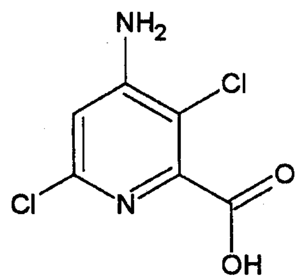
EPA
United States
Environmental Protection
Agency

Office of Prevention, Pesticides,
and Toxic Substances

Environmental Fate and Ecological Risk Assessment for the Registration of Aminopyralid



Aminopyralid, 4-amino-3,6-dichloro-2-pyridinecarboxylic acid
CAS Registry Number 150114-71-9
PC Codes 005100, 005209

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I. Executive Summary

Dow AgroSciences is seeking registration for the use of the new chemical, aminopyralid (XDE-750; 4-amino-3,6-dichloro-2-pyridinecarboxylic acid), and its herbicidal end-use product, GF-871 (40% a.i.), which contains triisopropanolammonium salt of aminopyralid as the sole active ingredient (21% aminopyralid acid equivalent (a.e.)). Registration is being requested nationally for control of annual and perennial broadleaf plants (including noxious and invasive weeds) in wheat (spring wheat, winter wheat and durum) and pasture/rangeland, as well as rights-of-way, roadsides and natural areas. The proposed methods of application are ground and aerial sprays with maximum seasonal rates of 0.11 lbs a.e./A for pastures and rangelands and 0.0089 lbs a.e./A for wheat.

The proposed uses of aminopyralid pose a risk to non-target terrestrial plants. Risk quotients (RQs) were highest for pasture and rangeland uses, due to the higher proposed application rate. However, even at the much lower rate for wheat, LOCs are still exceeded in some circumstances. The greatest risk is to dicotyledonous plants, although RQs for wetland monocots also exceeded the level of concern (LOC). The proposed uses of aminopyralid do not appear to pose acute or chronic risk to terrestrial and aquatic animals, nor an acute risk to aquatic plants.

Because plant RQs are above non-endangered species LOCs, the Agency considers this to be indicative of a potential for adverse effects to those listed species that rely either on a specific plant species (plant species obligate) or multiple plant species (plant dependant) for some important aspect of their life cycle. The extent to which the use of aminopyralid on wheat and pasture/rangeland will indirectly effect listed animal species will require identification of listed species that co-occur in areas of aminopyralid use and an evaluation of critical habit as described below. Because of the national extent of the proposed uses of aminopyralid, a 'may effect' designation is assumed to be possible for all listed animals.

Based on registrant-submitted environmental fate data, aminopyralid is expected to be at least moderately persistent and highly mobile in the environment. Since aminopyralid is stable to hydrolysis and aerobic and anaerobic aquatic metabolism, and moderately degraded by aerobic metabolism in some soils, transport of aminopyralid to surface water and ground water will occur. Aqueous photolysis (half-life = 0.6 days) could be an important route of degradation in shallow water bodies or those with low suspended sediment amounts. Both the aminopyralid TIPA salt and the pure aminopyralid acid will dissociate in the environment to yield the free anion, and the dissociation process is governed by an equilibrium constant which is so low (pKa of 2.56) that greater than 99.9% of the compound will be in the anion form at environmental pH ranges, regardless of the original molecular species.

Toxicity tests for terrestrial and aquatic animals, and for aquatic plants, were performed using aminopyralid acid. Aminopyralid acid was found to be practically non-toxic in acute toxicity tests on terrestrial and aquatic animals. Some chronic effects were observed in the freshwater fish early life-stage study, and acute effects in aquatic plant studies, but at concentrations above those expected in the environment. Terrestrial plant studies were performed using the formulated end-product.

The environmental fate and effects data submitted to the Agency are nearly complete. However, because of material-balance problems in the aerobic soil metabolism study, and uncertainty surrounding extraction procedures, the results from only one of five test soils could be used in environmental fate modeling. The aerobic soil metabolism half-life observed in some of the other four soils was apparently much longer than the 103.5-day half-life observed in the one acceptable soil. Therefore, the persistence of aminopyralid may be underestimated in this assessment, and estimated aquatic concentrations may not be conservative. However, Tier I modeling using the longest half-lives of the unacceptable soils studied did not result in aquatic concentrations that approach levels-of-concern for aquatic animals and plants.

There are several uncertainties regarding risk to plants. One is whether the default assumption of 5% spray drift (from aerial application) in TerrPlant is sufficiently protective. Estimates derived using the spray-drift model AgDrift range to higher that 20%, which could indicate that risk to plants is underestimated. Another uncertainty regarding the model used in this assessment is an assumption of a 60% 'efficiency factor' of application to the treated field after aerial application. The use of this factor appears to leave about 35% of the applied chemical unaccounted for and it is possible that risk to wetland plants is underestimated.

Despite the structural similarity to picloram and clopyralid, the other pyridine carboxylic acid herbicides, the uncertainties in the aminopyralid aerobic soil metabolism study make direct comparison of fate properties difficult. However, it is important to be aware of some of the issues that have been identified regarding these structurally similar chemicals. Clopyralid has been known to persist in grass clippings. When the grass clippings were used as mulch, unintended plant death resulted. The label was subsequently changed to prevent this occurrence. Picloram has been detected in appreciable amounts in groundwater monitoring, as described in the picloram RED. Whether either of these issues will occur with aminopyralid is uncertain.

II. Problem Formulation

A. Stressor Source and Distribution

1. Source and Intensity

Dow AgroSciences is seeking registration for the use of aminopyralid (XDE-750; 4-amino-3,6-dichloro-2-pyridinecarboxylic acid) and its herbicidal end-use product, GF-871 (40.6% a.i.), which contains triisopropanolammonium (TIPA) salt of aminopyralid as the sole active ingredient (21.1% aminopyralid acid equivalent (a.e.)). An acid equivalent is the theoretical yield of parent acid from a pesticide active ingredient that has been formulated as a derivative (http://www.ipm.uiuc.edu/bulletin/pastpest/articles/200002j.html). Aminopyralid application rates and concentrations are reported in "acid equivalents" (a.e.), instead of "active ingredient" (a.i.), because the acid part of the active ingredient salt is the herbicidally active component. Aminopyralid acid can potentially be formulated as a whole variety of active ingredients (*e.g.*, ester, salt, amine derivatives), each with a different amount of acid in them, relative to the total mass of the derivative. Changes can be made to the mass of the active ingredient (salt) without necessarily changing the activity of the pesticide, because activity is related to the amount of acid. Therefore, concentrations are reported in terms of this amount of acid (a.e.) to be able to compare different formulations (active ingredients) containing the same acid. Aminopyralid acid equivalents are calculated as 52.0% of active ingredient by mass, and 21.1% of formulated product by mass, based on percentages reported on the proposed label. However, terrestrial plants were tested with the formulated product and are evaluated base on the TIPA salt active ingredient.

Aminopyralid registration is being requested nationally for control of annual and perennial broadleaf plants (including noxious and invasive weeds) in wheat (spring wheat, winter wheat and durum) and pasture/rangeland, as well as rights-of-way, roadsides and natural areas. The proposed methods of application are ground and aerial sprays with maximum seasonal rates of 0.11 lbs a.e./A for pasture and rangeland and 0.0089 lbs a.e./A for wheat.

2. Physical/Chemical/Fate and Transport Properties

Aminopyralid is highly soluble (2.48 g/L in unbuffered distilled water at 20 °C), is not volatile (vapor pressure = 7.14 x 10^{-11} mm Hg at 20 °C) and is likely to be highly mobile (K_d range 0.03-0.72 mL/g). Based on registrant-submitted environmental fate data, its physical-chemical properties (**Table 1**), and the proposed use patterns, aminopyralid is expected to be moderately persistent and highly mobile in the environment. Based on its high solubility, and on resistance to biotic hydrolysis and abiotic aquatic degradation processes, as well as the high mobility of the chemical under laboratory conditions, it appears that the major route of dissipation for aminopyralid will be through runoff and leaching.

Table 1. Summary of physical-chemical properties of aminopyralid.

PARAMETER	VALUE	SOURCE
Chemical Name	4-amino-3,6-dichloropyridine- 2-carboxylic acid	–
Molecular Weight	207.02	--
Solubility (20 °C)	2480 mg/L or ppm	MRID: 46235701.
Vapor Pressure (20 °C)	7.14 x 10^{-11} mmHg	MRID: 46235701.
Henry's Law constant	9.2 x 10^{-14} atm-m^3/mol	(Estimated from vapor pressure and solubility)
pKa (20 °C)	2.56	MRID: 46235701.
Log K_{OW} (20 °C)	0.2	MRID: 46235701.

Since aminopyralid is a new chemical, information on the environmental fate and effects comes primarily from registrant-submitted data on technical grade aminopyralid acid and its formulated product (GF-871). Although the environmental fate studies (other than terrestrial field dissipation) were conducted using aminopyralid acid, and the end-use product is the ionized salt form, the part of the molecule that is principally responsible for biological activity is the acid anion, and the acid readily dissociates into its ionized form under most environmental conditions. The fact that aminopyralid exists in ionized form in the environment helps account for its high solubility, lack of volatility, and tendency to reside in the water compartment, rather than in soil.

No major data gaps were identified in the registrant-submitted data, although additional aerobic soil metabolism data would be helpful to characterize the persistence of aminopyralid, since the data for four of five soils were unusable due to material balance and extraction problems.

3. Pesticide Type, Class, and Mode of Action

Aminopyralid is a synthetic auxin analogue in the pyridine carboxylic acid class of herbicides. This class of herbicide includes picloram (4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid) and clopyralid (3,6-dichloro-2-pyridinecarboxylic acid). The specific mode of action of these chemicals is not fully known. Auxins are plant hormones that regulate a number of plant activities, including development of the plant embryo, leaf formation, phototropism, gravitropism, apical dominance, fruit development, abscission and root initiation. Auxins are actively transported into cells by a transmembrane transporter protein, and leaves the cells by facilitated diffusion through a different transporter (Taiz and Zeiger, 2002). Based on studies of the auxin analogues 2,4-D and 2,4,5-T, neither of which are pyridine carboxylic acids like aminopyralid, it is thought the import mechanism allows auxinic herbicides into the cell, but that they cannot leave the cell through the exporter. Cellular effects include alterations in cell wall elasticity and gene expression. Additionally, non-productive tissue growth is often induced, resulting in epinasty and phloem disruption, preventing the movement of photosynthate and causing death in days to weeks (Thill, 2002).

B. Receptors

Because aminopyralid is a new chemical, ecological effects endpoints are derived solely from registrant-submitted guideline studies as required for registration under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA; 40 CFR Part 158). The most sensitive endpoints (described below) from each study of surrogate species are used to estimate risk to the taxonomic group(s) represented by the surrogate tested.

