEL= 0.5E-05 lbs a.i./A	Shoot weight	
	Most sensitive dicot seedling emergence NOAEL(1) and EC_{25}	Rape	21-Day	EC_{25} = 2.5E-05 lbs a.i./A EC_{05} = 0.8E-05 lbs a.i./A	Shoot height	
	Most sensitive monocot vegetative vigor NOAEL(1) and EC_{25}	onion	21-Day	EC_{25} = 4.3E-05 lbs a.i./A NOAEL = 2.0E-05 lbs a.i./A	Shoot weight	43777201 Acceptable
	Most sensitive dicot vegetative vigor NOAEL(1) and EC_{25}	Rape	21-Day	EC_{25} = 3.3E-05 lbs a.i./A NOAEL = 1.0E-05 lbs a.i./A	Shoot height	

(1) If a NOAEL can not be determined or the minimum significant difference detectable is not appropriate, a IC_{05} is used as an alternative to the NOAEL.

1. Aquatic Effects Characterization

The acute toxicity of chlorimuron-ethyl was tested in two species of freshwater fish (rainbow trout (*Oncorhychus mykiss*) and bluegill sunfish (*Lepomis macrochirus*)), and one freshwater invertebrate (*Daphnia magna*). There are no available data for estuarine/marine species of fish or invertebrates. Aquatic chronic toxicity tests were submitted for freshwater invertebrate (*Daphnia magna*) and for rainbow trout *(Oncorhynchus mykiss)*. In additions, submitted aquatic plant toxicity tests was conducted on five species: green alga (*Selenastrum Capricornutum*), a bluegreen algae

(*Anabaena flos-aquae*), a marine diatom *Skeletonema costatum*), freshwater diatom (*Navicula pelliculosa*), and duckweed (*Lemna gibba*).

a. Fish

Acute

Aquatic animal toxicity studies using chlorimuron-ethyl had problems of precipitation occurring in the testing water. There were three submitted studies for fish acute toxicity. In the EEB review (February 12, 1985) for proposed registration of soybean, the reviewer has indicated that the "registrant has adequately demonstrated why the test material formed during testing and that appropriate measures were taken to get the material into test solution" for a bluegill toxicity study (MRID 00131575) the study was upgraded to acceptable. This study found the LC_{50} to be greater than 10 ppm.

A rainbow trout study (MRID 00131574) the precipitation of chlorimuron-ethyl occurred in area of the pipette stream where localized concentrations exceeded the solubility of the test water. Mixing of the water permitted the chemical to dissolve. However, the LC_{50} was greater than 12 ppm.

All of the above freshwater fish acute studies are classified as acceptable studies by the Agency. No mortality occurred in the controls or any of the treatment levels of the above studies. Chlorimuron-ethyl is considered to be practically non-toxic to fish.

Chronic

A rainbow trout early life stage study (MRID 45017901) was submitted. The NOAEC was found to be 8.2 ppm ai. The most sensitive endpoint is the timing for last day hatching. The study is acceptable.

b. Invertebrates

Acute

The acute toxicity test for the water flea, *Daphnia magna,* (MRID: 00131576) resulted in a 48-hr EC_{50} >10 ppm a.i. This study had solubility problems in the testing water at all concentrations and controls. Between 10 ppm and 40 ppm precipitation occurred.

Another acute toxicity study for the water flea, (MRID 143123) resulted in a 48-hr EC_{50} >1000 ppm a.i. for formulated product with unknown percentage active ingredient. The study is supplemental since it had minimal information and no raw data. Only 3 replicates were used with 3 concentration doses. Study may be a range finding study.

No mortality was observed at the treatment levels or controls of any of the above studies. Chlorimuron-ethyl is considered to be practically non-toxic to *Daphnia magna*

Chronic

A *Daphnia magna* life cycle study (MRID 44459701) was submitted. The NOEC was found to be 106 ppm ai with parameters affected being total length and dry weight. This study is acceptable.

2. Terrestrial Effects Characterization

a. Toxicity to Terrestrial Animals

The acute toxicity of chlorimuron-ethyl was tested in two species of birds - bobwhite quail (Colinus virginianus) and mallard duck (*Anas platyrhynchos*); and one terrestrial invertebrate (honey bee (*Apis mellifera*)). In addition, rat studies that were submitted to the Health Evaluation Division (HED)/OPP will also be incorporated into the risk assessment.

(1) Birds

An acute mallard duck single oral dose test (MRID: 00131577) resulted in an LD_{50} > 2510 mg/kg-bw. There were no mortalities in the controls or any of the treatment groups.

Two sub-acute acute avian toxicity studies were submitted. A mallard duck (MRID: 00132578) and bobwhite quail (MRID: 00131578) dietary toxicity tests resulted in an LC_{50} >5620 ppm a.i. for both species. No mortality or abnormal effects were observed during the studies at any of the treatment levels or the controls.

Chlorimuron-ethyl is considered to be practically non-toxic to birds on an acute and subacute basis. No mortalities were observed at all treatment levels and controls.

A dietary reproduction study of bobwhite quail (MRID: 43483701 and 43476001) resulted in a LOAEC of 1080 ppm a.i. and NOAEC of 180 ppm a.i., based on significant reductions in 14-day hatching survivors of both normal hatchings and egg set, percentage of egg set of eggs laid, and increase in number of eggs cracked. No effects were observed in a mallard duck (MRID 43483702) reproduction study up to 1080 ppm a.i. which is the highest dose tested.

All of the above avian studies are considered to be acceptable studies.

(2) Insects

One acute contact study (MRID 00143124) on honey bee was submitted, which resulted in an LD_{50} value of 12.5 µg/bee. Chlorimuron-ethyl is considered to be practically non-toxic to honey bee

(3) Mammals

An acute oral toxicity rat study (MRID: 00131566) resulted in an $LD_{50} > 5000$mg/kg-bw for male and female rats. No mortalities were observed in all treatment levels and controls. Chlorimuron-ethyl is considered to be practically non-toxic to rats on an acute oral basis.

A dietary two-generation rat reproductive study (MRID 00149580) had a reproductive NOAEL of greater than 177 mg/kg/day (2500 ppm) and offspring NOAEL of 17 mg/kg/day (250 ppm) for reduced pup weight. The offspring LOAEL is 177 mg/kg/day for reduced pup weight. The highest treatment level tested is 177 mg/kg/day.

b. Toxicity to Plants

(1) Terrestrial Plants

Tier II plant studies demonstrate the potential for chlorimuron-ethyl to affect terrestrial monocot and dicot plant species. In the seedling emergence studies (MRID 43777201), the EC_{25} ranges from 1.14×10^{-5} lb ai/A (onion) to >0.2438 lb ai/A (soybean). There are no discernible differences in toxicity between the monocots and the dicots. The NOAELs range from 0.5×10^{-5} (onion) to 0.020313 lb ai/A (soybean). The study was done with a technical grade (97.5%) chlorimuron-plus acetone which is acceptable since the chemical will be exposed only to the roots and shoots of the emerging plant.

The vegetative vigor studies (MRID 43777201) EC_{25} range from 3.3×10^{-5} (rape) to 376.3×10^{-5} lb ai/A (soybean). There are no discernible differences in toxicity between the monocots and the dicots. The NOAELs range from 1.0×10^{-5} (rape) to 126.9×10^{-5} lb ai/A (soybean). The vegetative vigor study was done with the technical grade (97.5%) chlorimuron-ethyl plus 0.25% non-ionic surfactant which is acceptable practice since the formulated product with have the same type of surfactant.

All of the seedling emergence and vegetative vigor studies are considered to be acceptable.

(2) Aquatic Plants

The duckweed, *Lemna gibba*, study (MRID 43913401) that was submitted showed an EC_{50} of 0.27 µg/L for frond number and 0.45 µg/L for biomass. The NOAEC is 0.07 µg/L for both frond number and biomass. The study is considered to be acceptable.

A growth and reproduction study of green algae (MRID: 43945501) resulted in a 120-hour EC_{50} of 0.77 µg/L for biomass and 1.1 µg/L for cell density. The study is considered to be acceptable and is the most sensitive of the unicellular plant studies.

Both of the diatoms submitted did not exhibit growth inhibition but showed growth stimulation. The 120-hour test showed a stimulatory effect of 11% for the marine diatom *Skeletonema costatum* (MRID 43945501) and 29% for the freshwater diatom *Navicula pelliculosa* (MRID 43945501) when compared to the controls.

The cyanobacteria *Anabaena flos-aquae* had EC_{50}s of 18.0 µg/L for cell density and 16.0 µg/L for biomass. .

All of the above studies are considered to be acceptable and were conducted with the technical active ingredient (98%).

3. Incident Data Review

EPA maintains an incident database system (Ecological Incident Information System or EIIS) to track and evaluate accidental kills associated with pesticide use. The likelihood that a particular pesticide caused the incident is classified as highly probable, probable, possible, or unlikely, based on the information contained in the incident report. The Ecological Incident Information System (EIIS) Database will be searched for any reported incidents with wildlife associated with the use of chlorimuron-ethyl. A summary of the incidents reported to the Agency is below.

There is one incident (I008768-007) of 200 fish killed in a pond in 1999. It is not certain as to whether chlorimuron-ethyl caused the fish kills since it is practically non-toxic. However the chemical is very toxic to aquatic plants and decomposing aquatic plants can lower the available dissolved oxygen content in the water. There is very little information concerning this incident.

There are at least 15 separate non-target plant incidents involving chlorimuron-ethyl. The certainty index ranges from possible to highly probable and were made from 1994 to 2005. All of the incidents involve chlorimuron-ethyl as a mixture with other herbicides. Additional information can be found in Appendix E.

IV. Risk Characterization

Risk characterization is the integration of exposure and effects characterization to determine the ecological risk from the use of chlorimuron-ethyl and the likelihood of effects on aquatic life, wildlife, and plants based on varying pesticide-use scenarios. The risk characterization provides estimations and descriptions of the risk and provides the risk managers with information to make regulatory decisions.

A. Risk Estimation - Integration of Exposure and Effects Data

Toxicity data and exposure estimates are used to evaluate the potential for adverse ecological effects on non-target species. For this screening-level assessment of chlorimuron-ethyl, the deterministic risk quotient method is used to provide a metric of potential risks. The RQ is a comparison of exposure estimates to toxicity endpoints; estimated exposure concentrations are divided by acute and chronic toxicity values according to the following equation:

RQ = EXPOSURE / MEASURE OF EFFECT

RQs are then compared to levels of concern (LOCs) to indicate the potential risk to non-target, listed (endangered or threatened), and non-listed organisms. The LOCs are presumptive risk values; an RQ that exceeds the LOC has a presumed risk to non-target organisms. Risk presumptions, along with the corresponding LOCs, are given in Table 12. These criteria are used to indicate when the use of a pesticide, as directed on the label, has the potential to cause adverse effects on non-target organisms.

LOCs currently address the following categories of presumed risk:

- **acute** - potential for acute risk and regulatory action beyond restricted use classification might be warranted
- **acute restricted** - the potential for acute risk, but might be mitigated through restricted use classification
- **acute listed species** - threatened and endangered species might be adversely affected
- **chronic risk** - the potential for chronic risk, and regulatory action might be warranted.

Table 12 Agency Levels of Concern (LOC)

Risk	Description	LOC	Taxa
Acute	Potential for acute risk to non-target organisms which may warrant regulatory action in addition to restricted use classification	acute RQ > 0.5	aquatic animals, mammals, birds
Acute	Potential for acute risk to non-target	acute RQ > 0.1	aquatic animals

Risk	Description	LOC	Taxa
Restricted Use	organisms, but may be mitigated through restricted use classification	acute RQ > 0.2	mammals and birds
Acute Listed Species	Listed species may be potentially affected by use	acute RQ > 0.05	aquatic animals
		acute RQ > 0.1	mammals and birds
Chronic	Potential for chronic risk may warrant regulatory action, listed species may potentially be affected through chronic exposure	chronic RQ > 1	all animals
Non-Listed and Listed Plant	Potential for effects in non-listed and listed plants	RQ > 1	all plants

1. Risk to Non-target Aquatic Organisms

(1) Risk to Fish and Aquatic Invertebrates

Risk to freshwater fish and invertebrates

To calculate acute RQs for freshwater aquatic organisms, peak EEC values were divided by the most sensitive acute toxicity endpoints: the Bluegill sunfish (*Lepomis macrochirus*) 96-hour LC_{50} (>100 ppm) for fish and the water flea (*Daphnia magna*) EC_{50} (>1000 ppm) for invertebrates. Chronic RQ values were calculated by dividing 21-day average EECs (for invertebrates) and 60-day average EECs (for fish) by the most sensitive chronic toxicity endpoints: the Rainbow trout (*Onclorhynchu mykiss*) NOAEC (8.2 ppm) for fish, and the water flea NOAEC (106 ppm) for invertebrates. The freshwater fish and invertebrate acute and chronic risk quotients and their respective LOCs are presented in Table 13.

The acute, acute restricted use, and listed species levels of concern for freshwater fish and invertebrates are not exceeded. Similarly, the chronic levels of concern for fish and invertebrates are not exceeded.

Table 13. Freshwater Fish and Invertebrate Acute and Chronic Risk Quotients

Risk	EEC (ppb)	Endpoint	RQ
Acute			
fish	3.75 (peak)	96-hour LC_{50} (>100 ppm)	<0.05
invertebrates	3.75(peak)	EC_{50} (>1000 ppm)	<0.05
Chronic			
fish	3.5 (60-day)	NOAEC (8.2 ppm)	<1.0
invertebrates	3.7 (21-day)	NOAEC (106 ppm)	<1.0

The acute RQ for aquatic animals are below the Agency's Level of Concern. This is further confirmed as chlorimuron-ethyl is considered to be practically non-toxic to fish and aquatic invertebrates with no mortality observed are the highest concentration tested.

(2) Risk to Aquatic Plants

The RQ for aquatic plants is shown in the Table 14 below:

Table 14. Aquatic Plant RQs

species	Tox endpoint	RQ (non-listed)	RQ (Listed)
Green algae (*Selenastrum capricornutum*)	EC_{50} = 0.77 ppb	4.9	Not applicable
Duckweed (*Lemna gibba)*	EC_{50} = 0.27 ppb NOAEC = 0.07 ppb	13.9	53.6

The RQ for aquatic plants exceeds the Agency's LOC for listed and non-listed non-target aquatic plant species.

2. Risk to Non-target Terrestrial Organisms

(1) Non-Target Terrestrial Animals

Acute risk quotients (RQ) for terrestrial animals are not needed since chlorimuron-ethyl is considered to be practically non-toxic to birds and mammals with no mortality observed at the highest concentration tested.

For chronic risk assessment for terrestrial animals, the avian reproductive endpoint is 180 ppm and the rat reproductive endpoint is 250 ppm for mammals. Table 15 below shows that the **chronic RQs are below the Agency's LOC (1) for birds and mammals.**

Table 15 Summary of Chronic Risk Quotient Calculations Based on Upper Bound Kenaga EECs

Upper Bound Kenaga, Chronic Avian Dietary Based Risk Quotients

NOAEC (ppm)	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/Large Insects	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
180	15.12	0.08	6.93	0.04	8.51	0.05	0.95	0.01
Size class not used for dietary risk quotients								

Upper Bound Kenaga, Chronic Mammalian Dietary Based Risk Quotients

NOAEC (ppm)	EECs and RQs							
	Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/Large Insects	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
250	15.12	0.06	6.93	0.03	8.51	0.03	0.95	0.00
Size class not used for dietary risk quotients								

Upper Bound Kenaga, Chronic Mammalian Dose-Based Risk Quotients

Size Class (grams)	Adjusted NOAEL	EECs and RQs									
		Short Grass		Tall Grass		Broadleaf Plants/ Small Insects		Fruits/Pods/ Seeds/Large Insects		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
15	37.36	14.42	**0.38**	6.61	**0.18**	8.11	**0.22**	0.90	0.02	0.20	0.01
35	30.23	9.96	**0.33**	4.57	**0.15**	5.60	**0.18**	0.62	0.02	0.14	0.00
1000	13.08	2.31	**0.18**	1.06	0.08	1.30	**0.10**	0.14	0.01	0.03	0.00

(2) Risk to Terrestrial Plants

The Agency's LOC for non-target terrestrial plants is exceeded as shown in Table 16a and 16b below:

Table 16a. RQ values for plants in dry and semi-aquatic areas exposed to chlorimuron through runoff and/or spray drift.* Ground application

Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
Monocot	non-listed	87.21	741.28	14.53
Monocot	listed	187.50	1593.75	31.25
Dicot	non-listed	150.00	1275.00	25.00
Dicot	listed	468.75	3984.38	78.13
*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.				

Table 16b. RQ values for plants in dry and semi-aquatic areas exposed to chlorimuron through runoff and/or spray drift.* Aerial Application

Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
Monocot	non-listed	145.35	799.42	72.67
Monocot	listed	312.50	1718.75	635.00
Dicot	non-listed	250.00	1375.00	125.00
Dicot	listed	781.25	4296.88	390.63
*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.				

The Agency's LOC is exceeded for non-target terrestrial plants from aerial and ground application.

B. Risk Description

The results of this screening-level risk assessment indicate that the proposed uses of chlorimuron-ethyl have the potential for direct adverse effects for freshwater algae, aquatic vascular plants listed, and non-target terrestrial plants. The hypothesis (Risk Hypothesis Section II.D.3) of chlorimuron-ethyl has the potential for adverse effects to non-target aquatic and terrestrial plants are supported. Since plants are vital components of most habitats and ecosystems, alterations in the abundance of plants or in the composition of plant communities could result in adverse effects to non-plant species. Potential effects include, but are not limited to, reduction in food resources, decrease in cover (e.g., for predator avoidance), change in water parameters (e.g., increases or decreases in temperature and pH), and loss of breeding/nesting habitat.

1. Risk to Aquatic Organisms

There appears to be no acute or chronic risk to aquatic animals.

The Agency's LOC for aquatic plants is exceeded. It appears non-target aquatic plants (vascular and green algae) will be adversely impacted from the use of chlorimuron-ethyl on corn and soybean fields. In addition, while the green alga is suppressed the cyanobacteria (blue-green algae) are not suppressed. This may lead to adverse environmental conditions of higher cyanobacteria populations at the expense of green algae populations which may be detrimental to aquatic animal populations.

ADRIFT model is a peer-reviewed model that predicts the amount of residue deposition from X number of feet from edge of field. EFED policy for AgDrift model inputs indicate that for herbicides that contain spray application labeling that do not use not specific language such as nozzle size, will use as input for the model the very fine to fine nozzle spray size. Very fine to fine nozzle size was used for input into the AgDrift model. Appendix F will show the output of the AgDrift model. Table 17 below will show comparisons between aerial and ground application of the aquatic assessment for spray drift. For comparison purpose, the *Lemna gibba* EC_{50} is 0.27 ppb and NOAEC is 0.07.

Table 17. Comparison of Terrestrial Assessment of Spray Drift between Aerial and Ground Application

Type of application	Distance to water body	Depth of water	Initial average concentration ng/L (ppt)	Exceedance of *Lemma gibba* EC_{50} by EEC (X times)	Exceedance of listed species LOC (conc./NOAEC)
ground	300 ft.	3 ft.	20.4	< 1	< 1
aerial	300 ft.	3 ft	619.7	2.3	8.9
ground	995 ft.	3 ft.	6.6	< 1	< 1
aerial	995 ft.	3 ft	301.4	1.1	4.3
ground	300 ft.	6 ft.	10.2	< 1	< 1
aerial	300 ft.	6 ft.	309.8	1.1	4.4

ground	995 ft.	6 ft.	3.3	< 1	< 1
aerial	995 ft.	6 ft.	150.7	< 1	2.2

It appears that areas containing sensitive non-target vascular plants that do not receive runoff waters containing chlorimuron residue but only aerial spray drift may have adverse effects to non-target aquatic plants including listed species that are nearby. **Ground applied spray drift containing chlorimuron residues does not appear to cause adverse effects to non-target aquatic plants including listed species.**

2. Risk to Terrestrial Organisms

There appears to be no acute or chronic risk to birds and to mammals. In addition, chlorimuron-ethyl is practically non-toxic to honey bees.

Non-target terrestrial plants are at risk from the use of chlorimuron-ethyl. There is no significant toxicity differences between dicots and monocots among the plants tested; however, the grasses tend to be less sensitive than the dicots. Non-target and non-listed plant RQs for spray drifts from aerial application range up to 125 and for spray drift from ground application up to 25. Non-target and non-listed plant RQs for chlorimuron residue runoffs from aerial application range up to 1375 and for runoff from ground application up to 1275.

The spectrum of toxicity of the plants tested would indicate that of the ten species tested nine would exceed the Agency's LOC for spray drift exposure 10 feet outside of the use site according to an assumption of 5% spray drift from aerial application.

EFED policy for AgDrift model inputs indicate that for herbicides that contain spray application labeling that do not use not specific language such as nozzle size, will use as input for the model the very fine to fine nozzle spray size. Very fine to fine nozzle size was used for input into the AgDrift model. Appendix F will show the output of the AgDrift model. Using the peer-reviewed AGDRIFT model with settings of very fine to fine nozzle spray, the **aerial spray drift residue deposition** at 995 feet from the use site would be 0.0026 lb ai/A which is 4.17% of the application rate. This would exceed the most sensitive EC_{25} (3.3E-5 lb ai/A) for non-target plants by 78.8X. Therefore, there are no mitigation measures that will reduce the risk to levels below the Agency's Level of Concern for aerial application short of elimination of aerial application.

Using the peer-reviewed AGDRIFT model **for ground application**, with settings of very fine to fine nozzle spray, the residue deposition at 995 feet from the use site would be 0.00006 lb ai/A which is 0.1% of the application rate. This would exceed the most sensitive EC_{25} (3.3E-5 lb ai/A) for non-target plants by 1.8X.

Table 18 below will provide a comparison between ground and aerial application of spray drift.

Table 18. Comparison of Terrestrial Assessment of Spray Drift Between Aerial and Ground Application

Type of application	Deposition at 995 feet	Percentage of application rate	Exceedance of most sensitive EC_{25} by X times	Number of test species EC_{25} below deposition at 995 feet
aerial	0.0026 lb ai/A	4.17 %	78.8	1
ground	0.00006 lb ai/A	0.1 %	1.8	7

Non-targeted plants exposed to contaminated irrigation water containing 0.145 ppb of chlorimuron-ethyl in one inch of irrigation water exceed the Agency's LOC for the most sensitive non-target terrestrial plants. Since the peak EEC in runoff to surface water bodies is 3.75 ppb, it appears that contaminated surface water bodies containing chlorimuron-ethyl may adversely impact non-target terrestrial plants from irrigation. The aquatic EEC from runoff would exceed the Agency's LOC for sensitive non-target plants irrigated by one-inch of contaminated water by 25.9X (3.75/0.145).

Chlorimuron measured at monitored sites have been found to have concentrations as high as 0.05 ppb (East Fork Lake, OH) which is below the EC25 level of 0.145 ppb for terrestrial plants being irrigated from contaminated water sources. However, if 2 inches of water containing chlorimuron residues is irrigated to sensitive crops, then the amount of chlorimuron residues will approach the EC_{25} for the most sensitive non-target crop.

V. Bibliography

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Appendix A Ecological Effects - Chlorimuron

Ecological Effects Toxicity Assessment

a. Toxicity to Terrestrial Animals

i. Birds, Acute and Subacute

An acute oral toxicity study using the technical grade of the active ingredient (TGAI) is required to establish the toxicity of chlorimuron to birds. The preferred test species is either mallard duck (a waterfowl) or bobwhite quail (an upland game bird). Results of this test are tabulated below.