1. Aquatic Effects

Aminopyralid's effect on aquatic organisms is estimated from acute, subacute and chronic laboratory studies submitted to the Agency. The registrant has submitted acute and chronic studies on aquatic vertebrates and invertebrates and studies on the acute effects on aquatic plants. Freshwater fish, *e.g.*, bluegill sunfish (*Lepomis macrochirus*), rainbow trout (*Oncorhynchus mykiss*) and fathead minnow (*Pimephales promelas*) are used as surrogates for all freshwater fish species. Freshwater fish are usually used as surrogates for aquatic-phase amphibians; however, an acute aquatic amphibian toxicity study was submitted for aminopyralid. Freshwater invertebrate effects are estimated from studies using the waterflea (*Daphnia magna*). Effects of aminopyralid on all estuarine/marine fish are estimated from effects on sheepshead minnow (*Cyprinodon variegatus*), while invertebrate effects are estimated from studies on oyster (*Crassostrea virginica*) and mysid (*Americamysis bahia*). Effects on aquatic vascular plants are estimated from studies on duckweed (*Lemna gibba*), while effects on algae, diatoms and cyanobacteria are similarly estimated from studies on surrogate species.

2. Terrestrial Effects

The effect of aminopyralid on all bird species is estimated from acute, subacute and chronic studies on two species, bobwhite quail (*Colinus virginianus*) and mallard duck (*Anas platyrhynchos*). These species also act as surrogates for reptiles and terrestrial-phase amphibians. Effects on mammals are estimated from acute and chronic rat studies submitted to and reviewed by the Health Effects Division (HED). Ten species of terrestrial crop plants are studied to estimate the effect of aminopyralid on all terrestrial plant species.

3. Ecosystems at Risk

Because of the widespread areas planted with wheat, the ecosystems at risk are national in scope, and as a result it is not possible to identify specific ecosystems at the screening level. In general terms, ecosystems potentially at risk could be identified as those proximal to the use sites. This could include fresh surface water, *e.g.*, streams and lakes), saltwater (estuary and/or nearshore), forests (deciduous, coniferous or mixed), grasslands, or wetlands. Because pasture/rangeland use rates are much higher than for wheat, it is likely that ecosystems proximal to those use sites will have a greater likelihood of exposure. However, because of the moderate persistence and high mobility of aminopyralid, ecosystems further from use sites may also be affected.

C. Assessment Endpoints

Assessment endpoints are intended to be representative estimates of biological entities to be protected, and their attributes which might be affected by exposure to the pesticide stressor. The valued entities are terrestrial and aquatic vertebrates and invertebrates, aquatic vascular and nonvascular plants, and terrestrial plants. The attributes used to gauge the effects of aminopyralid on the valued entities are acute mortality (or phytotoxicity) and chronic reproductive, growth (length and weight) and survival effects.

FIFRA Part 158 guideline toxicity tests (CFR 40 §158.202, 2002) are intended to determine pesticidal effects on ecological entities that include birds, mammals, fish, terrestrial and aquatic invertebrates and plants. The most sensitive toxicity endpoints are used from surrogate test species (receptors) to estimate treatment-related direct effects on acute and chronic reproductive, growth and survival assessment endpoints. The studies are used to evaluate the potential of a pesticide to cause adverse effects, to determine whether further testing is required, and to determine the need for precautionary label statements to minimize the potential adverse effects to non-target animals and plants.

The risk assessment considers applications for foliar treatments where those data are available. This assessment does not take into account atmospheric transport in estimating environmental concentrations (note, very low vapor pressure indicates that vapor phase transport will be negligible), nor does it account for ingestion of aminopyralid residues by animals in drinking water or contaminated grit, ingestion through preening activities, or uptake through inhalation or dermal absorption by terrestrial animals. Exposure to terrestrial animals is based primarily on dietary consumption of residues while aquatic assessments assume that all potential routes of direct exposure are accounted for. Plant exposure is based on spray drift and runoff.

D. Conceptual Model

1. Risk Hypothesis

Aminopyralid is proposed for use as a herbicide on pastures and rangelands and wheat which involves situations in the environment where potential routes of exposure can be direct contact to food items (*e.g.*, grass), as well as indirect contamination of adjacent bodies of water. Based on aminopyralid persistence, mode of action, direct toxicity and potential indirect effects to plants, it is assumed that this compound has the potential to cause reduced survival, and reproductive impairment to both terrestrial and aquatic organisms.

2. Diagram

The conceptual model is represented visually in **Figure 1**.

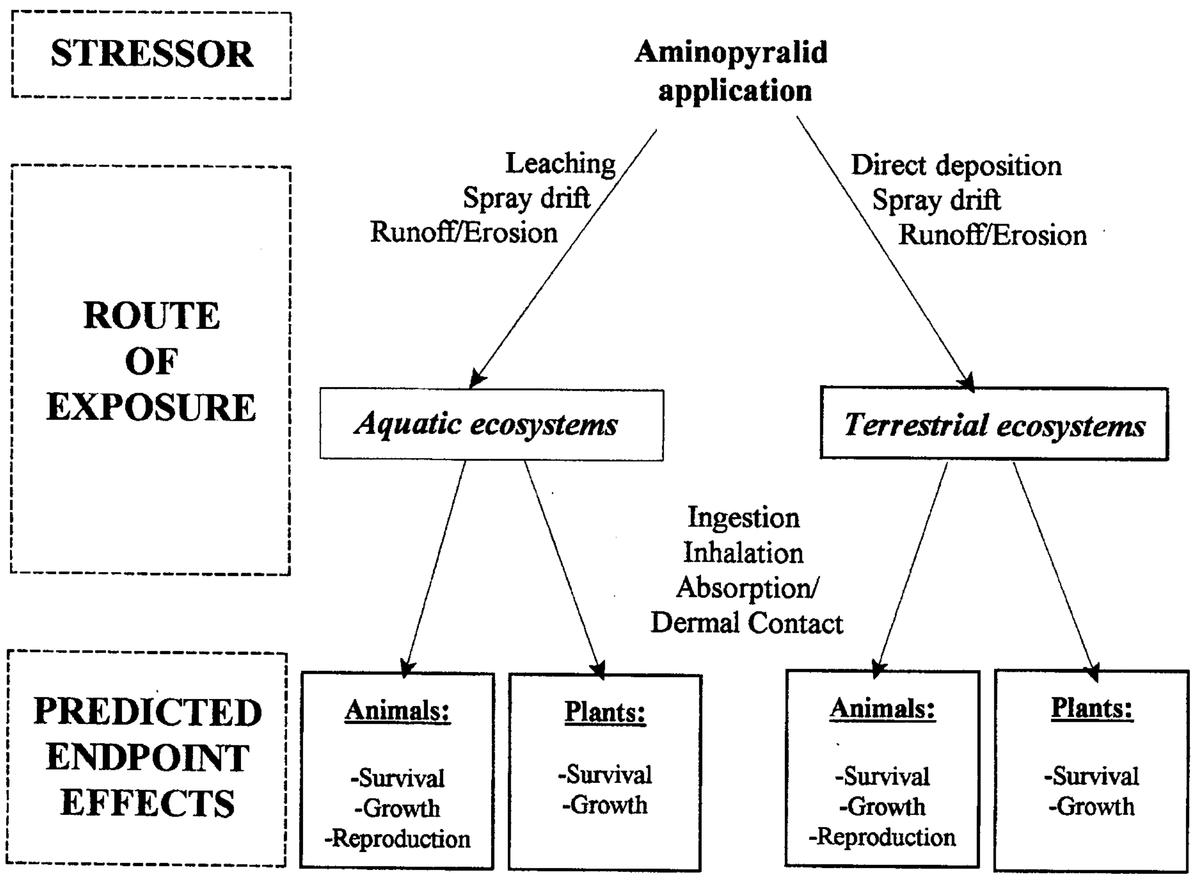


Figure 1. Diagram of potential stressor/receptor interactions.

E. Analysis Plan

Since this is the first risk assessment for aminopyralid, the analysis is a first-tier screening-level risk assessment. This document characterizes the environmental fate of aminopyralid to assess the extent to which non-target organisms might be exposed through the proposed uses of this herbicide. The toxicity of aminopyralid is also characterized, based primarily on registrant-submitted guideline toxicity tests. Additional information from open literature will be considered if available through the Agency's ECOTOX database (http://www.epa.gov/ecotox/). Estimated exposure and effects are integrated to calculate risk quotients (RQs) for non-target endangered/threatened and non-endangered animals and plants. These RQs are compared to predetermined levels-of-concern (LOCs) to screen out those taxa to which aminopyralid appears not to pose unacceptable risk. The determination of which non-target organisms may and should not be at risk from aminopyralid exposure will be considered as part of the registration decision of aminopyralid under the requirements of the FIFRA and the Endangered Species Act (ESA).

Although risk, in the context intended here, is often defined as the likelihood and magnitude of adverse ecological effects, the risk quotient-based approach does not provide a quantitative estimate of likelihood and/or magnitude of an adverse effect. Such estimates may be possible through a more refined, probabilistic assessment. However, this is beyond the scope of this screening-level assessment.

1. Preliminary Identification of Data Gaps and Methods

The environmental fate and effects data submitted to the Agency are nearly complete. However, because of material-balance and extraction problems in the aerobic soil metabolism study, the results from only one of five test soils could be used in environmental transport modeling. The aerobic soil metabolism half-life observed in some of the other four soils was apparently much longer than the 103.5-day half-life observed in the one soil system without material balance problems. Therefore, the persistence of aminopyralid may be underestimated in this assessment, and estimated aquatic concentrations may not be conservative. However, aquatic modeling at the longest aerobic soil metabolism half-life submitted did not substantially change estimated environmental concentrations; thus, we still have confidence that risks found to be below the level of concern are correct in spite of the limitation of the metabolism data. The preliminary data screen is included as **Appendix A.**

2. Measures to Evaluate Risk Hypotheses and Conceptual Model

a. Measures of Exposure

There are three measures of exposure of non-target organisms to aminopyralid. Exposure to terrestrial animals through consumption of treated feed items is calculated from the maximum proposed label rate using a nomogram derived from the work of Hoerger and Kenaga (1972) and Fletcher et al. (1994) using the spreadsheet model T-REX (version 1.1).

Measures of exposure to aquatic animals and plants are concentrations in surface water simulated by the Generic Estimated Environmental Concentration computer model (GENEEC; version 2.0). GENEEC uses registrant-submitted environmental fate data and proposed label rates for aminopyralid to simulate runoff and spray drift to a standard pond that is intended to represent a site which is more vulnerable than most sites in the United States, and makes a deterministic estimate of the concentration that would be equaled or exceeded in the pond once every ten years.

Measures of exposure to terrestrial plants are expressed as a fraction of the mass of the TIPA salt form of aminopyralid applied to a treated field. The screening model TerrPlant (version 1.0) assumes that default fractions of the intended application will be transported to an adjacent field through runoff and spray drift. A refinement of the exposure from spray drift is accomplished using the spray drift model AgDrift (version 2.01).

b. Measures of Effect

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 were selected based on their ability to thrive under laboratory conditions. Consistent with EPA test guidelines, Dow AgroSciences has provided a suite of ecological effects data that comply with good laboratory practice (GLP) testing requirements. Acute measures of effect are the concentrations that produce 50% mortality or growth reduction in the test organisms (LC_{50}s and EC_{50}s, respectively). The measure of effect for terrestrial plants is the EC_{25}. Endangered plant effects endpoints are the lowest test concentration where there is no observed effect (NOECs) on survival, growth or reproduction.

c. Measures of Ecosystem and Receptor Characteristics

Because of its intended use on wheat, pasture/rangeland and rights-of-way (ROWs), a wide variety of ecosystems are likely to be exposed to aminopyralid. Generally, ecosystems at risk are those proximal temporally and spatially to the use areas. However, due to the moderate persistence and high mobility of aminopyralid (as subsequently discussed), exposure may occur at times and locations far removed from the use site. As exposure is strongly linked to application rate, higher use rate sites, such as pasture/rangeland and ROWs, represent greater potential sources of exposure to ecosystems.

Since aminopyralid is an herbicide, it is not surprising that sensitive plant species may be adversely affected. Beyond direct mortality, exposure may apply selective pressure to plant communities, potentially altering population distributions. These effects may be beneficial or adverse. Certainly, any endangered plant species (direct effect) or endangered animal species with an obligate or dependent relationship with a sensitive plant species (indirect effect) could be at potential risk if it is exposed.

III. Analysis

A. Use Characterization

Aminopyralid is proposed for use as an herbicide on broadleaf invasive and noxious weeds in range and pastures, industrial vegetation management, roadsides, and rights-of-way. The single currently proposed food use is on wheat, including durum. **Table 2** provides maximum proposed single application rates which are identical to maximum proposed seasonal application rates (proposed label located in **Appendix C**). Although the label does explicitly state an annual seasonal application rate, according to John Jachetta of Dow Agrosciences (email dated 1-13-05), this maximum proposed seasonal application rate is intended to specify the total maximum value for the "annual growing season," defined as "per year" (**Appendix C**). The current proposed label does not state the maximum number of applications or re-application interval, and, therefore, allows subsequent treatments. The registrant states that spot treatment after 4 to 6 months is possible but "it is unlikely that there would be more than two applications per year." Therefore, it is likely that either the majority of or the entire maximum rate will be applied in the first application, with relatively minimal spot treatments, if any, applied at an interval of 120 days (4 months) or more. Aminopyralid proposed label use allows for both aerial and ground spray broadcast application of the dissolved formulated product. Application as a coarse, low-pressure spray is recommended.

Table 2. Summary of proposed uses, maximum single application rates, number of applications, application intervals and maximum seasonal application rates for the formulated end-product of aminopyralid.

Use	Maximum Single Application Rate lbs. a.e./A	Maximum Number of Applications	Application Interval Days	Maximum Seasonal Application Rate lbs a.e./A/season
		Aerial or Ground (40.6 % a.i.; 21.1% a.e.)		
Rangeland	0.11	n/a	n/a	0.11
Wheat	0.0089	n/a	n/a	0.0089

B. Exposure Characterization

1. Environmental Fate and Transport Characterization

Based on the submitted environmental fate data and reported physical-chemical properties, aminopyralid is expected to be at least moderately persistent (Goring 1975) and highly mobile (McCall 1980) in the environment. There was no measurable degradation at any pH by hydrolysis, or by anaerobic aquatic metabolism. Aerobic aquatic metabolism rates were longer than one year (half-life range of 462-990 days). In the laboratory, aminopyralid degraded rapidly via aqueous photolysis (half-life of 0.6 days) to small acids, acid amides, and CO_2, but this mode of degradation is only likely influential in clear, shallow water, under non-cloudy atmospheric conditions. In actual environmental systems, aqueous photolysis is likely to proceed at a much slower rate due to the depth of water bodies, light adsorption by suspended solids, and natural obstruction of sunlight.

The predominant means of aminopyralid degradation in the environment is likely to be aerobic soil metabolism (half-life of 103.5 days), with loss of the compound attributed to the formation of CO_2. There is considerable uncertainty in the rate of aerobic degradation of aminopyralid in different soils, however, since there were useable data for only one soil type, and potential aerobic soil metabolism half-lives in unuseable soils ranged from 31.5 to 533.2 days.

Aminopyralid has very low soil water partition coefficients (K_d in eight soils ranged from 0.03-0.72 mg/L; K_{OC} of 1.05-24.30 mL/g). Binding to organic carbon is not expected for anions like aminopyralid. The high water solubility of aminopyralid (2480 mg/L) suggests a high potential for run-off into surface water and leaching to groundwater. In surface water bodies, it will presumably not be associated with sediments and will be primarily dissolved in the water column. Given its low octanol-water partition coefficient (K_{OW} of 1.58), significant bioaccumulation in aquatic organisms is not anticipated. Thus, no bioconcentration in fish study was required or submitted.

Table 3 summarizes the physical and chemical properties and environmental fate and transport characteristics of aminopyralid, derived from information submitted under product chemistry and fate guideline studies. All fate studies except terrestrial field dissipation were conducted with aminopyralid acid, and application rates and environmental concentrations are reported in units of a.e. More complete information on the environmental fate studies can be located in **Appendix B**. Although some registrant-submitted studies contained deficiencies and most were classified as supplemental, the studies as a whole provided sufficient information for assessing the environmental fate of aminopyralid in this screening-level assessment. The only additional study requested in another aerobic soil metabolism to clarify the uncertainty surrounding the aerobic soil metabolism half-life.

Table 3. Summary of physical/chemical and environmental fate and transport properties of aminopyralid based on information from the registrant.[1]

PARAMETER	VALUE(S)	SOURCE	STUDY CLASSIFICATION
Chemical Name	4-amino-3,6-dichloropyridine- 2-carboxylic acid	–	–
Molecular Weight	207.02	–	–
Solubility (20 °C)	2480 mg/L or ppm	MRID: 46235701.	–
Vapor Pressure (20 °C)	7.14×10^{-11} mmHg	MRID: 46235701.	–
Henry's Law constant	9.2×10^{-14} atm-m^3/mol	(Estimated from vapor pressure and water solubility)	–
pKa (20 °C)	2.56	MRID: 46235701.	–
Octanol-Water Partition Coefficient ($K_{OW,}$ at 20 °C)	1.58	MRID: 46235701.	–
Hydrolysis Half-life (pH 5, 7, 9; 25 °C)	stable	MRID: 46235726.	Acceptable.
Aqueous Photolysis Half-life (pH 5)	$t_{1/2}$ = 0.6 days[2]	MRID: 46235727.	Supplemental.
Soil Photolysis Half-life	$t_{1/2}$ = 72.2 days	MRID: 46235728.	Supplemental.
Aerobic Soil Metabolism Half-life	$t_{1/2}$ = 103.5 days	MRID: 46235729.	Supplemental.[3]
Anaerobic Aquatic Metabolism Half-life	stable	MRID: 46235730.	Acceptable.

PARAMETER	VALUE(S)	SOURCE	STUDY CLASSIFICATION
Aerobic Aquatic Metabolism Half-life	$t_{1/2}$ = 462.1 days, 866.4 days, 990.2 days (Italian, French, US systems)	MRID: 46235731.	Supplemental.
Organic Carbon Partition Coefficient (K_{oc})	1.05, 2.33, 4.49, 4.59, 7.39, 7.54, 19.95, 24.30	MRID: 46235732.	Supplemental.
Soil Partition Coefficient (K_d, mL/g)	0.03, 0.03, 0.04, 0.07, 0.08, 0.15, 0.29, 0.72	MRID: 46235732.	Supplemental.
Terrestrial Field Dissipation Half-life	$t_{1/2}$ (in surfaces soil)= 32.1 days; $t_{1/2}$ (in total soil profile)= 34 days; DT_{90}(in total soil profile) = 114 days detected above LOQ to 15 cm (MS) $t_{1/2}$ (in surfaces soil)= 20.0 days; $t_{1/2}$ (in total soil profile)= 26 days; DT_{90}(in total soil profile) = 85 days detected above LOQ in single replicates to 90 cm (CA)	MRID: 46235734.	Supplemental.

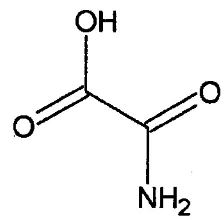
[1] Complete status of data requirements is located in **Appendix I**.
[2] Vale corrected to represent natural sunlight at 40°N latitude; uncorrected laboratory half-life of 0.3 days (continuous irradiation; xenon lamp)
[3] Data used quantitatively for only one soil type because material balances were either low or variable in the other four soils.

Degradates

The only potentially major transformation products resulting from any of the degradation processes of aminopyralid are two metabolites formed via aqueous photolysis: oxamic and malonamic acid (**Figure 2**). The transformation products detected in the irradiated samples of the aqueous photolysis study were not all identified nor separately quantified, despite the use of multiple chromatogaphy methods. The amount of degradates could only be reported as a total concentration of major transformation products, containing these two identified acids (oxamic acid and malonamic acid) together with four or more unidentified acid amides (2 or 3 carbons in length). Neither of these identified products are expected to form in large concentrations, since aqueous photolysis will occur only to the depth to which sunlight penetrates a water body.

In addition, oxamic and malonamic acids are unlikely to exhibit similar toxicity to the parent. The Health Effects Division (HED) has very low concern regarding the hazard associated with these environmental metabolites. Searches of various hazard databases (*e.g.*, TOXNET, MEDLINE, and others) did not reveal any cause for concern for either chemical. Both chemicals are small amino acid analogs. Following uptake, they are expected to be readily metabolized and/or rapidly excreted without any significant biological effects. Therefore, because these degradates are expected to form at such low concentrations and HED does not consider them toxic, neither oxamic nor malonamic acid were not considered in this assessment.

Only CO_2 and bound residues were observed in amounts over 10% of applied in all other laboratory degradation studies, at maximums of 76.2.% in aerobic soil metabolism and 15.0% in aerobic aquatic metabolism, respectively. Residue extraction was attempted by extracting with a relatively mild acetone/1.0 N HCl (90:10, v:v) solution on a horizontal shaker at low speed for all studies involving soil, except in the U.S. anaerobic aquatic metabolism study, which was extracted with a methanol/1.0 N NaOH (90:10, v:v) solution. It is uncertain whether or not greater amounts of soil-bound material could have been extracted using harsher methods. Minor degradates were detected via HPLC at less than 3.5% in aqueous photolysis and less than 3.0% in aerobic aquatic studies. These degradates were not identified because they occur at such low concentrations. There was no unidentified radioactivity over 7.2%. **Table 4** summarizes aminopyralid degradates resulting from all degradation processes. Structures of the parent compound and its radio-labeled form are presented in **Appendix B**.



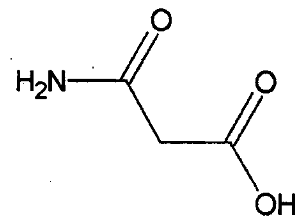


Figure 2. **Oxamic acid** **Malonamic acid**

Table 4. Maximum levels of characterized and identified aminopyralid degradates (as percentages of applied[1]) and day of occurrence by study type.