Avian Acute Oral Toxicity

Species	% ai	LD_{50} (mg/kg) (confidence interval)	Toxicity Category (slope)	MRID No. Author/Year	Study Classification (1)
Mallard duck *(Anas platyrhynchos)*	96	>2510	Practically non- toxic	00131577 Beavers, 1983	acceptable

(1) Acceptable (study satisfies guideline). Supplemental (study is scientifically sound, but does not satisfy guideline)

Since the LD_{50} is greater than 2510 mg ai/kg, chlorimuron is categorized as practically non-toxic to avian species on an acute oral basis.

Two subacute dietary studies using the TGAI are required to establish the toxicity of chlorimuron to birds. The preferred test species are mallard duck and bobwhite quail. Results of these tests are tabulated below.

Avian Subacute Dietary Toxicity

Species	% ai	5-Day LC_{50} (ppm) (confidence interval)	Toxicity Category (slope)	MRID No. Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	96	>5620	Practically non-toxic	00131578 Beavers,1983	acceptable
Mallard duck *(Anas platyrhynchos)*	96	>5620	Practically non-toxic	00132578 Beavers,1983	acceptable

Since the LC_{50} greater than 5620 ppm, chlorimuron is categorized as practically non-toxic to avian species on a subacute dietary basis

ii. Birds, Chronic

Avian reproduction studies using the TGAI are required for Chlorimuron because the birds may be subject to repeated exposure to the pesticide, especially preceding or during the breeding season, field data has indicate that the pesticide is persistent in plant and invertebrate food items in potentially toxic amounts, and information derived from mammalian reproduction studies indicates reproduction in terrestrial vertebrates may be adversely affected by the anticipated use of the product. The preferred test species are mallard duck and bobwhite quail.

The above criteria were developed when the test was primarily used to determine effects of organochlorine pesticides and other persistent chemicals and reflect the concern for pesticides with chronic exposure patterns. The criteria would not necessary trigger a test for pesticides that pose risk of adverse reproductive effects from short term exposure. Several pesticides have been shown to reduce egg production within days after initiation of dietary exposure (Bennett and Bennett 1990, Bennett et al. 1991). Effects of eggshell quality (Bennett and Bennett 1990, Haegele and Tucker 1974) and incubation and brood rearing behavior (Bennett et al. 1991, Brewer et al. 1988, Busby) have also resulted from short-term pesticide exposures. Results of these tests are tabulated below.

Avian Reproduction

Species/ Study Duration	% ai	NOEC/LOEC (ppm)	LOEC Endpoints	MRID No. Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	98.5	180/1080	14-day hatching survivors of both normal hatchings and egg set, percentage of egg set of eggs laid, increase in number of eggs cracked	43483701, 43476001 Beavers, 1994	acceptable
Mallard duck *(Anas platyrhynchos)*	98.5	>1080	no effect	43483702 Beavers, 1994	acceptable

iii. Mammals, Acute and Chronic

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.

Mammalian Toxicity

Species/ Study Duration	% ai	Test Type	Toxicity Value	Affected Endpoints	MRID No.
laboratory rat *(Rattus norvegicus)*	75	acute oral	LD_{50}> 5000 mg/kg (Male and female)	mortality	00131566
laboratory rat *(Rattus norvegicus)*		2-generation reproductive	NOEL >177mg/kg/day (male) (> 2500 ppm)(1)	Reproductive	00149580
			Offspring NOEL = 17 mg/kg/day (250 ppm) LOEL = 177mg/kg/day (male) (2500 ppm)	Reduced pup weight	

(1) The study indicates that 17 mg/kg/day = 250 ppm and 177 mg/kg/day = 2500 ppm. 2500 ppm was the highest dose tested.

An analysis of the results indicates that Chlorimuron is categorized as practically non-toxic to small mammals on an acute oral basis.

iv. Insects

A honey bee acute contact study using the TGAI is required for Chlorimuron because its use (potato) will result in honey bee exposure. Results of this test are tabulated below.

Non-target Insect Acute Contact Toxicity

Species	% ai	LD_{50} (µg/bee)	Toxicity Category	MRID No. Author/Year	Study Classification
Honey bee *(Apis mellifera)*	92.5	12.5	Practically non-toxic	00143124 Meade, 1984	acceptable

An analysis of the results indicates that chlorimuron is categorized as practically non-toxic to bees on an acute contact basis.

b. Toxicity to Freshwater Aquatic Animals

i. Freshwater Fish, Acute

Two freshwater fish toxicity studies using the TGAI are required to establish the toxicity of chlorimuron to fish. The preferred test species are rainbow trout (a coldwater fish) and bluegill sunfish (a warm water fish). Results of these tests are tabulated below.

Freshwater Fish Acute Toxicity

Species	% ai	96-hour LC_{50} (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
Rainbow trout (static) *(Oncorhynchus mykiss)*	96	>12.0 [1]	slightly toxic	00131574 Hall, 1983	acceptable
Bluegill sunfish (static) *(Lepomis macrochirus)*	96	>10	slightly toxic	00131575 Hall, 1983	Acceptable [2]

1 Test material precipitation occurred in area of pipette stream where localized concentrations exceeded the solubility of the test water. Mixing permitted dissolution of the material.

2 Registrant has adequately demonstrated why the test material formed during testing and that appropriate measures were taken to get the material into test solution. Therefore the study was considered to be acceptable for guideline requirements. EEB Review 2/12/85 for proposed registration of soybean.

Since the $LC_{50} > 10$ ppm, chlorimuron is categorized as slightly toxic to freshwater fish on an acute basis.

ii. Freshwater Fish, Chronic

A freshwater fish early life-stage test using the TGAI is not required for Chlorimuron because the EEC in water is less than 0.01 of any acute LC_{50} value.

Freshwater Fish Early-Life Stage Toxicity

Species	% ai	NOEC	Remarks	MRID No. Author/Year	Study Classification
Rainbow trout *(Oncorhynchus mykiss)*	99.4	8.2 ppm	Last day hatching LOEC = 16 ppm	45017901 Hoke, 1999	acceptable

iii. Freshwater Invertebrates, Acute

A freshwater aquatic invertebrate toxicity test using the TGAI is required to establish the toxicity of chlorimuron to aquatic invertebrates. The preferred test species is *Daphnia magna*. Results of this test are tabulated below.

Freshwater Invertebrate Acute Toxicity

Species	% ai	48-hour LC_{50}/ EC_{50} (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
Waterflea *(Daphnia magna)*	96	>10	Slightly toxic	00131576 Hall, 1983	Acceptable [1]
Waterflea *(Daphnia magna)*	unknown	>1000	Practically non-toxic	143123 E.I. DuPont, 1984	Supplemental [2]

1 Registrant has adequately demonstrated why the test material formed during testing and that appropriate measures were taken to get the material into test solution. Therefore the study was considered to be acceptable for guideline requirements per EEB Review 2/12/85 for proposed registration of soybean.

2 Study had minimal information and no raw data. Only 3 replicates were used and 3 concentration doses. Study may be a range finding study.

Since the EC_{50} >10 ppm, chlorimuron is categorized as slightly toxic to aquatic invertebrates on an acute basis.

iv. Freshwater Invertebrate, Chronic

The preferred test species is *Daphnia magna*. Results of the test are tabulated below.

Freshwater Invertebrate Life Cycle Toxicity

Species/Static or Flow-through	% ai	NOEC	Remarks	MRID No. Author/Year	Study Classification
Waterflea *(Daphnia magna)*		NOEC= 106 ppm LOEC= 211 ppm	total length and dry weight	44459701 Samel, Drottar, 1997	acceptable

c. Toxicity to Estuarine and Marine Animals

No data available

d. Toxicity to Plants

i. Terrestrial Plants

Currently, terrestrial plant testing is not required for pesticides other than herbicides except on a case-by-case basis (*e.g.*, labeling contains phytotoxicity warnings, incident data, or literature that demonstrate phytotoxicity). Chlorimuron is a herbicide. Therefore, a Tier II seedling emergence and vegetative vigor tests (123-1) are needed to assess risk to non-target terrestrial plants.

For seedling emergence and vegetative vigor testing the following plant species and groups should be tested: (1) six species of at least four dicotyledonous families, one species of which is soybean (*Glycine max*) and the second is a root crop, and (2) four species of at least two monocotyledonous families, one of which is corn (*Zea mays*). Result of the test is tabulated below.

Toxicity of Chlorimuron to Terrestrial Plants - Tier II Seedling Emergence

Species (slope)	*% ai*	*EC_{25} (lb ai/A)*	*NOEC (lb ai/A)*	*Parameter*	*MRID No. Author, Year*	*Study Classification*
Onion	97.5 + acetone	**1.14E-05**	**0.496E-05**	**Shoot weight**	43777201 Heldreth, 1995	Acceptable
Rape		**2.5E-05**	**0.077E-05**	**Shoot height**		
Cucumber		9.81E-05	0.000159	Shoot weight		
Sugar beet		12.4E-05	0.000159	Shoot weight		
Tomato		18.0E-05	0.00016	Shoot weight		
Sorghum		61.8E-05	0.000638	Shoot weight		
Corn		61.9E-05	<0.000638	Shoot weight		
Wheat		220.0E-05	0.00032	Shoot weight		
Pea		320.6E-05	0.001269	Shoot weight		
Soybean		>0.24375	0.020313	Visual response		

The sensitivity of monocots and dicots are similar. Therefore, there should not be any distinction of phytotoxicity between the monocots and dicots.

The EC25 for rape is less than the NOEC. This may be due to the slope being 0.64.

Toxicity of Chlorimuron to Terrestrial Plants - Tier II Vegetative Vigor

Species	*% ai*	*EC_{25} (lb ai/A)*	*NOEC (lb ai/A)*	*Parameter*	*MRID No. Author, Year*	*Study Classification*
Rape	97.5 + 0.025% Non-ionic	**1.56E-05**	**0.124E-05**	**Shoot height**	43777201 Heldreth, 1995	acceptable
Onion		**4.45E-05**	**1.98E-05**	**Shoot weight**		
Cucumber		5.64E-05	0.000159	Visual response		
Sugar beet		7.75E-05	1.98E-05	Shoot weight		

Species	% ai	EC_{25} (lb ai/A)	NOEC (lb ai/A)	Parameter	MRID No. Author, Year	Study Classification
Tomato	surfactant	0.00025	0.000159	Shoot weight		
Sorghum		0.00057	0.000318	Shoot weight		
Corn		0.00066	0.000638	Shoot weight		
Wheat		0.00069	0.000638	Shoot weight		
Pea		0.00164	7.94E-05	Visual response		
Soybean		0.00376	0.001269	Shoot weight		

The sensitivity of monocots and dicots are similar. Therefore, there should not be any distinction of phytotoxicity between the monocots and dicots.

ii. Aquatic Plants

Currently, aquatic plant testing is not required for pesticides other than herbicides and fungicides except on a case-by-case basis (*e.g.*, labeling contains phytotoxicity warnings, incident data, or literature that demonstrate phytotoxicity). Chlorimuron is a herbicide. Therefore, Tier II phytotoxicity testing for non-target aquatic plants is needed at this time.

The following plant species should be tested: a green alga (*Selenastrum Capricornutum*), a bluegreen algae (*Anabaena flos-aquae*), a marine diatom *Skeletonema costatum*), freshwater diatom (*Navicula pelliculosa*), and duckweed (*Lemna gibba*). Result of the test is tabulated below.

Non-target Aquatic Plant Toxicity (Tier II)

Species	**AI**	**EC50 (a.i.)**	**NOEC (a.i.)**	**parameter**	**Study Category**	**MRID**
Green algae		1.1 ug/L	0.31 ug/L	Cell density		43945501
(*Selenastrum capricornutum*)	98.2	0.77 ug/L	0.17 ug/L	Biomass	Acceptable	Thompson, 1996
Marine diatom						43945501
(*Skeletonema costatum*)	98.2	(1)			Acceptable	Thompson, 1996
Freshwater diatom						43945501
(*Navicula pelliculosa*)	98.2	(2)			Acceptable	Thompson, 1996
Duckweed		0.27 ug/L	0.07 ug/L	Frond number		43913401
(*Lemna gibba*)	98.0	0.45 ug/L	0.07 ug/L	biomass	Acceptable	Kannuck, 1996
Bluegreen algae		18.0 ug/L	2.8 ug/L	Cell density		43945501
(*Anabaena flos-aquae*)	98.2	16.0 ug/L	2.8 ug/L	Biomass	Acceptable	Thompson, 1996

(1) 120 hour result is 11% simulation compared to controls
(2) 120 hour result is 29% stimulation when compared to controls

Appendix B T-REX Methodology

Acute dose-based approach.