	Oxamic acid, Malonamic acid, and other amines[2]	Minor degradates[3]	Unidentified radioactivity	CO_2 and other VOC	Non-extractable Residues
Hydrolysis	Not Detected	Not Detected	Not Detected	Not Detected	Not Applicable
Aqueous Photodegradation.[1]	68.8% (12 days)	2.9% (12 days) 2.0% (8 hours) 3.3% (2 days)	7.2% (8 hours)	CO_2: 28.4% (15 days) Other VOC: 2.4% (6 days)	Not Applicable
Soil Photodegradation	Not Detected	Not Detected	4.6% (44 days)	CO_2 and acid volatiles: 3.8% (14 days)	8.0% (44 days)[4]
Aerobic Soil Metabolism[5]	Not Detected	Not Detected	Not Detected[6]	CO_2: 76.2% (190 days)[5] Other VOC: Not Measured	13.3% (63 days)[4]
Aerobic Aquatic Metabolism	Not Detected			CO_2:	
French system:		1.0% (14 days) 3.0% (21 days)	0.5% (21 days)	2.7% (101 days)	3.2% (101 days)[4]
Italian system:		0.7% (3 days) 0.7% (21 days)	0.5% (62 days)	1.7% (62 days)	15.0% (101 days)
U.S. system:		0.8% (14 days) 0.9% (7 days)	0.8% (62 days)	1.2% (101 days)	6.8% (101 days)
Anaerobic Aquatic Metabolism	Not Detected	Not Detected		CO_2:	
English system:			1.2% (0 days)	0.7% (268 days)	2.4% (181 days)[4]
U.S. system:			0.8% (59 days)	0.4% (120 days)	1.3% (30 days)[7]
Terrestrial Field Dissipation	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured

[1] Percentages of applied are reported as the average in the stated interval (not individual replicates). In some cases, individual replicates showed a higher percent of applied of a particular degradate than the reported average value.

[2] The major transformation products detected in the irradiated samples of the aqueous photolysis study were not all identified nor separately quantified, despite the use of multiple chromatogaphy methods. The amount of degradates could only be reported as a total concentration, containing the two identified acids (oxamic acid and malonamic acid) together with four or more unidentified acid amides (2 or 3 carbons in length).
[3] Minor transformation products were detected, but not identified at 11.5, 13, and 16 minutes during aqueous photolysis, and at 3 -4 and 7 minutes during aerobic aquatic metabolism.
[4] Soil samples were extracted three times with an acetone/1.0 N HCl (90:10, v:v) solution on a horizontal shaker at low speed.
[5] Results reported only for the soil quantitatively useable in the aerobic soil metabolism study; the other four soils were invalid.
[6] All extractable radioactivity was quantified as parent, by HPLC chromatogram.
[7] Sediment samples were extracted three times with a methanol/1.0 N NaOH (90:10, v:v) solution on a horizontal shaker at low speed.

Dissipation pathways (degradation and off-site movement)

In addition to its degradation via aerobic soil metabolism and aqueous photolysis (in clear, shallow water), aminopyralid is likely to dissipate off site mainly via leaching through soil and runoff of dissolved residues from treated fields. Deposition off-field or into surface water via spray drift may also play a role in the movement of aminopyralid off-site. Aminopyralid is not expected to be subject to soil, water or air transport via soil-bound residues (very low adsorption) or atmospheric transport via partitioning to air through spray drift or volatization (low vapor pressure).

Fate on soil

Based on the available laboratory data, surface soil aerobic metabolism and, to a lesser extent, surface soil photolysis, to CO_2 and non-extractable residues are likely to be major routes of aminopyralid degradation in the environment. However, given its high water solubility and very low soil adsorption capacity, aminopyralid is not likely to partition to the soil compartment in the environment. Therefore, aminopyralid may not be present in surface soil long enough to undergo substantial degradation.

Aerobic soil metabolism

Only one of five soils submitted in the aerobic soil metabolism study was useable for quantitative aerobic biotic degradation estimation. In that one silt loam soil, aerobic biotic degradation was moderate ($t_{1/2}$ = 103.5; MRID: 46235729). When incubated in darkness for up to one year at 25 °C, maintained at 75% of 1/3 bar moisture, aminopyralid degraded to CO_2 and non-extractable residues. Due to the mild extraction procedures implemented in the study, non-extractible residues were assumed to consist of parent which had just not been extracted harshly enough, and their amounts were added to parent concentration in half-life calculation. While material balances in the other four soils were low or variable and half-lives calculated from those data are unreliable estimates of the degradation rate of aminopyralid, they suggest half-lives potentially five times greater. (Half-lives in the four invalid soils ranged from 31.5 to 533.2 days when calculated by adding non-extractible residue amounts in with parent concentrations.)

High uncertainty surrounds the estimate of the aerobic soil metabolism half-life given the large range of potential half-lives. Studies on soils systems with acceptable material balances would help reduce this uncertainty. Since the aerobic soil metabolism half-life observed in some of the other four soils was apparently much longer than the 103.5-day half-life observed in the one useable soil, the persistence of aminopyralid may be underestimated in this assessment.

This study was classified as supplemental because extraction was insufficient and material balances were low or variable in four of the five soils. Additionally, because aerobic soil metabolism in Barnes clay loam was not valid, the Subdivision N requirement that one of the soils tested in the adsorption/desorption study also be tested in the aerobic soil metabolism study was not fulfilled.

Soil Photodegradation

On silt loam surface soil maintained at 25 ^{o}C and 75% of 1/3 bar moisture, aminopyralid abiotic photodegradation was moderately slow under favorable light conditions (a xenon lamp for the equivalent of 28 days of summer sunlight at 40 ^{o}N latitude) in the laboratory ($t_{1/2}$ = 72.2 days, corrected for natural sunlight and biotic soil metabolism; MRID: 46235728). Aminopyralid degraded into non-extractable residues, CO_2 and acid volatiles. This study was classified as supplemental because of a loss of material balance in the irradiated samples and concurrent loss and variability in material balance in the dark samples.

Fate in water

Aminopyralid will enter surface water through spray drift when applied using ground spray or aerial spray. Aminopyralid will also reach surface water through runoff from agricultural fields, although if there is a large temporal gap between pesticide application and rainfall, runoff concern may be attenuated by the compound's moderate aerobic soil degradation. When it does reach surface water, aminopyralid is expected to persist.

Given its high mobility, and moderate persistence in soil, aminopyralid is likely to leach to ground water, irrespective of soil type. Once aminopyralid reaches anaerobic soil depths, degradation will essentially cease, and only the high mobility of aminopyralid will be a factor in ground water contamination. Aminopyralid concentrations in ground water are anticipated to be higher in areas with a high water table (because there is less depth to travel before reaching groundwater) and during times when rainfall occurs soon after application.

Aqueous photodegradation

Aminopyralid has a rapid aqueous photolysis degradation rate ($t_{1/2}$ = 0.6 days; MRID: 46235727) when maintained at 25 ^{o}C in sterile pH 5 aqueous buffered solution and irradiated with a xenon lamp for 32 hours (the equivalent of 38 days of summer sunlight at 40 ^{o}N latitude). In addition to CO_2, major degradates included oxamic acid and malonamic acid. The rest of the degradates were not identified but analysis indicated that they were at least four different 2 and 3 carbon acid amides, reported as a total concentration with both identified acids. This pathway will be the primary means of degradation in clear and shallow surface water under favorable light conditions. However, direct photolytic degradation of aminopyralid in water which is turbid and/or deep may be limited by the attenuation of sunlight's rays, and the half-life may be considerably longer under such conditions. Aminopyralid is likely to be persistent in deep or turbid water and water/sediment systems based on laboratory studies. This study was classified as supplemental because of the lack of identification and quantification of all major degradates.

Leaching and Adsorption/Desorption

Aminopyralid is expected to have high mobility in most soils, and is generally expected not to bind to aquatic sediments in the water column, as characterized by very low laboratory sorption coefficients derived from a batch equilibrium study on eight types of soil (K_d of 0.03-0.72 mg/L, K_{oc} of 1.05-24.30 mL/g; MRID: 46235732). Correlation analyses do not indicate that soil binding is related to any particular soil property. Laboratory adsorption was not highly correlated to organic carbon content (r^2=0.3656), pH (r^2=0.1725), cation exchange capacity (r^2=0.0998) or clay content (r^2=0.0003). Mobility may vary slightly relative to the rate of drainage of soil, increasing in coarse-grained, well-drained soils and decreasing in fine-grained, poorly-drained soils. However, in general, aminopyralid is likely to be highly mobile in most soils in the environment. The fact that aminopyralid will be in its anion form at environmental pH ranges is consistent with the chemical's very low adsorption capacity. This study was classified as supplemental because none of the test soils had an organic matter content of greater than or equal to 1%, as required by Subdivision N guidelines.

Hydrolysis

Aminopyralid is stable to hydrolysis (MRID: 46235726). There was no statistically significant degradation observed in a study conducted in darkness for 31 days at 25 °C and for 5 days at 50 °C in sterile pH 5, 7, and 9 aqueous buffer solutions. This study was classified as acceptable.

Anaerobic aquatic metabolism

Aminopyralid is stable to anaerobic aquatic metabolism (MRID: 46235730). There was no statistically significant degradation observed in a study conducted in English and U.S. anaerobic pond and flooded soil systems incubated in the dark at 19.5 and 25.5 °C for 120 and 363 days, respectively. A t-test showed that the slopes of both degradation curves were no different than zero. This study was classified as acceptable.

Aerobic aquatic metabolism

Despite the fact that the slope of the log-linear degradation curve was statistically different from zero in the aerobic aquatic metabolism study, total system half-lives were extrapolated far beyond the 120-day study duration ($t_{1/2}$ of 462.1, 866.4, and 990.2 days; MRID: 46235731), when aminopyralid was incubated in the dark at 20 °C for 101 days in three aerobic pond water/sediment systems (Italian, French, and U.S. systems, respectively). Aminopyralid degraded extremely slowly to form non-extractable residues (from 3-15 % of applied at the end of the study) and a few minor, unidentified degradates (generally <1% at any sampling interval with the exception of 3 % in one replicate). Qualitatively, the estimated aerobic aquatic half-lives help substantiate the likely persistence of aminopyralid in water/sediment systems. This study was classified as supplemental because the three systems were anaerobic (moderately to strongly reducing water and sediment phases) throughout most of the study. In addition, the half-life values are imprecise due to extrapolation beyond the time limits of the sampling period.

Fate in air

Based on its low vapor pressure (7.14×10^{-11} mmHg) and low estimated Henry's Law constant (9.2×10^{-14} atm-m^3/mol), aminopyralid is not likely to partition significantly to air. In addition, volatile products other than CO_2 were not detected in volatile traps in the laboratory studies; most of the applied radioactivity, except that of mineralized CO_2, was found in the soil or water compartments. At environmental pH ranges, aminopyralid will be in a non-volatile anion form and is not likely to vaporize from soil or water. Therefore, long-range transport in air is not likely to be a dissipation route of concern.

Aminopyralid field studies

The laboratory-predicted major route of dissipation cannot be confirmed from the one submitted terrestrial field dissipation guideline study (MRID: 46235734) conducted at two sites. Even though the lab studies suggest that aminopyralid is highly soluble, highly mobile and moderately persistent, leaching could not be verified in the field study. Aminopyralid was not detected below 15 cm in one field in Mississippi and was detected only in a single replicate (albeit above LOQ) from 30-90 cm in second field study in California. These field data show that aminopyralid dissipates from the top layer of soil moderately quickly (with a half-life of 20-32 days), but cannot document to where and in what form it dissipates. Potentially, aminopyralid could be degrading to non-extractable residues, CO_2, or small acids. Or, it could be moving off site through leaching downward through the soil, subsurface flow laterally, or surface runoff. Aminopyralid is likely not volatilizing or moving through runoff of sediment-bound residues, but neither of these dissipation means can be empirically disproved, as run-off of bound or unbound residues, and volatilization were not measured.

Additional uncertainties in the field studies include uneven application, temporally variable concentrations, and questionably adequate sampling schedules. In the Mississippi field, there was a range of 32-144 ng/g soil of parent aminopyralid measured at time zero and a 72-119% recovery in application rate verification procedures. (Aminopyralid was not detected below 15 cm in this field; it is uncertain whether the uneven application affected this result.) Concentrations were temporally variable at both sites, originally increasing to levels above those at time zero at the second (9 days; CA) and third (15 days; MS) sampling interval. Finally, 8 (MS) or 9 (CA) days elapsed between time zero and the first samples. Aminopyralid may have leached down in the soil column before the second set of soil cores were sampled (particularly in the sandy loam of the California field).

2. Measures of Aquatic Exposure

a. Aquatic Exposure Modeling

Aquatic exposures estimated in this screening-level risk assessment are based on a set of standardized assumptions related to water body size, watershed size and proximity to the application area. These assumptions are intended to result in high-end, protective exposure estimates. Computer models that simulate the fate of pesticides in the environment are used to calculate estimated environmental concentrations (EECs) of aminopyralid acid in surface and ground water. This information is used to estimate exposure to fish, aquatic invertebrates and aquatic plants. The EECs are based on submitted fate data that describe how the aminopyralid will degrade and how it will move in the environment (*e.g.*, run off, leaching).

EFED used the Tier 1 for pesticide aquatic ecological exposure assessment screening model, GENEEC (GENeric Estimated Exposure Concentration, version 2.0, 08/01/01), to calculate surface water EECs (Estimated Environmental Concentrations). The GENEEC-calculated peak value represents a 1-in-10 year peak value and the maximum 4, 21, 60, and 90-day values represent the 1-in-10 year maximum 4, 21, 60, and 90-day rolling mean, respectively. A summary of the model input parameter values is presented in **Table 5**. Input parameters were selected in accordance with EFED's "Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides," Version II (2-28-02).

The application rate for pasture/rangeland, specified in units of acid equivalents (a.e.), was used in the surface water assessment, because it represents the maximum application rate on the proposed label (*i.e.*, "0.11 lb a.e./A/annual growing season"). This rate is the total maximum value allowable for the annual growing season. The maximum label application rate for wheat ("0.0089 lb a.e./A/growing season") was additionally modeled to estimate for comparison maximum concentrations in the environment resulting from aminopyralid application for food use. The current proposed label (presented in **Appendix C**) does not specify minimum spray intervals or maximum numbers of applications, therefore, the EEC values reported here are based on the assumption that the maximum rate will be applied in one application. In the event that the maximum annual rate is applied as more than one application, it is probable that the associated acute EEC values calculated to represent those application scenarios would be lower than those reported here.

For GENEEC surface water modeling inputs, the soil partition coefficient (K_d) was used instead of the organic carbon partition coefficient (K_{OC}), because correlation of K_d with organic carbon was low ($R^2 = 0.3656$) for the eight soils tested and there was less variability among the eight K_d measures than among the eight converted K_{OC} measures, suggesting that the adsorption of aminopyralid is not closely related to organic carbon content. Therefore, the partition coefficient uncorrected for organic carbon (K_d), was assumed to better represent partitioning in soil. The values from which the lowest non-sand K_d was chosen are presented in **Appendix C.**

Degradation half-lives were adjusted for use in the GENEEC model according to the input-parameter guidelines. The aerobic soil metabolism half-life was calculated by linear regression on log-transformed data (parent plus non-extractable residues), and then that value was multiplied by three to account for the uncertainty associated with using a single value. The aerobic aquatic metabolism half-lives were calculated using first-order linear regression on log-transformed data, then the 90^{th} percentile of the upper confidence bound on the mean of the three half-lives was calculated. The values from which the aerobic aquatic metabolism half-life input value was calculated are presented in **Appendix C.** The aqueous photolysis study was continuously illuminated and the aqueous photolysis half-life input value was adjusted to reflect photolysis in summer sunlight at 40° N latitude. There was no degradation observed in the dark controls and no dark-control correction was necessary.

While the proposed label allows for both ground and aerial application, aerial spray was modeled as the method of application in order to be protective of all application scenarios. When all other parameters remain the same, GENEEC calculates higher surface water concentrations for aerial spray than for ground spray due to default drift assumptions.

Table 5. Input parameters for the GENEEC modeling of aminopyralid.

Parameter	Value	Source	Comments
Application Rate (lbs. a.e./A)	0.11 (pasture/rangeland) 0.0089 (wheat)	Proposed label.	maximum per annual growing season
Number of Applications	1	Email correspondence with registrant, 1-13-15.	not specified on label
Interval between Applications (days)	n/a	Email correspondence with registrant, 1-13-15.	not specified on label
Soil Partition Coefficient (K_d; mL/g)	0.03	MRID: 46235732.	Represents the lowest non-sand value among eight values ranging from 0.03 to 0.72 mL/g
Aerobic Soil Metabolism Half-life (days)	310.5	MRID: 46235729.	Determined by multiplying the calculated half-life (103.5) by 3 to account for the uncertainty associated with using a single value
Wetted in?	No	Proposed label.	
Depth of Incorporation (inches)	0	Proposed label.	
Method of Application	aerial spray	Proposed label.	
Droplet Size	medium to coarse	Proposed label.	
No Spray Zone	0 (none)		
Solubility in Water @ 20 °C, unbuffered (mg/L or ppm)	2480	MRID: 46235701.	

Parameter	Value	Source	Comments
Aerobic Aquatic Metabolism Half-life (days)	1073.6	MRID: 46235731.	Represents the 90th percentile of the upper confidence bound on the mean of three half-life values (772.9)
Hydrolysis Half-life @ pH 7 (days)	stable	MRID: 46235726.	
Aquatic Photolysis Half-life @ pH 5 (days)	0.6	MRID: 46235727.	

The lower application rate for wheat resulted in proportionately lower concentrations (**Table 6**). As there were only two major degradates (oxamic and malonamic acids) detected in only the aqueous photolysis study (not expected to be a major route of degradation), it is assumed that these degradates are not likely to result in significant environmental concentrations. In addition, oxamic and malonamic acid are unlikely to exhibit similar toxicity to the parent aminopyralid and HED has very low concern regarding the hazard associated with these environmental metabolites. Therefore, estimated environmental concentrations are based on the parent compound alone.

Table 6. Estimated environmental concentrations for surface water based on the GENEEC model using single application of aminopyralid.

Crop (rate in lbs. a.e./A)	Peak	Max 21-day	Max 60-day
Pasture/Rangeland (0.11)	6.38 µg/L	6.04 µg/L	5.45 µg/L
Wheat (0.0089)	0.516 µg/L	0.489 µg/L	0.441 µg/L

3. Measures of Terrestrial Exposure

Proposed application methods for aminopyralid are ground or aerial broadcast spray, high-volume foliar spray and spot treatments. These application methods can result in various routes of exposure to non-target terrestrial organisms, including ingestion of treated foods, spray drift and runoff. The label does not specify limitations on multiple application, so this assessment assumes a single application at the highest annual rate (0.11 lbs a.e./A for pasture/rangeland and 0.0089 lbs a.e./A for wheat). Aminopyralid can be applied to prevent seedling emergence of susceptible species, as well as to control mature plants and, thus, may be applied throughout the growing season.

a. Terrestrial Animals

The estimated environmental concentration (EEC) values used for terrestrial exposure are derived from the Kenega nomogram, as modified by Fletcher *et al.* (1994), based on a large set of field residue data. The upper limit values from the nomogram represent the 95th percentile of residue values from actual field measurements (Hoerger and Kenaga, 1972). The Fletcher et al. (1994) modifications to the Kenaga nomogram are based on measured field residues from 249 published research papers, including information on 118 species of plants, 121 pesticides, and 17 chemical classes. These modifications represent the 95th percentile of the expanded data set. Risk quotients are based on the most sensitive LC_{50} and NOEC from avian studies, and LD_{50} and NOEC for mammals (based on laboratory studies of rats).

Terrestrial estimated environmental concentrations (**Table** 7) were derived for both proposed uses at the maximum application rates assuming a single application per year. Uncertainties in the terrestrial EECs are primarily associated with a lack of data on interception and subsequent dissipation from foliar surfaces. No data from the registrant regarding foliar residues was submitted for review, so the Agency's default value (35 days) was used. Terrestrial exposure estimates for avian and mammalian risk assessments were derived using the T-REX model (version 1.1). A more complete description of the model and its output is contained in **Appendix D**.

Table 7. Estimates of foliar residues of aminopyralid from the T-REX model, based on Hoerger and Kenaga (1972), as modified by Fletcher *et al.* (1996).

Use/ Application method	Application Rate (lbs. a.e./A)	Food Items	Maximum EEC (ppm)
Pasture/Rangeland	0.11	Short grass	26.40
		Tall grass	12.10
		Broadleaf plants/small insects	14.85
		Fruits, pods, seeds, and large insects	1.65
Wheat	0.0089	Short grass	2.16
		Tall grass	0.99
		Broadleaf plants/small insects	1.22
		Fruits, pods, seeds, and large insects	0.14

b. Terrestrial Plants

In the screening-level risk assessment, terrestrial plant exposure is estimated using the spreadsheet-based TerrPlant model (version 1.0). Terrestrial plants inhabiting dry and semi-aquatic (wetland) areas may be exposed to pesticides from runoff and/or spray drift. Resulting EECs (based on the TIPA salt active ingredient) are presented in **Table 8**. The model estimates EECs based on application rate, a solubility factor and default assumptions of drift. An application efficiency factor of 60% is used in calculating EECs for runoff values from aerial application. A description of the model is in **Appendix E**.

Table 8. Estimated environmental concentrations (EECs) derived from the TerrPlant screening model assuming one application per season at maximum label rate.