The dose-based approach assumes that the uptake and absorption kinetics of a gavage toxicity study approximate the absorption associated with uptake from a dietary matrix. Toxic response is a function of duration and intensity of exposure and the importance of absorption kinetics across the gut and the importance of enzymatic activation/deactivation of a toxicant may be important and are likely variable across chemicals and species. For many compounds a gavage dose represents a very short-term high intensity exposure, where dietary exposure may be of a more prolonged nature. The dietary-based approach assumes that animals in the field are consuming food at a rate similar to that of confined laboratory animals. Energy content in food items differs between the field and the laboratory as does the energy requirements of wild and captive animals. The Wildlife Exposure Factors Handbook can provide insights into energy requirements of animals in the wild as well as energy content of their diets

Reproduction RQ Approach

The typical 21-week avian reproduction study does not define the true exposure duration needed to elicit the observed responses. The study protocol was designed to establish a steady-state tissue concentration for bioaccumulative compounds. For other pesticides, it is entirely possible that steady-state tissue concentrations are achieved earlier than the 21-week exposure period. Moreover, pesticides may exert effects at critical periods of the reproduction cycle and so long term exposure may not be necessary to elicit the effect observed in the 21-week protocol. The EFED screening risk assessment uses the single-day maximum estimated EEC as a conservative approach. The degree to which this exposure is conservative cannot be determined by the existing reproduction study. However, risk assessment discussions should be accompanied by the graphics from the T-REX model regarding the number of days dietary exposure is above the NOAEC. The greater number of days EECs exceed the NOAEC, the greater the confidence in predictions of reproductive risk concerns.

USEPA. 1993. Wildlife Exposure Factors Handbook. Volume I of II. EPA/600/R-93/187a. Office of Research and Development, Washington, DC 20460.

The table below shows the input for T-REX:

Chemical Name:	chlorimuron
Use:	GAT soybean and corn
Product name and form:	Classic
% A.I. (leading zero must be entered for formulations <1% a.i.):	100.00%
Application Rate (lbs/A):	0.0625
Half-life (days):	30
Application Interval (days):	
Number of Applications:	1

Note: Sources of wildlife diet are assumed to be available for less than one year for this model.

Endpoints

Avian

		Indicate test species below
LD50 (mg/kg-bw)		Mallard duck
LC50 (mg/kg-diet)		Bobwhite quail
NOAEL (mg/kg-bw)		Mallard duck
NOAEC (mg/kg-diet)	180.00	Bobwhite quail
Enter the Mineau et al. Scaling Factor	1.15	

Mammals

LD50 (mg/kg-bw)		
LC50 (mg/kg-diet)		
Reported Chronic Endpoint	17.00	mg/kg-bw
Is dietary concentration (mg/kg-diet) reported from the available chronic mammal study? (yes or no)	yes	
Enter dietary concentration (mg/kg-diet)	250.00	

Endpoints			
Avian	Mallard duck	LD50 (mg/kg-bw)	0.00
	Bobwhite quail	LC50 (mg/kg-diet)	0.00
	Mallard duck	NOAEL(mg/kg-bw)	0.00
	Bobwhite quail	NOAEC (mg/kg-diet)	180.00
Mammals		LD50 (mg/kg-bw)	0.00
		LC50 (mg/kg-diet)	0.00
		NOAEL (mg/kg-bw)	17.00
		NOAEC (mg/kg-diet)	250.00

Dietary-based EECs (ppm)	Kenaga Values
Short Grass	15.00
Tall Grass	6.88
Broadleaf plants/sm Insects	8.44
Fruits/pods/seeds/lg insects	0.94

Avian Results

Avian Class	Body Weight (g)	Ingestion (Fdry) (g bw/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Small	20	5	23	114	2.28E-02
Mid	100	13	65	65	6.49E-02
Large	1000	58	291	29	2.91E-01

Avian Body Weight (g)	Adjusted LD50 (mg/kg-bw)
20	0.00
100	0.00
1000	0.00

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small 20 g	mid 100 g	large 1000 g
Short Grass	17.08	9.74	4.36
Tall Grass	7.83	4.46	2.00
Broadleaf plants/sm Insects	9.61	5.48	2.45
Fruits/pods/seeds/lg insects	1.07	0.61	0.27

Dose-based RQs (Dose-based EEC/adjusted LD50)	Avian Acute RQs		
	20 g	100 g	1000 g
Short Grass	#DIV/0!	#DIV/0!	#DIV/0!
Tall Grass	#DIV/0!	#DIV/0!	#DIV/0!
Broadleaf plants/sm Insects	#DIV/0!	#DIV/0!	#DIV/0!
Fruits/pods/seeds/lg insects	#DIV/0!	#DIV/0!	#DIV/0!

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	RQs	
	Acute	Chronic
Short Grass	#DIV/0!	0.08
Tall Grass	#DIV/0!	0.04
Broadleaf plants/sm Insects	#DIV/0!	0.05
Fruits/pods/seeds/lg insects	#DIV/0!	0.01

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

Mammalian Results

Mammalian Class	Body Weight	Ingestion (Fdry) (g bwt/day)	Ingestion (Fwet) (g/day)	% body wgt consumed	FI (kg-diet/day)
Herbivores/ insectivores	15	3	14	95	1.43E-02
	35	5	23	66	2.31E-02
	1000	31	153	15	1.53E-01
Grainvores	15	3	3	21	3.18E-03
	35	5	5	15	5.13E-03
	1000	31	34	3	3.40E-02

Mammalian Class	Body Weight	Adjusted LD50	Adjusted NOAEL
Herbivores/ insectivores	15	0.00	37.36
	35	0.00	30.23
	1000	0.00	13.08
Grainvores	15	0.00	37.36
	35	0.00	30.23
	1000	0.00	13.08

Dose-Based EECs (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	14.30	9.88	2.29			
Tall Grass	6.55	4.53	1.05			
Broadleaf plants/sm Insects	8.04	5.56	1.29			
Fruits/pods/seeds/lg insects	0.89	0.62	0.14	0.20	0.14	0.03

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	#DIV/0!	0.38	#DIV/0!	0.33	#DIV/0!	0.18
Tall Grass	#DIV/0!	0.18	#DIV/0!	0.15	#DIV/0!	0.08
Broadleaf plants/sm insects	#DIV/0!	0.22	#DIV/0!	0.18	#DIV/0!	0.10
Fruits/pods/lg insects	#DIV/0!	0.02	#DIV/0!	0.02	#DIV/0!	0.01
Seeds (granivore)	#DIV/0!	0.01	#DIV/0!	0.00	#DIV/0!	0.00

Dietary-based RQs (Dietary-based EEC/LC50 or NOAEC)	Mammal RQs	
	Acute	Chronic
Short Grass	#DIV/0!	0.06
Tall Grass	#DIV/0!	0.03
Broadleaf plants/sm insects	#DIV/0!	0.03
Fruits/pods/seeds/lg insects	#DIV/0!	0.00

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

Appendix C TERRPLANT Results

TerrPlant v. 1.2.2
Aerial Application

Table 1. Chemical Identity.	
Chemical Name	**chlorimuron**
PC code	**x**
Use	**GAT soybean and corn**
Application Method	**aerial**
Application Form	**liquid**
Solubility in Water (ppm)	**1200**

Table 2. Input parameters used to derive EECs.			
Input Parameter	**Symbol**	**Value**	**Units**
Application Rate	A	**0.0625**	**lb ai/A**
Incorporation	I	**1**	none
Runoff Fraction	R	**0.05**	none
Drift Fraction	D	**0.05**	none

Table 3. EECs for chlorimuron . Units in lb ai/A.		
Description	**Equation**	**EEC**
Runoff to dry areas	(A/I)*R	0.003125
Runoff to semi-aquatic areas	(A/I)*R*10	0.03125
Spray drift	**A*D**	**0.003125**
Total for dry areas	**((A/I)*R)+(A*D)**	**0.00625**
Total for semi-aquatic areas	**((A/I)*R*10)+(A*D)**	**0.034375**

Table 4. Plant survival and growth data used for RQ derivation. Units are in lb ai/A.				
	Seedling Emergence		**Vegetative Vigor**	
Plant type	**EC_{25}**	**NOAEC**	**EC_{25}**	**NOAEC**
Monocot	0.000011	0.000005	4.30E-05	2.00E-05
Dicot	0.000025	8.00E-06	3.30E-05	1.00E-05

Table 5. RQ values for plants in dry and semi-aquatic areas exposed to chlorimuron through runoff and/or spray drift.*				
Plant Type	**Listed Status**	**Dry**	**Semi-Aquatic**	**Spray Drift**
Monocot	non-listed	145.35	799.42	72.67
Monocot	listed	312.50	1718.75	635.00
Dicot	non-listed	250.00	1375.00	125.00
Dicot	listed	781.25	4296.88	390.63
*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.				

TerrPlant v. 1.2.2
Ground Application

Table 1. Chemical Identity.	
Chemical Name	**chlorimuron**
PC code	**x**
Use	**GAT soybean and corn**
Application Method	**ground**
Application Form	**liquid**
Solubility in Water (ppm)	**1200**

Table 2. Input parameters used to derive EECs.			
Input Parameter	**Symbol**	**Value**	**Units**
Application Rate	A	**0.0625**	**lb ai/A**
Incorporation	I	**1**	none
Runoff Fraction	R	**0.05**	none
Drift Fraction	D	**0.01**	none

Table 3. EECs for chlorimuron . Units in lb ai/A.		
Description	**Equation**	**EEC**
Runoff to dry areas	(A/I)*R	0.003125
Runoff to semi-aquatic areas	(A/I)*R*10	0.03125
Spray drift	**A*D**	**0.000625**
Total for dry areas	**((A/I)*R)+(A*D)**	**0.00375**
Total for semi-aquatic areas	**((A/I)*R*10)+(A*D)**	**0.031875**

Table 4. Plant survival and growth data used for RQ derivation. Units are in lb ai/A.				
	Seedling Emergence		**Vegetative Vigor**	
Plant type	**EC_{25}**	**NOAEC**	**EC_{25}**	**NOAEC**
Monocot	0.000011	0.000005	4.30E-05	2.00E-05
Dicot	0.000025	8.00E-06	3.30E-05	1.00E-05

Table 5. RQ values for plants in dry and semi-aquatic areas exposed to chlorimuron through runoff and/or spray drift.*				
Plant Type	**Listed Status**	**Dry**	**Semi-Aquatic**	**Spray Drift**
Monocot	non-listed	87.21	741.28	14.53
Monocot	listed	187.50	1593.75	31.25
Dicot	non-listed	150.00	1275.00	25.00
Dicot	listed	468.75	3984.38	78.13
*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.				