Crop	Application Rate lbs a.i./A	Application Method	Total loading to adjacent areas[1]	Total loading to semi-aquatic areas[2]	Drift EEC[3]
Pasture/rangeland	0.211	Aerial spray	0.0169	0.0739	0.0106

		Ground spray	0.0127	0.1076	0.0021
Wheat	0.017	Aerial spray	0.0014	0.0060	0.0009
		Ground spray	0.0010	0.0087	0.0002

[1] EEC for ground applications = drift + runoff = total load Drift = application rate (lbs. a.i/acre) x 0.01 (drift)
Runoff = application rate (lbs. a.i./acre) x 0.05 (based on solubility)
[2] EEC for aerial applications = drift + runoff = total load
Drift = application rate (lbs. a.i./acre) x 0.05 (drift)
Runoff = application rate (lbs. a.i/acre) x 0.05 (based on solubility) x 0.6 efficiency factor

Because aminopyralid is an herbicide, a more in-depth spray drift exposure assessment utilizing Tier I AgDRIFT® (version 2.01) modeling is also provided to better characterize potential exposure of terrestrial plants. AgDRIFT® utilizes empirical data to estimate off-site deposition of aerial and ground applied pesticides, and acts as a tool for evaluating the potential of buffer zones to protect sensitive habitats from undesired exposures. **Table 9** contains EECs at several distances from the edge of the field.

Table 9. Estimated environmental concentrations (EECs) from off-target terrestrial exposure to formulated aminopyralid through spray drift derived from AgDrift® at varying distance from the edge of field.

	Use	Max. Single Application Rate lbs. a.e./A	Deposition (lb. a.e./acre) at Specified Distance From Edge of Field (feet)			
			0	100	500	900
Aerial	Pasture/Rangeland	0.211	0.1055	0.0202	0.004	0.0026
	Wheat	0.017	0.0085	0.0017	0.0003	0.0002
Ground	Pasture/Rangeland	0.211	0.211	0.0052	0.0008	0.0003
	Wheat	0.017	0.017	0.0004	0.00007	0.00003

Additionally, this risk assessment evaluates risk to plants from direct application of aminopyralid, as would be the case for pasture/rangeland, rights of way and natural areas. For this assessment, the application rate (0.211 lbs. a.i./A) is assumed to be the EEC.

C. Ecological Effects Characterization

The toxicity testing reported in this section does not represent all species of bird, mammal, or aquatic organisms. Only a few surrogate species are used to represent all freshwater fish (2000+) and bird (680+) species in the United States. For mammals, studies are usually limited to Norway rat (*Rattus norvegicus*) or the house mouse (*Mus musculus*). Estuarine/marine testing is usually limited to a crustacean, a mollusk, and a fish. In most cases, neither reptiles nor amphibians are tested. The assessment of risk or hazard makes the assumption that avian toxicity is similar to terrestrial-phase amphibians and reptiles. The same assumption is made for fish and aquatic-phase amphibians. There were 25 ecological effect studies submitted by the registrant in support of the registration of aminopyralid. All toxicity studies were conducted with aminopyralid acid (XDE-750), with the exception of terrestrial plant studies, which were conducted with the formulated product, GF-871. Twenty-four of the studies were classified as having provided useful information for ecological risk assessment toward fulfilling the required guideline data and 14 were classified as acceptable and consistent with study guideline recommendations; however, the remaining studies were classified as supplemental. In-depth discussion of the studies and rationale for classification are presented in **Appendix F**. An ECOTOX search of relevant open literature resulted in only two papers, both of which failed the screening procedures and neither directly concerning aminopyralid.

1. Aquatic Effects Characterization

Because aminopyralid is a synthetic analogue of auxin, a plant growth hormone, effects on aquatic animals are expected to be limited. The registrant has submitted a battery of studies, as required by CFR 40 Part 158, that examine the toxicity of aminopyralid to representative aquatic organisms that serve as surrogates for organisms that may be exposed. Both acute and chronic effects were determined for freshwater fish and invertebrates. Acute effects on marine/estuarine fish and invertebrates and aquatic vascular and nonvascular plants were also examined.

a. Aquatic Animals

(1). Acute Effects

Fish and Aquatic-phase Amphibians

The preferred test species, rainbow trout (*Oncorhynchus mykiss*; a surrogate for coldwater vertebrates) and bluegill sunfish (*Lepomis macrochirus*; a surrogate for warmwater vertebrates) were evaluated in 96-hour acute limit toxicity tests. In the rainbow trout test (MRID 462358-14), partial loss of equilibrium was observed in 7% of the fish in the treatment group. In the test with bluegill sunfish (MRID 462358-15), no mortality or sublethal effects were observed in the treatment group. For both species, the LC_{50} values are higher than 100 mg a.e./L, and aminopyralid is classified as practically non-toxic to freshwater fish on an acute exposure basis (**Table 10**). A non-guideline 96-hour static acute toxicity study of an amphibian species, *i.e.*, the northern leopard frog (*Rana pipiens*) larvae, was also submitted (MRID 462358-16). The LC_{50} value exceeds 95.2 mg a.e./L; no mortality or sublethal effects were observed. Aminopyralid is classified as practically non-toxic to aquatic-phase amphibians.

Table 10. Freshwater fish and amphibian acute toxicity for technical grade aminopyralid.

Species/ static or flow-through	% a.e.	96-hour LC_{50} mg a.e./L (measured)	Toxicity Category	MRID No. Author/Year	Study Classification
Rainbow trout (*Oncorhynchus mykiss*)/ Static	94.5 Technical	>100 (limit test)	Practically non- toxic	462358-14 Marino *et al.*, 2001	Acceptable
Bluegill sunfish (*Lepomis macrochirus*)/ Static	94.5 Technical	>100 (limit test)	Practically non- toxic	462358-15 Machado, 2003	Supplemental

Species/ static or flow-through	% a.e.	96-hour LC_{50} mg a.e./L (measured)	Toxicity Category	MRID No. Author/Year	Study Classification
Northern leopard frog (*Rana pipiens*)/ Static	94.5 Technical	>95.2 (limit test)	Practically non- toxic	462358-16 Henry *et al.*, 2003	Supplemental

In an acute toxicity study with sheepshead minnow (*Cyprinodon variegatus*; MRID 462358-20), the 96-hour LC_{50} value exceeds 120 mg a.e./L (**Table 11**); no mortality or sublethal effects were observed. Aminopyralid is classified as practically non-toxic to estuarine/marine fish on an acute exposure basis.

Table 11. Estuarine/marine fish acute toxicity to technical grade aminopyralid.

Species/Static or Flow-through	% a.e.	96-hour LC_{50} (mg a.e./L) (measured)	Toxicity Category	MRID No. Author/Year	Study Classification
Sheepshead minnow (*Cyprinodon variegatus*) Static	94.5 Technical	>120	practically non-toxic	462358-20 Machado, 2002	Acceptable

Aquatic Invertebrates

The waterflea (*Daphnia magna*) is used to estimate toxicity to freshwater invertebrates. An acute limit toxicity test under static conditions with waterfleas (MRID 462358-17) resulted in a 48-hour EC_{50} greater than 98.6 mg a.e./L (**Table 12**); no mortality or sublethal effects were observed during the study. Aminopyralid is classified as practically non-toxic to freshwater invertebrates on an acute exposure basis.

Table 12. Freshwater invertebrate acute toxicity for technical grade aminopyralid.

Species/Static or Static renewal	% a.e.	48-hour EC_{50} mg a.e./L (measured)	Toxicity Category	MRID No. Author/Year	Study Classification
Waterflea (*Daphnia magna*) Static	94.5 Technical	>98.6 (limit test)	Practically non-toxic	462358-17 Marino *et al.*, 2001	Acceptable

Acute toxicity testing of estuarine/marine invertebrates was conducted using the mysid shrimp (*Americamysis bahia*) and Eastern oyster (*Crassostrea virginica*). In a 96-hour acute toxicity study of mysid shrimp (MRID 462358-19), no mortality or sub-lethal effects were observed for aminopyralid-treated groups at up to the limit concentration of 100 mg a.e./L. The 96-hour LC_{50} value exceeds 100 mg a.e./L (**Table 13**), and aminopyralid is classified as practically non-toxic to the estuarine/marine mysids on an acute exposure basis. In the 96-hour acute shell deposition toxicity study of Eastern oysters (MRID 462358-18), the EC_{50} value exceeds 89 mg a.e./L, and no mortality or sub-lethal effects were observed. Aminopyralid is classified as slightly toxic to the estuarine/marine mollusk on an acute exposure basis.

Table 13. Estuarine/marine invertebrate acute toxicity for technical grade aminopyralid.

Species	% a.e.	96-hour LC_{50} mg a.e.L (measured)	Toxicity Category	MRID Author/Year	Study Classification
Eastern oyster shell deposition *(Crassostrea virginica)* Flow-through	94.5 Technical	>89	slightly toxic	462358-18 Cafarella, 2002	Acceptable
Mysid *(Americamysis bahia)* Static	94.5 Technical	>100	practically non-toxic	462358-19 Machado, 2002	Acceptable

(2). Chronic Effects

Aquatic vertebrates

In a fish early life-stage toxicity study of the freshwater fathead minnow (MRID 462358-21), percent post-hatch (larval) survival and growth (wet weight and length) were significantly ($p<0.05$) reduced at 2.44 mg a.e./L relative to controls (**Table 14**). Sub-lethal clinical effects were observed at exposure concentrations at or exceeding 2.44 mg a.e./L; sublethal effects included pale coloration, immobility, deformed or underdeveloped bodies, and scoliosis (curvature of the spine).

Table 14. Early life-stage toxicity of technical grade aminopyralid to freshwater fish.

Species/ static or flow-through	% a.e.	NOEC mg a.e./L (measured)	LOEC mg a.e./L (measured)	Endpoints Affected	MRID No. Author/Year	Study Classification
Fathead minnow *(Pimphales promelas)*/ Flow-through	94.5 Technical	1.36	2.44	Post-hatch survival, growth (wet-weight and length), and sub-lethal effects	462358-21 Marino *et al.*, 2002	Supplemental

No chronic toxicity data were submitted for estuarine/marine fish. An estuarine/marine fish early life-stage test (Guideline 72-4a) using the TGAI is not required for aminopyralid because the 96-hour aquatic acute LC_{50} of the estuarine/marine fish species exceeds 1,000 µg/L.

Aquatic Invertebrates

Because the aquatic invertebrate studies were conducted with aminopyralid acid, the highest concentrations generally became highly acidic (pH > 4.0). It is not possible to determine if effects at these concentrations were due to aminopyralid toxicity or pH. Therefore, this risk assessment assumes effects at these concentrations are due to aminopyralid.

A freshwater invertebrate life-cycle test using aminopyralid acid was conducted using the waterflea (*Daphnia magna*). In a 21-day static-renewal life cycle test (MRID 462358-22), no treatment-related effects on mortality, growth (length), or reproduction (mean number of young per reproductive day) were observed up to and including the highest concentration tested (102 mg a.e./L); therefore, the no-observed-effect concentration (NOEC) is 102 mg a.e./L (**Table 15**).