Model:	**TerrPlant**
Version:	1.2.2
Date:	12/26/2006
Contact:	This spreadsheet was developed by the Plant Technical Team (PTT) of the Environmental Fate and Effects Division (EFED). For more information or assistance, please contact the PTT Co-Chairs.
Description:	TerrPlant is used by EFED as a Tier 1 model for screening level assessments of pesticides. The purpose of this model is to provide estimates of exposure to terrestrial plants from single pesticide applications. The model does not consider exposures to plants from multiple pesticide applications. TerrPlant derives pesticide EECs in runoff and in drift. RQs are developed for non-listed and listed species of monocots and dicots inhabiting dry and semi-aquatic areas.
Documentation:	Equations for EEC calculations are located in table 3 of the model spreadsheet. Please see user manual for model description, including conceptual model, input parameter guidance, assumptions, uncertainties and references. Click on the hyperlink below. ..\User Guide\TerrPlant_v1.2.2_User Guide.doc
Past Versions: (date)	1.0 (October 16, 2002) 1.2.1 (November 9, 2005)
Version Update Notes:	1) In 2005, TerrPlant was modified to v1.2.1 in order to remove an assumption that aerial applications result in 60% application efficiency. TerrPlant v1.2.1 and v1.2.2 assume 100% efficiency in ground and aerial applications (USEPA 2005). Note that application efficiency is considered separately from spray drift; where the sum of the two does not necessarily equal 100%. 2) v1.2.2 represents a cosmetic update of v1.2.1. The EECs and RQs are the same when comparing outputs of the two versions. No model assumptions or equations were altered from v1.2.1. 3) v1.2.2 automates the derivation of EECs by allowing the user to indicate the drift assumption. This results in direct calculation of EECs relevant to the application method and form. The previous version did not allow the user to select drift assumptions. This resulted in calculation of EECs which were not relevant to the pesticide being modeled. For example, if a user was modeling a liquid pesticide applied by ground, v1.2.1 automatically calculated EECs and RQs for pesticides applied by aerial methods. The model also calculated EECs and RQs for the pesticide assuming it was a granular form. For v1.2.2, the default assumptions for spray drift are 1% for ground and 5% for aerial methods.

4) v1.2.1 incorrectly indicated that the user should input the incorporation depth in terms of units of cm. v1.2.2 corrects the units reference to inches.
5) Current guidance indicates that drift EECs should be compared to the more sensitive measure of effect: either seedling emergence or vegetative vigor. v1.2.2 derives RQs for non-listed species exposed to drift by automating the selection of the lowest EC25 value for both monocots and dicots when comparing the two endpoints. It then selects the corresponding NOAEC value for monocots and dicots for derivation of RQs for listed species exposed to drift.

Notes to User:

1) In cases where multiple application methods (ground and aerial/airblast/spray chemigation) and/or application forms (liquid and granule) are possible for a pesticide, multiple drift fractions are possible for a pesticide. This impacts the calculation of EECs of that pesticide. To calculate the different EECs and resulting RQs for the different possible drift fractions, the user should complete the following steps: A) input all relevant data for the pesticide according to one relevant type of application method and form (Tables 1, 2 and 4); B) copy the worksheet within the Excel file; C) alter the relevant application method and/or form to represent another application scenario; and D) repeat as necessary.
2) In cases where a pesticide label allows for multiple applications, the single highest application rate should be modeled. If the single highest application rate is lower than the maximum annual application rate, the maximum annual rate should not be modeled.

Appendix D PRZM-EXAMS Output

stored as chlor14.out
Chemical: chlorimuron-ethyl
PRZM environment: MScornSTD.txt modified Tueday, 29 May 2007 at 13:57:40
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 06:14:08
Metfile: w03940.dvf modified Tueday, 26 August 2008 at 06:14:14
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.465	0.4619	0.4492	0.4225	0.4014	0.2284
1962	2.617	2.605	2.569	2.446	2.325	1.304
1963	1.458	1.447	1.422	1.365	1.312	1.024
1964	1.959	1.947	1.898	1.816	1.727	1.113
1965	0.9728	0.9673	0.9444	0.8921	0.8513	0.6852
1966	1.212	1.205	1.178	1.122	1.069	0.7034
1967	1.371	1.364	1.337	1.259	1.199	0.8366
1968	1.092	1.087	1.071	1.022	0.9695	0.724
1969	2.011	1.999	1.951	1.835	1.737	1.08
1970	1.14	1.132	1.107	1.076	1.031	0.7902
1971	1.948	1.938	1.901	1.82	1.73	1.069
1972	1.085	1.078	1.062	1.003	0.9687	0.7578
1973	3.086	3.071	3.024	2.862	2.711	1.573
1974	3.346	3.33	3.287	3.134	2.99	1.985
1975	1.856	1.844	1.815	1.709	1.649	1.319
1976	1.174	1.167	1.143	1.09	1.047	0.826
1977	1.389	1.381	1.345	1.261	1.194	0.8035
1978	1.024	1.018	1.011	0.9777	0.9369	0.6668
1979	5.456	5.428	5.332	5.075	4.842	2.801
1980	6.463	6.432	6.332	5.991	5.686	3.661
1981	2.691	2.685	2.657	2.592	2.534	1.966
1982	2.266	2.254	2.222	2.083	1.975	1.382
1983	3.797	3.781	3.711	3.578	3.433	2.142
1984	1.991	1.978	1.929	1.853	1.784	1.447
1985	1.074	1.068	1.045	0.9888	0.9534	0.7642
1986	0.7175	0.7138	0.7009	0.6606	0.6514	0.4954
1987	0.6397	0.6351	0.6182	0.581	0.5508	0.4016
1988	0.9599	0.9546	0.9306	0.8718	0.8254	0.532
1989	1.325	1.316	1.293	1.237	1.175	0.7563
1990	1.048	1.041	1.014	0.9709	0.9233	0.6829

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	6.463	6.432	6.332	5.991	5.686	3.661
0.0645161290322581	5.456	5.428	5.332	5.075	4.842	2.801
0.0967741935483871	3.797	3.781	3.711	3.578	3.433	2.142
0.129032258064516	3.346	3.33	3.287	3.134	2.99	1.985
0.161290322580645	3.086	3.071	3.024	2.862	2.711	1.966
0.193548387096774	2.691	2.685	2.657	2.592	2.534	1.573
0.225806451612903	2.617	2.605	2.569	2.446	2.325	1.447
0.258064516129032	2.266	2.254	2.222	2.083	1.975	1.382
0.290322580645161	2.011	1.999	1.951	1.853	1.784	1.319

```
0.32258064516129  1.991 1.978 1.929 1.835 1.737 1.304
0.354838709677419 1.959 1.947 1.901 1.82  1.73  1.113
0.387096774193548 1.948 1.938 1.898 1.816 1.727 1.08
0.419354838709677 1.856 1.844 1.815 1.709 1.649 1.069
0.451612903225806 1.458 1.447 1.422 1.365 1.312 1.024
0.483870967741936 1.389 1.381 1.345 1.261 1.199 0.8366
0.516129032258065 1.371 1.364 1.337 1.259 1.194 0.826
0.548387096774194 1.325 1.316 1.293 1.237 1.175 0.8035
0.580645161290323 1.212 1.205 1.178 1.122 1.069 0.7902
0.612903225806452 1.174 1.167 1.143 1.09  1.047 0.7642
0.645161290322581 1.14  1.132 1.107 1.076 1.031 0.7578
0.67741935483871  1.092 1.087 1.071 1.022 0.9695      0.7563
0.709677419354839 1.085 1.078 1.062 1.003 0.9687      0.724
0.741935483870968 1.074 1.068 1.045 0.9888      0.9534      0.7034
0.774193548387097 1.048 1.041 1.014 0.9777      0.9369      0.6852
0.806451612903226 1.024 1.018 1.011 0.9709      0.9233      0.6829
0.838709677419355 0.9728      0.9673      0.9444      0.8921
      0.8513      0.6668
0.870967741935484 0.9599      0.9546      0.9306      0.8718
      0.8254      0.532
0.903225806451613 0.7175      0.7138      0.7009      0.6606
      0.6514      0.4954
0.935483870967742 0.6397      0.6351      0.6182      0.581 0.5508
      0.4016
0.967741935483871 0.465 0.4619      0.4492      0.4225      0.4014
      0.2284

0.1   3.7519      3.7359      3.6686      3.5336      3.3887
      2.1263
                              Average of yearly averages:
      1.15067666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: chlor14
Metfile:    w03940.dvf
PRZM scenario:    MScornSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:    chlorimuron-ethyl
Description Variable Name     Value Units Comments
Molecular weight  mwt   414.8 g/mol
Henry's Law Const.      henry 7.48E-14    atm-m^3/mol
Vapor Pressure    vapr  1.5E-5      torr
Solubility  sol   1200  mg/L
Kd    Kd    1.6   mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 212   days  Halfife
Anaerobic Aquatic Metabolism  kbacs 21    days  Halfife
Aerobic Soil Metabolism asm   106   days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0.0   cm
Application Rate: TAPP  0.07  kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
```

Application Date Date 10-04 dd/mm or dd/mmm or dd-mm or dd-mmm
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

stored as chlor20.out
Chemical: chlorimuron-ethyl
PRZM environment: NECornStd.txt modified Monday, 25 August 2008 at 15:38:46
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 06:14:08
Metfile: w94918.dvf modified Tueday, 26 August 2008 at 06:16:36
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.169	1.161	1.137	1.08	1.028	0.5225
1962	2.347	2.331	2.282	2.168	2.07	1.32
1963	1.753	1.74	1.718	1.639	1.562	1.326
1964	2.962	2.944	2.883	2.74	2.603	1.724
1965	2.021	2.008	1.977	1.884	1.799	1.571
1966	1.681	1.67	1.628	1.535	1.46	1.208
1967	1.639	1.633	1.605	1.517	1.45	1.131
1968	1.37	1.362	1.35	1.297	1.237	1.007
1969	1.077	1.071	1.045	1.004	0.9602	0.8152
1970	0.971	0.9651	0.9458	0.895	0.8535	0.7039
1971	0.7736	0.7681	0.7581	0.716	0.697	0.5991
1972	0.6818	0.6784	0.6662	0.642	0.619	0.5104
1973	1.827	1.818	1.768	1.666	1.587	0.9666
1974	1.321	1.316	1.284	1.214	1.157	0.9881
1975	0.9387	0.9335	0.912	0.8698	0.8268	0.7119
1976	0.8564	0.8504	0.822	0.761	0.7234	0.5877
1977	0.6945	0.6883	0.6725	0.6506	0.6407	0.5478
1978	0.7039	0.6992	0.6787	0.6399	0.618	0.5049
1979	0.679	0.6743	0.6545	0.6298	0.6044	0.4797
1980	1.184	1.177	1.155	1.08	1.021	0.6774
1981	0.7869	0.7818	0.7726	0.7394	0.7225	0.6643
1982	1.935	1.925	1.891	1.815	1.732	1.106
1983	1.721	1.711	1.666	1.551	1.466	1.195
1984	1.327	1.321	1.303	1.235	1.182	0.9919
1985	0.8453	0.8409	0.8299	0.7993	0.7875	0.6975
1986	0.7496	0.7442	0.7244	0.7041	0.6776	0.5577
1987	2.724	2.704	2.658	2.488	2.359	1.387
1988	2.063	2.049	1.982	1.931	1.853	1.547
1989	1.38	1.372	1.332	1.29	1.252	1.128
1990	1.103	1.096	1.066	1.012	0.975	0.8304

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	2.962	2.944	2.883	2.74	2.603	1.724
0.0645161290322581	2.724	2.704	2.658	2.488	2.359	1.571
0.0967741935483871	2.347	2.331	2.282	2.168	2.07	1.547
0.129032258064516	2.063	2.049	1.982	1.931	1.853	1.387
0.161290322580645	2.021	2.008	1.977	1.884	1.799	1.326
0.193548387096774	1.935	1.925	1.891	1.815	1.732	1.32
0.225806451612903	1.827	1.818	1.768	1.666	1.587	1.208
0.258064516129032	1.753	1.74	1.718	1.639	1.562	1.195
0.290322580645161	1.721	1.711	1.666	1.551	1.466	1.131
0.32258064516129	1.681	1.67	1.628	1.535	1.46	1.128
0.354838709677419	1.639	1.633	1.605	1.517	1.45	1.106
0.387096774193548	1.38	1.372	1.35	1.297	1.252	1.007
0.419354838709677	1.37	1.362	1.332	1.29	1.237	0.9919
0.451612903225806	1.327	1.321	1.303	1.235	1.182	0.9881
0.483870967741936	1.321	1.316	1.284	1.214	1.157	0.9666
0.516129032258065	1.184	1.177	1.155	1.08	1.028	0.8304
0.548387096774194	1.169	1.161	1.137	1.08	1.021	0.8152
0.580645161290323	1.103	1.096	1.066	1.012	0.975	0.7119
0.612903225806452	1.077	1.071	1.045	1.004	0.9602	0.7039
0.645161290322581	0.971	0.9651	0.9458	0.895	0.8535	0.6975
0.67741935483871	0.9387	0.9335	0.912	0.8698	0.8268	0.6774
0.709677419354839	0.8564	0.8504	0.8299	0.7993	0.7875	0.6643
0.741935483870968	0.8453	0.8409	0.822	0.761	0.7234	0.5991
0.774193548387097	0.7869	0.7818	0.7726	0.7394	0.7225	0.5877
0.806451612903226	0.7736	0.7681	0.7581	0.716	0.697	0.5577
0.838709677419355	0.7496	0.7442	0.7244	0.7041	0.6776	0.5478
0.870967741935484	0.7039	0.6992	0.6787	0.6506	0.6407	0.5225
0.903225806451613	0.6945	0.6883	0.6725	0.642	0.619	0.5104
0.935483870967742	0.6818	0.6784	0.6662	0.6399	0.618	0.5049
0.967741935483871	0.679	0.6743	0.6545	0.6298	0.6044	0.4797
0.1	2.3186	2.3028	2.252	2.1443	2.0483	1.531