Table 15. Freshwater invertebrate full life-cycle toxicity for technical grade aminopyralid.

Species Type of study/ static or flow-through	% a.e.	NOEC/LOEC mg a.e./L (measured)	Endpoints Affected	MRID Author/Year	Study Classification
Waterflea *(Daphnia magna)* Static-renewal	94.5 Technical	21-day: 102/>102	None	462358-22 Henry *et al*, 2003	Supplemental

A non-guideline 28-day chronic toxicity study for aminopyralid using the midge, *Chironomus riparius*, was conducted under static conditions in a water-sediment system where the overlying water was spiked (MRID 462358-23). The NOEC is 82 mg a.e./L (pore water) based on percent emergence.

No chronic toxicity data were submitted for estuarine/marine invertebrates. The estuarine/marine aquatic invertebrate life-cycle test (Guideline 72-4c) is not required for aminopyralid because the 96-hour aquatic acute LC_{50} of the estuarine/marine invertebrate species exceeds 1,000 µg/L.

b. Aquatic Plants

Because the aquatic plant studies were conducted with aminopyralid acid, the highest concentrations generally became highly acidic (pH > 4.0). It is not possible to determine if effects at these concentrations were due to aminopyralid toxicity or pH. Therefore, this risk assessment assumes effects at these concentrations are due to aminopyralid.

Tier II toxicity studies were provided for the following aquatic plant species: green algae (*Pseudokirchneriella subcapitata),* duck weed (*Lemna gibba*), marine diatom (*Skeletonema costatum*), blue-green algae (*Anabaena flos-aquae*), and a freshwater diatom (*Navicula pelliculosa*).

In a 96-hour static acute toxicity study with the freshwater algae *Pseudokirchneriella subcapitata* (MRID 462358-30), the EC_{50} for growth rate was 30 mg a.e./L. The NOEC was 23 mg a.e./L for all endpoints measured (**Table 16**). The NOEC was used in risk estimation.

In a 14-day static acute toxicity test with the freshwater vascular plant duckweed, *Lemna gibba* (MRID 462358-26), the number of fronds was significantly ($p<0.05$) inhibited by 13% at the highest concentration tested (88 mg a.e./L). The NOEC was 44 mg a.e./L and the EC_{50} exceeds the highest concentration tested, *i.e.*, EC_{50}>88 mg a.e./L.

In a 120-hour static acute toxicity study with the marine diatom *Skeletonema costatum* (MRID 462358-28), the NOEC for biomass was 13 mg a.e./L and the EC_{50} was 70 mg a.e./L .

In a 120-hour static acute toxicity study with the freshwater diatom *Navicula pelliculosa* (MRID 462358-27), the EC_{50} was 18 mg a.e./L for biomass; the NOEC for biomass was 6 mg a.e./L.

A study of the cyanobacteria *Anabaena flos-aquae* (MRID 462358-29) was classified as unacceptable because high variability in the controls made interpretation of the data uncertain.

Table 16. Toxicity of technical grade aminopyralid to aquatic plant species.

Species/ static or static renewal (duration)	% a.e.	Most sensitive endpoint, NOEC/EC_{50} mg a.e./L (measured)	MRID Author/Year	Study Classification
Freshwater algae *Pseudokirchneriella subcapitata* Static (96 hours)	94.5 Technical	Growth rate, 23/30	462358-30 Hoberg, 2003	Acceptable
Aquatic vascular plant (duckweed) *Lemna gibba* Static (14 days)	94.5 Technical	Number of fronds, 44/>88	462358-26 Hoberg, 2003	Acceptable
Marine diatom *Skeletonema costatum* Static (120 hours)	94.5 Technical	Biomass, 13/70	462358-28 Hoberg, 2002	Acceptable
Freshwater diatom *Navicula pelliculosa* Static (120 hours)	94.5 Technical	Biomass, 6/18	462358-27 Hoberg, 2002	Acceptable
Cyanobacteria *Anabaena flos-aquae*	94.5 Technical	not determined	46238-29 Hoberg, 2002	Unacceptable

2. Terrestrial Effects Characterization

Effects on terrestrial fauna are expected to be limited since aminopyralid is a synthetic analogue of auxin, a plant growth hormone, which has no known action in animal metabolism. Non-target terrestrial plants may reasonably be expected to be affected by the application of aminopyralid. The registrant has submitted a battery of studies that examine the toxicity of aminopyralid to representative terrestrial organisms that stand as surrogates for animals and plants at risk of exposure. Acute and chronic effects were estimated for terrestrial animals; acute effects on terrestrial vascular plants were also examined.

a. Terrestrial Animals

(1). Acute and Sublethal Effects

Birds

In an acute oral toxicity study (MRID 462358-08) of northern bobwhite quail, *Colinus virginianus*, the LD_{50} is greater than the highest dose tested, *i.e.* LD_{50}>2250 mg a.e./kg body weight (**Table 17**). Therefore, aminopyralid acid is categorized as practically non-toxic to avian species on an acute oral exposure basis. A second acute oral toxicity study (MRID 462358-09) conducted with northern bobwhite quail was submitted to provide supplemental data. In this study, the LD_{50} was greater than the highest dose tested, *i.e.*, LD_{50} >292 mg a.e./kg body weight (**Table 17**). Clinical signs of toxicity (ruffled appearance, loss of coordination, lethargy, neck curl, prostrate posture, and/or lower limb weakness) were observed in oral treatments of 23 through 292 mg a.e./kg body weight; therefore, the acute oral no-observed effect level is 14 mg a.e./kg body weight. These effects were transitory, with time affected increasing with concentration. No treatment-related effects on body weight changes or feed consumption were observed.

Table 17. Avian acute oral toxicity for technical grade aminopyralid.

Species	% a.e.	LD_{50} (mg a.e./kg bw)	Toxicity Category	MRID Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	94.5 Technical	>2250	Practically non-toxic	462358-08 Gallagher *et al.*, 2001	Acceptable
Northern bobwhite quail *(Colinus virginianus)*	94.5 Technical	>292	Not classifiable	462358-09 Gallagher *et al.*, 2003	Supplemental

Subacute dietary toxicity testing with both bobwhite quail (MRID 462358-10) and mallard ducks (MRID 462358-11) indicated that the 8-day LC_{50} values exceeds the maximum concentrations tested, *i.e.*, LC_{50}>5556 mg a.e./kg of diet and LC_{50}>5496 mg a.e./kg of diet, respectively. No sublethal effects were noted for either species; therefore, the subacute dietary NOECs for bobwhite quail and mallard ducks are the highest concentrations tested, *i.e.*, 5556 mg a.e./kg of diet and 5496 mg a.e./kg of diet, respectively (**Table 18**). Since the LC_{50} values for both species is greater than 5000 mg a.e./kg of diet, aminopyralid acid is classified as practically non-toxic on an subacute dietary exposure basis.

Table 18. Avian subacute dietary toxicity for technical grade aminopyralid.

Species	% a.e.	LC_{50} (mg a.e./kg diet) (measured)	Toxicity Category	MRID Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	94.5 Technical	>5556	Practically non-toxic	462358-10 Gallagher, *et al.*, 2001	Acceptable
Mallard duck *(Anas platyrhynchos)*	94.5 Technical	>5496	Practically non-toxic	462358-11 Gallagher, *et al.*, 2001	Acceptable

Mammals

An acute oral toxicity study on Fischer rats (MRID 462356-03) resulted in an oral LD_{50} for both males and females greater than 5000 mg a.e./kg body weight (**Table 19**). This study was submitted to and reviewed by the Health Effects Division (HED) of the Office of Pesticide Programs. Based on the reported results, aminopyralid is classified as practically non-toxic to terrestrial mammals on an acute oral exposure basis.

Clinical observations were as follows. One male (1/5) died on day 3. "Clinical observations for the male that died were consistent with the rats moribund condition". The nine surviving rats exhibited a high incidence of perineal soiling, watery feces, perioral soiling, and perinasal soiling. A lower incidence of periocular soiling, decreased muscle tone, decreased resistance to removal, decreased extensor thrust and decreased reactivity to handling was also observed. A transient loss in body weight was observed in 4 rats during the first week of the study, however all animals regained weight during the study. At necropsy, the decedent exhibited hemolyzed blood, gas in the gastrointestinal tract and perineal soiling. No gross abnormalities were observed at necropsy in animals which survived to study termination.

Table 19. Acute mammalian toxicity for aminopyralid.

Species	% a.e.	LD_{50}	Toxicity Category	Affected Endpoints	MRID No.	Classification
Fischer rat *Rattus rattus*	94.5%	>5000 mg a.e./kg bw	practically non-toxic	none	462356-03	acceptable

Terrestrial-phase Amphibians, Reptiles and Beneficial Insects

No studies on terrestrial-phase amphibians or reptiles have been submitted for aminopyralid. However, a acceptable acute honeybee contact toxicity test (Guideline §141-1), was submitted, as well as a non-guideline acute honey bee oral toxicity test. In the 48-hour contact toxicity study (MRID 462358-31), the LD_{50} value exceeded the maximum dose tested, *i.e.*, LD_{50} >100 µg a.e./bee **(Table 20)**. In a 48-hour acute oral toxicity study (MRID 462358-32), the LC_{50} for aminopyralid exceeds 117 µg a.e./bee. No sub-lethal effects were observed in any of the treatments. Aminopyralid is categorized as practically non-toxic to pollinators on an acute contact basis.

Table 20. Nontarget insect acute toxicity for technical grade aminopyralid.

Species	% a.e.	LD_{50} (µg a.e./bee)	Toxicity Category	MRID No. Author/Year	Study Classification
Honey bee (*Apis mellifera*)	94.5 Technical	>100 (contact)	Practically non-toxic	462358-31 Aufderheide, 2001	Acceptable
Honey bee (*Apis mellifera*)	94.5 Technical	>117 (oral)	Practically non-toxic	462358-32 Aufderheide, 2001	Supplemental

(2). Chronic Effects

Birds

In an avian reproduction study, there were no treatment-related effects on any adult or offspring parameter for mallard ducks (MRID 462358-13). Thus, the chronic NOEC is greater than the maximum concentration tested, *i.e.*, 2623 mg a.e./kg of diet **(Table 21)**.

In a study of bobwhite quail (MRID 462358-12), there were statistically significant differences only at the lowest dose tested (640 mg a.e./kg diet) for two survival endpoints (hatchling survival per eggs set and 14-day hatchling survival), but it is unclear whether these are treatment-related effects. The differences appear to be artifacts of poor husbandry during the study. A new study should be submitted to clarify potential toxicity.

Table 21. Avian reproduction chronic toxicity for technical grade aminopyralid.