Average of yearly averages:
0.933566666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: chlor20
Metfile: w94918.dvf
PRZM scenario: NECornStd.txt
EXAMS environment file: pond298.exv
Chemical Name: chlorimuron-ethyl

Description Variable Name Value Units Comments
Molecular weight mwt 414.8 g/mol
Henry's Law Const. henry 7.48E-14 atm-m^3/mol
Vapor Pressure vapr 1.5E-5 torr
Solubility sol 1200 mg/L
Kd Kd 1.6 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 212 days Halfife
Anaerobic Aquatic Metabolism kbacs 21 days Halfife
Aerobic Soil Metabolism asm 106 days Halfife
Hydrolysis: pH 7 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0.0 cm
Application Rate: TAPP 0.07 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 25-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

stored as chlor28.out
Chemical: chlorimuron-ethyl
PRZM environment: MSsoybeanSTD.txt modified Tueday, 29 May 2007 at 13:58:06
EXAMS environment: pond298.exv modified Tueday, 26 August 2008 at 06:14:08
Metfile: w03940.dvf modified Tueday, 26 August 2008 at 06:14:14
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.4342	0.4312	0.4191	0.393	0.3728	0.2028
1962	0.5571	0.553	0.5399	0.5062	0.4784	0.3127
1963	0.7291	0.7238	0.7021	0.6759	0.6542	0.4272
1964	0.8199	0.8149	0.7914	0.7385	0.6978	0.4699
1965	0.4762	0.4735	0.4618	0.4358	0.4168	0.3231
1966	0.8966	0.8916	0.8743	0.8285	0.7883	0.4887
1967	1.368	1.361	1.334	1.256	1.192	0.7734
1968	1.053	1.047	1.034	0.979	0.9272	0.6977
1969	2.85	2.834	2.766	2.602	2.463	1.45
1970	1.417	1.407	1.368	1.313	1.257	1.016
1971	1.762	1.753	1.723	1.639	1.556	1.007
1972	0.9066	0.9007	0.8831	0.8459	0.8103	0.644
1973	2.964	2.948	2.896	2.731	2.584	1.479

1974	1.573	1.565	1.529	1.45	1.382	1.093
1975	1.237	1.229	1.201	1.132	1.072	0.7882
1976	0.8303	0.8255	0.8116	0.7706	0.7408	0.572
1977	1.052	1.046	1.02	0.9536	0.9018	0.5949
1978	0.8669	0.8629	0.8463	0.8135	0.7765	0.5408
1979	0.9416	0.9357	0.9233	0.8721	0.8278	0.5693
1980	1.264	1.255	1.232	1.17	1.105	0.7081
1981	0.7315	0.7271	0.7108	0.6584	0.6415	0.5064
1982	1.249	1.242	1.22	1.142	1.081	0.6727
1983	1.001	0.9969	0.9709	0.9141	0.8631	0.6289
1984	0.8752	0.8696	0.8471	0.8037	0.7708	0.5542
1985	0.6168	0.6134	0.5996	0.5641	0.54	0.4025
1986	0.4999	0.4973	0.4853	0.4563	0.4343	0.3217
1987	0.542	0.5381	0.5228	0.4904	0.4646	0.3217
1988	0.874	0.8691	0.8471	0.7933	0.7507	0.4738
1989	1.306	1.299	1.281	1.218	1.155	0.7282
1990	1.366	1.357	1.321	1.248	1.191	0.8182

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	2.964	2.948	2.896	2.731	2.584	1.479
0.0645161290322581	2.85	2.834	2.766	2.602	2.463	1.45
0.0967741935483871	1.762	1.753	1.723	1.639	1.556	1.093
0.129032258064516	1.573	1.565	1.529	1.45	1.382	1.016
0.161290322580645	1.417	1.407	1.368	1.313	1.257	1.007
0.193548387096774	1.368	1.361	1.334	1.256	1.192	0.8182
0.225806451612903	1.366	1.357	1.321	1.248	1.191	0.7882
0.258064516129032	1.306	1.299	1.281	1.218	1.155	0.7734
0.290322580645161	1.264	1.255	1.232	1.17	1.105	0.7282
0.32258064516129	1.249	1.242	1.22	1.142	1.081	0.7081
0.354838709677419	1.237	1.229	1.201	1.132	1.072	0.6977
0.387096774193548	1.053	1.047	1.034	0.979	0.9272	0.6727
0.419354838709677	1.052	1.046	1.02	0.9536	0.9018	0.644
0.451612903225806	1.001	0.9969	0.9709	0.9141	0.8631	0.6289
0.483870967741936	0.9416	0.9357	0.9233	0.8721	0.8278	0.5949
0.516129032258065	0.9066	0.9007	0.8831	0.8459	0.8103	0.572
0.548387096774194	0.8966	0.8916	0.8743	0.8285	0.7883	0.5693
0.580645161290323	0.8752	0.8696	0.8471	0.8135	0.7765	0.5542
0.612903225806452	0.874	0.8691	0.8471	0.8037	0.7708	0.5408
0.645161290322581	0.8669	0.8629	0.8463	0.7933	0.7507	0.5064
0.67741935483871	0.8303	0.8255	0.8116	0.7706	0.7408	0.4887
0.709677419354839	0.8199	0.8149	0.7914	0.7385	0.6978	0.4738

```
0.741935483870968 0.7315      0.7271      0.7108      0.6759
      0.6542      0.4699
0.774193548387097 0.7291      0.7238      0.7021      0.6584
      0.6415      0.4272
0.806451612903226 0.6168      0.6134      0.5996      0.5641      0.54
      0.4025
0.838709677419355 0.5571      0.553 0.5399      0.5062      0.4784
      0.3231
0.870967741935484 0.542 0.5381      0.5228      0.4904      0.4646
      0.3217
0.903225806451613 0.4999      0.4973      0.4853      0.4563
      0.4343      0.3217
0.935483870967742 0.4762      0.4735      0.4618      0.4358
      0.4168      0.3127
0.967741935483871 0.4342      0.4312      0.4191      0.393 0.3728
      0.2028

0.1   1.7431      1.7342      1.7036      1.6201      1.5386
      1.0853
                              Average of yearly averages:   0.65287
```

Inputs generated by pe5.pl - Novemeber 2006

```
Data used for this run:
Output File: chlor28
Metfile:      w03940.dvf
PRZM scenario:      MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:      chlorimuron-ethyl
Description Variable Name      Value Units Comments
Molecular weight  mwt   414.8 g/mol
Henry's Law Const.      henry 7.48E-14      atm-m^3/mol
Vapor Pressure      vapr  1.5E-5      torr
Solubility  sol   1200  mg/L
Kd    Kd    1.6   mg/L
Koc   Koc         mg/L
Photolysis half-life      kdp   0     days  Half-life
Aerobic Aquatic Metabolism      kbacw 212   days  Halfife
Anaerobic Aquatic Metabolism    kbacs 21    days  Halfife
Aerobic Soil Metabolism asm   106   days  Halfife
Hydrolysis: pH 7  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:      DEPI  0.0   cm
Application Rate: TAPP  0.07  kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  16-04 dd/mm or dd/mmm or dd-mm or dd-mmm
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or
total(average of entire run)
```

Appendix E Chlorimuron-ethyl Incident Report

EIIS Pesticide Summary Report: General Information

Chlorimuron-ethyl (128901)

	Incident # / Formul.	Date / Appl. Method	County / Total Magnitude	State	Certainty	Legal.	
AQUATIC							
POND							
	I008768-007	6/3/1999			2	UN	
	N/R	N/R			200		
PLANTS							
Agricultural Area							
	I005880-011		LAFAYETTE	WI	3	MA	Spray
	I005880-055	5/18/1997		MN	3	UN	Spray
N/R							
	I009556-004			NC	2	MA	
	N/R			N/R	UNKNOWN		
	I009556-003			NC	2	MA	
	N/R			N/R	UNKNOWN		
	B000603-006	5/18/1997		IN	2	UN	N/R
	I016225-001	4/5/2005	Fayette	IL	2	UN	
	WDG	Spray	1 acre				
Soybean							
	I001131-001	6/27/1994	PULASKI	AR	2	RU	
	N/R	AERIAL	UNKNOWN				
	I007371-008	5/20/1997		PA	4	MA	N/R
	I012366-012	5/12/2000	MACOMB	MI	2	UN	Broadcast

Wednesday, September 12, 2007 Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident # Formul.	Date Appl. Method	County Total Magnitude	State	Certainty	Legal.	
I012366-016	6/21/2000		AR	2	UN	
I014108-001 WDG	5/1/2003 228 acres	Randolph	AR	2	RU	
I014106-001 WDG	5/15/2003 227 acres	Arkansas	AR	2	RU	
I014103-001 WDG	5/15/2003 300 acres	Arkansas	AR	2	RU	
I014102-001 WDG	5/15/2003 250 acres	Prairie	AR	2	RU	
Soybeans						
I014104-001 WDG	5/1/2003 45 acres	Randolph	AR	2	RU	

TERRESTRIAL

N/R

I007334-001	6/18/1998	White	IL	2	UN	Spray

 Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

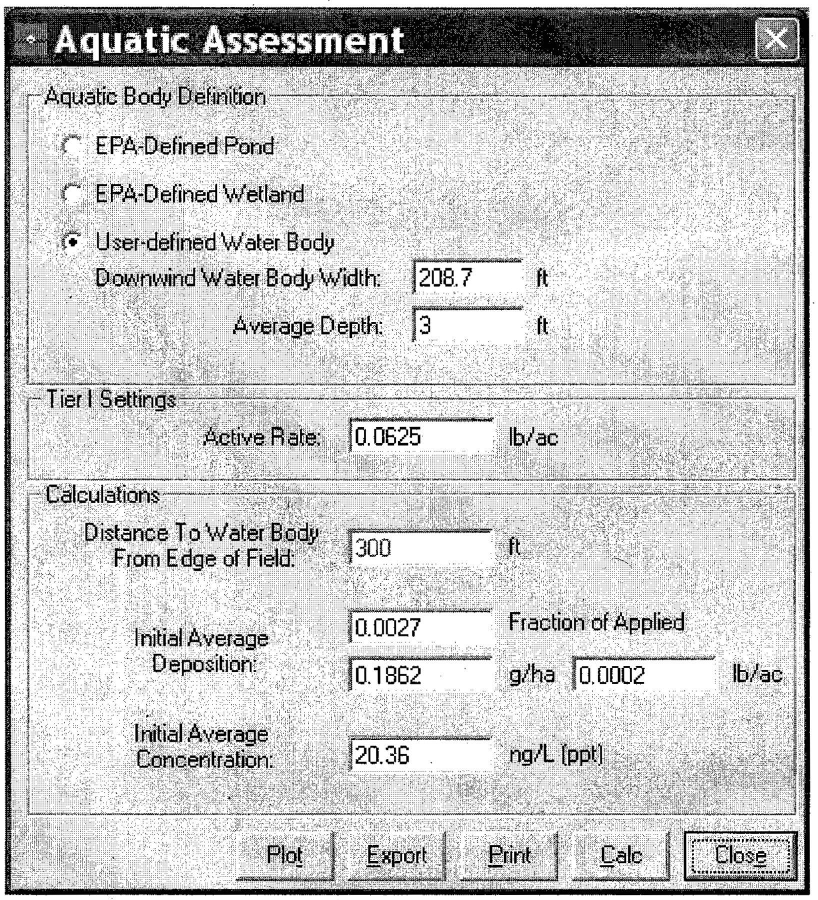
NA refers to information not available for the table below.

Incident No.	Year	State	No. Acres	Mixture – if mixture; chlorimuron plus names of others chemicals	Certainty index	comments
IO5880-011	NA	WI	1700	Command, Sencor	probable	Adverse effects on trees, oats, alfalfa, ornamentals
IO5880-055	1997	MN	NA	Command, Sencor	probable	Ginko, willows trees injured
IO9556-003	NA	NC	NA	Harmony, Canopy, Classic	possible	Non-target plant injury reported – no further details
IO9556-004	NA	NC	NA	Harmony, Canopy, Classic	possible	Non-target plant injury reported – no further details
IO7371-008	1997	PA	NA	Paraquat, Canopy	Highly probable	Residues found beyond property line. Non-target plant injury reported – no further details
BO00603-006	1997	IN	3	Command	Highly probable	Ginko and willow trees whiten. Whiten symptoms is more of Command mode of action effect.
IO16225-001	2005	IL	1	Glyphosate + imazapic ammonium salt or Canopy or Express	possible	two half/acre plots of strawberry plants were damaged as the result of spray drift from pesticides that had been applied to neighboring fields. One field had been treated with DuPont Canopy herbicide, another with DuPont Express Herbicide and a third with Monsanto Glyphosate + imazapic ammonium salt. The damage was reputed to be 60% mortality in one of the plots and, in the other, black spots appeared on the plants. No analyses were conducted, so it must be concluded that any of the products applied might have caused the damage.
IO1131-001	1994	AR		Classic, Sencor, Paraquat	possible	Trees and vegetables. Symptoms within 24 hrs.
IO14106-001	2003	AR	227	Metribuzin, S-Metolachlor, Sulfentrazone, Canopy XL, Boundary	possible	Three soybean fields sprayed. Carryover of residues into next year cause damage to Rice crop. Symtoms include poor root growth, chlorosis, stunting,
IO14108-001	2003	AR	228	Canopy XL, Roundup,	possible	Soybean fields sprayed. Carryover of residues into next year cause damage to Rice crop. Symtoms include poor root growth, chlorosis, stunting,
IO14103-001	2003	AR	300	S-Metolachlor, Sulfentrazone	possible	Soybean fields sprayed. Carryover of residues into next year cause damage to Rice crop. Symtoms

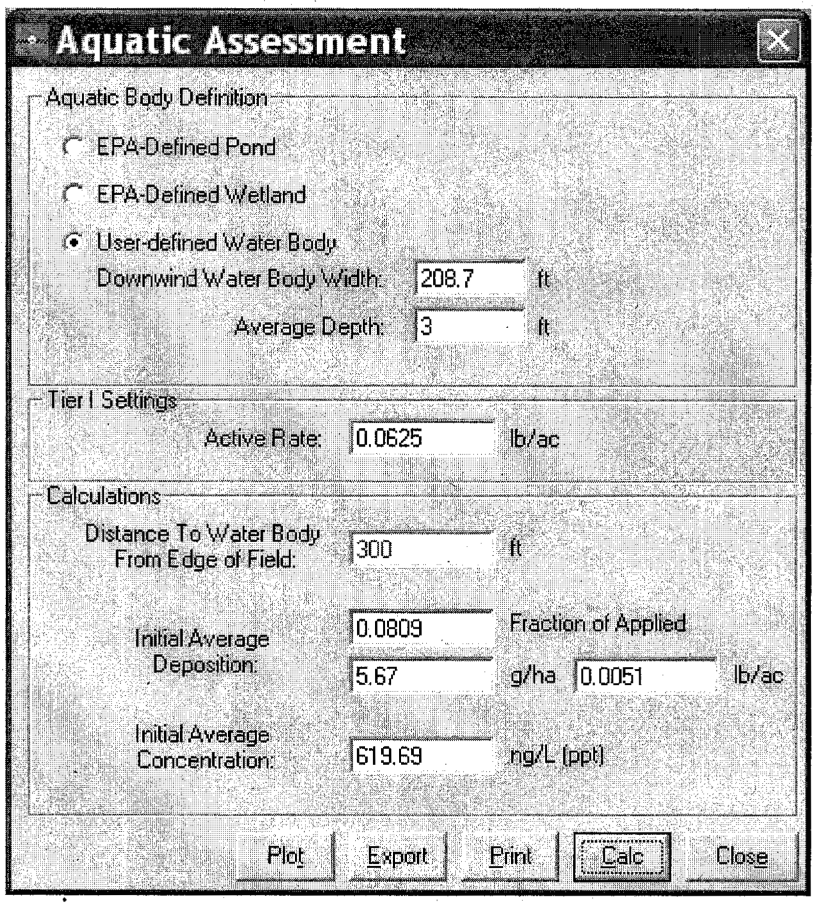
						include poor root growth, chlorosis, stunting
IO14102-001	2003	AR	250	Canopy XL, Authority, Boundary	possible	Soybean fields sprayed. Carryover of residues into next year cause damage to Rice crop. Symtoms include poor root growth, chlorosis, stunting
IO14104-001	2003	AR	45	Classic, Glyposate, Canopy XL	possible	Soybean fields sprayed. Carryover of residues into next year cause damage to Rice crop. Symtoms include poor root growth, chlorosis, stunting
IO07334-001	1998	IL	18 out of 103A	Paraquat, Canopy, Dual	Not determined	Corn crop damage one-half mile from application site, 4 birds dead, windy conditions at time of spraying,
I012366-012	2000	MI	320 out of 367 A	Python, Canopy and Partner	possible	PYTHON damaged 320 acres of a 367-acre soybean crop. In the Problem Description of the Dow report is the following: "Weather and moisture stress contributed to stunted, drawstringed leaves where ALSs were used."
IO08768-007	1999	na	0.75 A	Metribuzin and paraquat	possible	Approximately 200 dead fish, bluegill and bass combined, were reported by a Conservation Officer that were found in a 3/4 acre pond. At least two frogs also were found dead, but there were no deaths among pond catfish.

Appendix F AGDRIFT Output

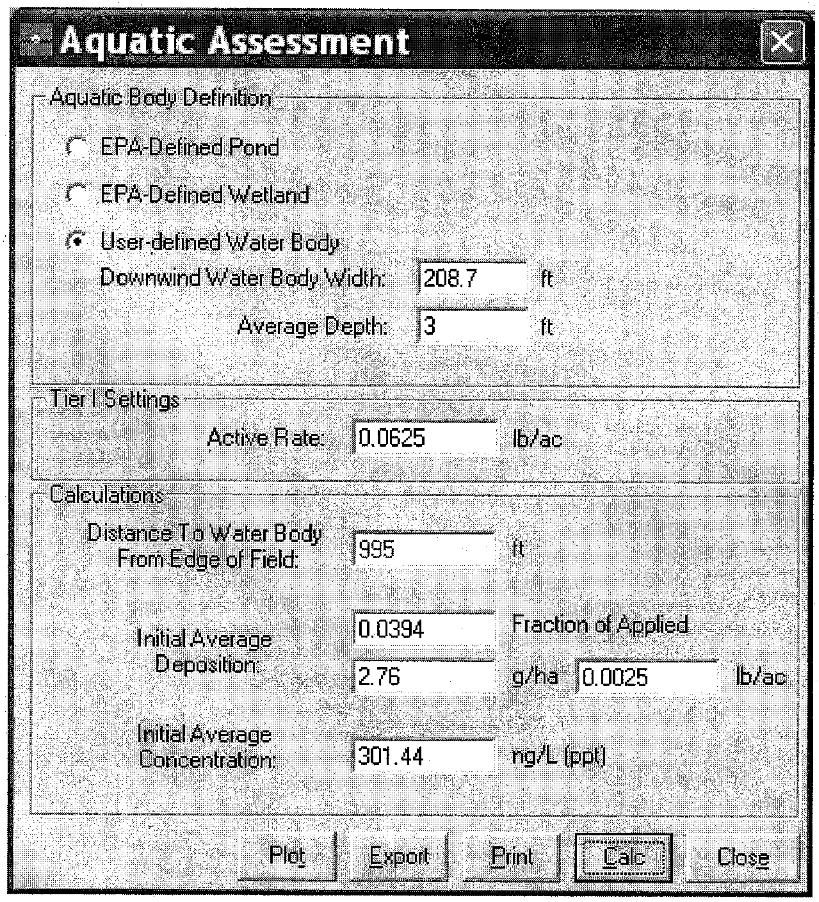
ASAE very fine to fine nozzle
Ground application, 300 ft from edge of field to water body, 3 feet depth



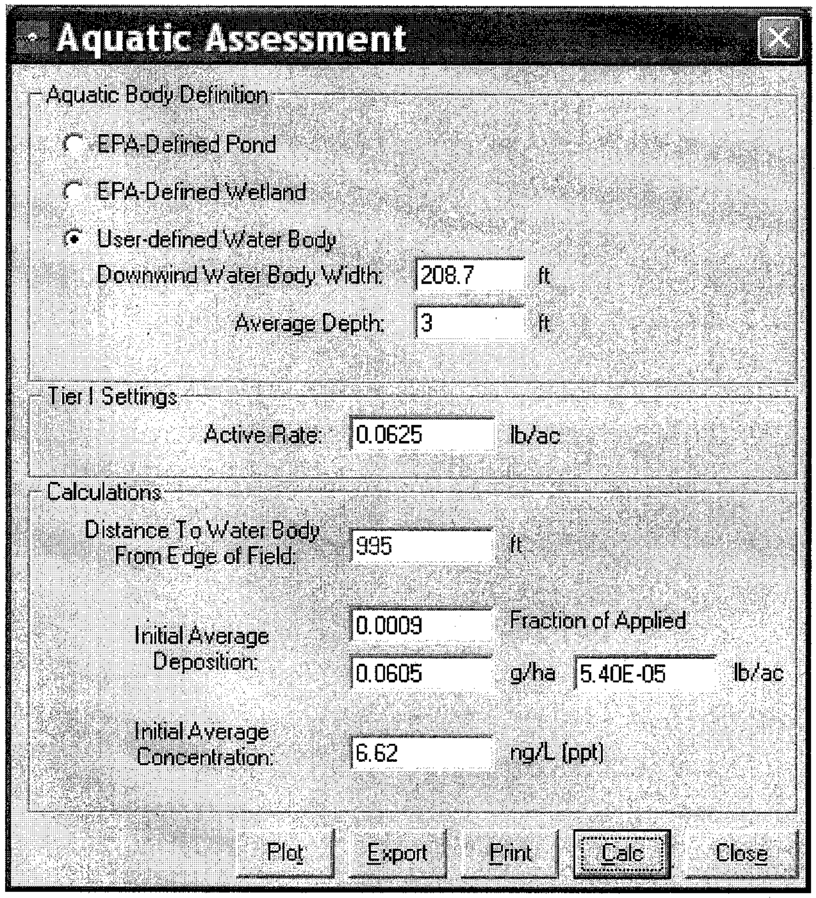
ASAE very fine to fine nozzle
Aerial application, 300 ft from edge of field to water body, 3 feet depth



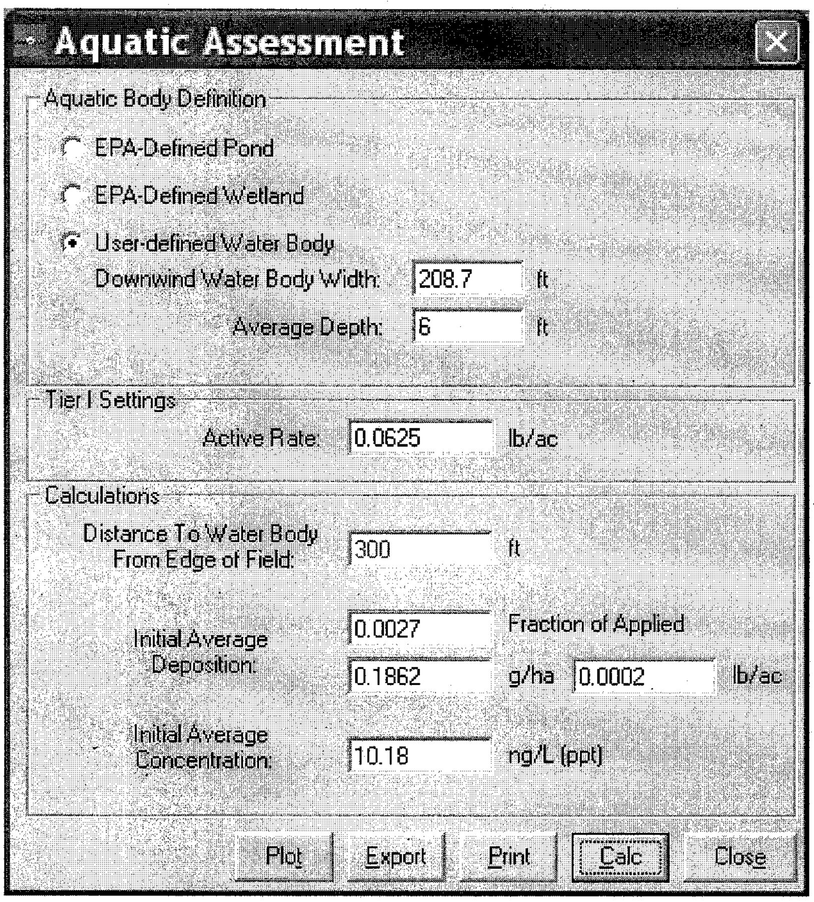
ASAE very fine to fine nozzle,
Aerial application, 3 ft. depth, 995 ft from edge of field to water body



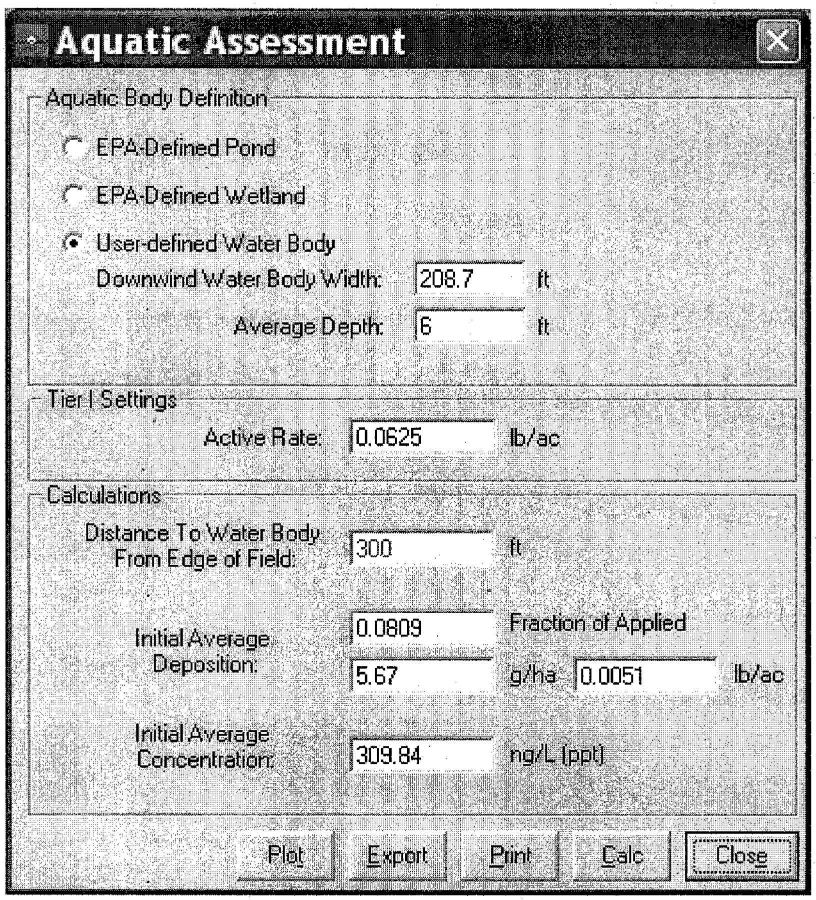
ASAE very fine to fine nozzle, low boom
Ground application, 3 ft. depth, 995 ft from edge of field to water body



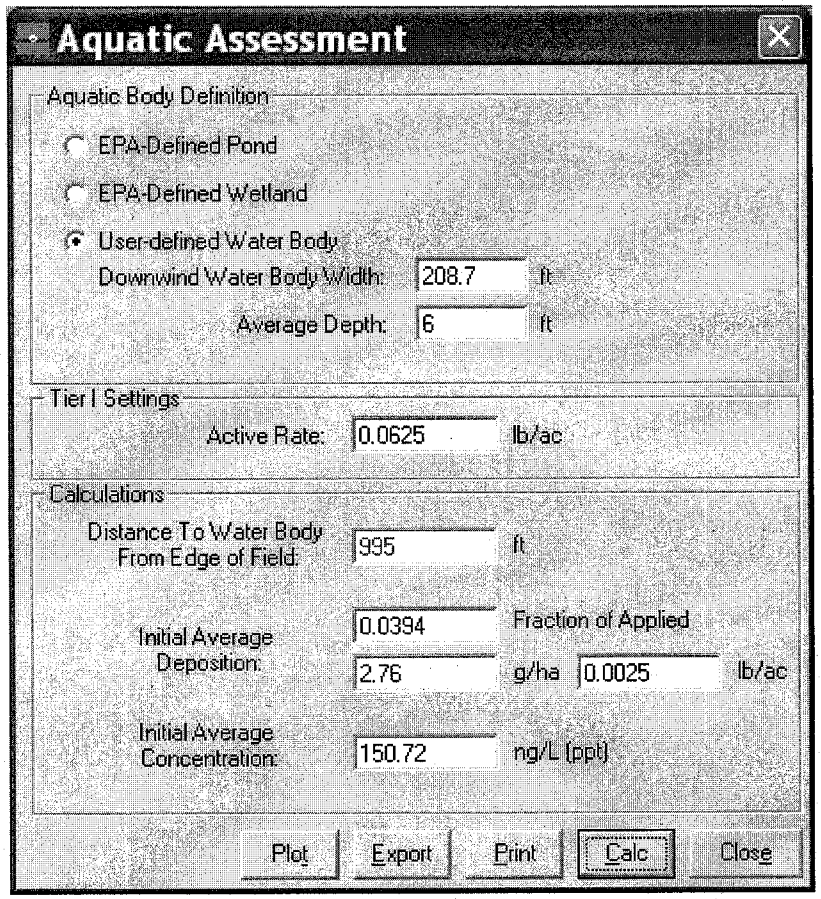
ASAE very fine to fine nozzle, low boom
Ground application, 6 ft. depth, 300 ft from edge of field to water body



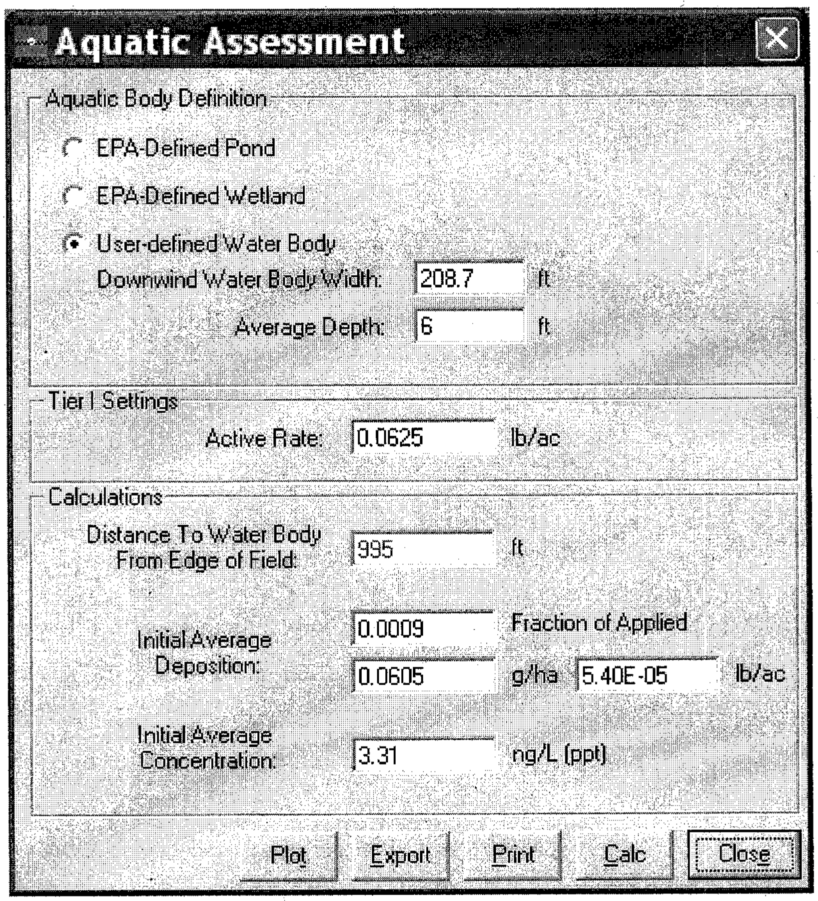
ASAE very fine to fine nozzle
Aerial application, 300 ft from edge of field to water body, 6 feet depth



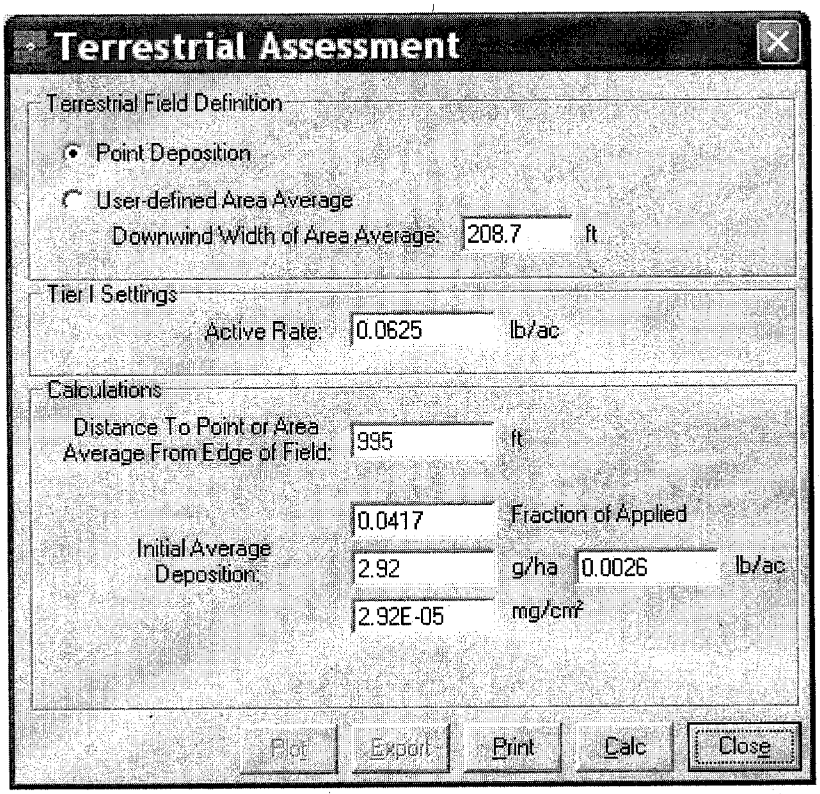
ASAE very fine to fine nozzle,
Aerial application, 6 ft. depth, 995 ft from edge of field to water body



ASAE very fine to fine nozzle, low boom
Ground application, 6 ft. depth, 995 ft from edge of field to water body



Aerial Application, ASAE very fine to fine nozzle
995 from edge of field



Ground Application, ASAE very fine to fine nozzle
995 from edge of field