Species	% a.e.	NOEC (mg a.e./kg diet) (measured)	LOEC (mg a.e./kg diet) (measured)	MRID Author/Year	Study Classification
Mallard duck *(Anas platyrhynchos)*	94.5 Technical	2623	>2623	462358-13 Mach, 2003	Acceptable
Northern bobwhite quail *(Colinus virginianus)*	94.5 Technical	Not determined	640	462358-12 Mach, 2003	Supplemental

Mammals

In a 2-generation rat reproduction study, aminopyralid was administered to 30 CD rats per sex per group in the diet at concentrations of 0, 50, 250 or 1000 mg a.e./kg bw/day (equal to 0, 52.0, 259 or 1030 mg a.e./kg bw/day for males, and 0, 49.3, 245 or 973 mg a.e./kg bw/day for females). Each female in each generation was mated to produce one litter. For parent animals, there were no treatment-related effects on mortality, clinical signs, body weight and body weight gain, food intake, reproductive function, reproductive parameters or histopathology. For pups, there were no treatment-related effects on clinical signs, viability/litter parameters, pup body weight and body weight gain, organ weights or gross pathology. Therefore, the NOEL for parent and offspring is greater than the highest dietary concentration tested, 1000 mg a.e./kg bw/day (**Table 22**).

Table 22. Chronic toxicity of aminopyralid to mammals.

Species	% a.e.	Test Type	Toxicity Category	Affected Endpoints	MRID No.	Classification
CD rat *Rattus norvegicus*	94.5%	NOEL >1000 mg a.e./kg bw/day	–	none	PMRA	Acceptable

b. Terrestrial Plants

Tier II seedling emergence and vegetative vigor studies were submitted to fulfill data requirements. Seedling emergence testing (MRID 462358-24) with the TIPA salt form of aminopyralid (**Table 23**) indicated that onion was the most sensitive monocot (shoot weight EC_{25} = 0.026 lbs a.i./A); the EC_{05} for onion fresh shoot weight was 0.011 lbs a.i./A. Soybeans were the most sensitive dicot (fresh shoot weight EC_{25} = 0.002 lbs a.i./A); the NOEC for soybean fresh shoot weight was 0.0008 lbs a.i./A. Vegetative vigor testing (MRID 462358-25) with the TIPA salt form of aminopyralid indicated that onion was again the most sensitive monocot (fresh shoot weight EC_{25} = 0.05 lbs a.i./A); the EC_{05} for onion fresh shoot weight was 0.0016 lbs a.i./A). Soybeans were the most sensitive dicot (fresh shoot length EC_{25} = 0.00066 lbs a.i./A); the NOEC for soybean fresh shoot length was 0.0004 lbs a.i./A. **Tables 23 and 24** provide the most sensitive endpoints for all plant species tested.

Table 23. Summary of terrestrial and semi-aquatic seedling emergence and vegetative vigor toxicity testing for formulated aminopyralid.

Species	Test	NOEC (lbs a.i./A)	EC_{25} (lbs a.i./A)	MRID	Classification
Soybean (*Glycine max*)	seedling emergence	0.0008	0.002	462358-24	Supplemental
Soybean	vegetative vigor	0.0004	0.00066	462358-25	Supplemental
Onion (*Allium cepa*)	seedling emergence	0.0111	0.026	462358-24	Supplemental
Onion	vegetative vigor	0.0016	0.047	462358-25	Supplemental

[1] EC_{05} which is used when calculated EC_{25} is less than derived NOEC.

Table 24. Terrestrial plant Tier II seedling emergence[1] toxicity testing for formulated aminopyralid.

Crop	Emergence			Shoot length			Shoot fresh weight			Most sensitive para-meter
	NOEC	EC_{05}	EC_{25}/(slope)	NOEC	EC_{05}	EC_{25}/ (slope)	NOEC	EC_{05}	EC_{25}/ (slope)	
Barnyard grass-monocot	0.206	ND	>0.206/N/A	0.206	>0.206	>0.206/N/A	0.206	0.03	>0.206/0.822	None
Corn-monocot	0.206	>0.206	>0.206/N/A	0.206	>0.206	>0.206/N/A	0.206	>0.206	>0.206/N/A	None
Onion-monocot	0.05	0.02	0.041/3.40	0.03	0.014	0.083/1.25	0.05	0.01	0.026/2.62	Fresh Weight
Wheat-monocot	0.206	0.04	>0.206/0.288	0.206	>0.206	>0.206/N/A	0.206	ND	>0.206/N/A	None
Cucumber-dicot	>0.051	ND	>0.051/0.140	0.05	ND	>0.051/N/A	0.05	0.04	>57.7/3.53	None
Soybean-dicot	0	0	0.015/2.1	0.01	0	0.004/1.64	0	0	0.002/2.08	Fresh Weight
Sugar Beet-dicot	0.05	>0.051	>0.051/N/A	0	0.01	0.019/1.75	0.01	0	0.012/2.55	Fresh Weight
Lettuce-dicot	0.05	0.03	0.067/2.52	>0.051	0	0.054/2.21	0.01	0	0.018/3.87	Fresh Weight
Oilseed Rape-dicot	0.206	>0.206	>0.206/N/A	0.206	ND	>0.206/0.052	0.05	0	0.044/0.972	Fresh Weight
Radish-dicot	0.206	>0.206	>0.206/N/A	0.206	ND	>0.206/N/A	0.206	ND	>0.206/0.082 1	None

[1] All NOEC, EC_{05} and EC_{25} values are reported in lb a.i/A.

Table 25. Terrestrial plant Tier II vegetative vigor[1] toxicity testing for formulated aminopyralid.

Crop	Shoot length			Shoot fresh weight			Most sensitive parameter
	NOEC	EC_{05}	EC_{25}/(slope)	NOEC	EC_{05}	EC_{25}/(slope)	
Barnyard grass-monocot	0.206	>0.206	>0.206/N/A	0.206	ND	>0.206/N/A	None

Corn-monocot	0.206	>0.206	>0.206/N/A	0.206	>0.206	>0.206/N/A	None
Onion-monocot	0.0016	0.07	>0.206/1.06	0.0016	0	0.047/0.266	Fresh weight
Wheat-monocot	0.206	>0.206	>0.206/N/A	0.206	>0.206	>0.206/N/A	None
Cucumber-dicot	0.006	0.005	0.01/2.58	0.006	0.017	0.023/6.82	Shoot length
Soybean-dicot	0.0004	0	0.00066/0.676	0.0004	0.0002	0.0012/1.20	Shoot length
Sugar Beet-dicot	0.026	0.032	0.05/4.95	0.003	0.0001	0.0075/0.553	Fresh weight
Lettuce-dicot	0.003	0.0015	0.0057/1.67	0.026	0.0012	0.0029/2.66	Fresh weight
Oilseed Rape-dicot	0.206	>0.206	>0.206/N/A	0.206	>0.206	>0.206/N/A	None
Radish-dicot	0.102	0.067	>0.102/2.93	0.006	0.0077	0.048/1.22	Fresh weight

[1] All NOEC, EC_{05} and EC_{25} values are reported in lb a.i./A.

Aquatic Plants

IV. Risk Characterization

A. Risk Estimation

In a deterministic (point estimate) approach to evaluating potential risk to non-target organisms from the proposed uses of aminopyralid, risk quotients (RQs) are calculated from the ratio of estimated environmental concentrations (EECs) to ecotoxicity values. RQs are then compared to levels of concern (LOCs) used by OPP to indicate potential risk to non-target organisms and the need to consider regulatory action. For studies on taxa where no effects were observed (with no endpoint established), the highest dose tested is used in RQ calculation and is sufficient to show that little to no risk would be expected, even if the endpoint (*e.g.*, LC_{50}) were established at a higher dose.

1. Aquatic Animals and Plants

For acute toxicity, estimated 1-in-10-year peak surface water concentrations are divided by the 96-hour LC_{50} for fish or 48-hour EC_{50} for invertebrates. For plants, 120-hour or 14-day EC_{50} values are used. For chronic RQs, 1-in-10 year 21-day (invertebrates) or 60-day (fish) mean concentrations are divided by chronic NOAEC values. Derivation of aquatic estimated environmental concentrations was discussed previously in the water resources assessment. EECs used for predicting risk quotients for aminopyralid are based on parent compound alone, as no degradates of concern were identified. The 1-in-10 year peak concentration of aminopyralid in surface water is 0.00633 ppm, the 1-in-10 year 21-day average concentration is 0.006 ppm and the 1-in-10 year 60-day average concentration is 0.0054 ppm. These EECs are from the pasture/rangeland application rate; EECs from wheat applications are less.

Aquatic Vertebrates

At the maximum proposed application rate for pasture and rangeland, no acute levels of concern (RQ≥0.1) for freshwater and estuarine/marine vertebrates are exceeded (**Table 26**). Similarly, chronic risk quotients for freshwater vertebrates, based on average 60-day EECs, do not exceed LOCs (RQ≥1.0). Chronic risk to estuarine/marine vertebrates was not assessed, as discussed previously since no chronic toxicity data are available.

Table 26. Acute and chronic risk quotients for aquatic vertebrates exposed to aminopyralid.

Crop Application Rate (lbs. a.e./A)	EECs	Acute Risk Quotients		Chronic Risk Quotients	
	Peak / 21-day Average (µg/L)	Freshwater [1] LC_{50} > 100 mg/L	Estuarine/marine[2] EC_{50} > 120 mg/L	Freshwater [1] NOEC = 1.36 mg/L	Estuarine/marine NOEC = ND[3]
Pasture/Rangeland 0.11	6.38 6.04	<0.01 –	<0.01 –	– <0.01	– ND
Wheat 0.0089	0.52 0.49	<0.01 -	<0.01 -	- <0.01	- ND

[1] Rainbow trout (*Oncorhynchus mykiss*) and bluegill sunfish (*Lepomis macrochirus*)
[2] Sheepshead minnow (*Cyprinodon variegatus*)
[3] Not determined

Aquatic Invertebrates

At the maximum proposed application rate for pasture and rangeland, no acute levels of concern (RQ≥0.1) for freshwater and estuarine/marine invertebrates are exceeded (RQ<0.01; **Table 27**). Chronic risk quotients for freshwater vertebrates, based on average 21-day EECs do not exceed LOCs (RQ≥1.0) with values less than 0.01. Chronic risk to estuarine/marine vertebrates was not assessed, as discussed previously since no chronic toxicity data are available.

Table 27. Acute and chronic risk quotients for aquatic invertebrates exposed to aminopyralid.

Crop Application Rate (lbs. a.e./A)	EECs	Acute Risk Quotients		Chronic Risk Quotients	
	Peak / 21-day Average (µg/L)	Freshwater [1] EC_{50} > 98.6 mg/L	Estuarine/marine[2] LC_{50} > 89 mg/L	Freshwater [1] NOEC = 102 mg/L	Estuarine/marine NOEC = ND[3]
Pasture/Rangeland 0.11	6.38 6.04	<0.01 –	<0.01 –	– <0.01	– ND
Wheat 0.0089	0.52 0.49	<0.01 -	<0.01 -	- <0.01	- ND

[1] Waterflea (*Daphnia magna*)
[2] Eastern oyster (*Crassostrea virginica*)
[3] Not determined

Aquatic Plants

RQs for aquatic plants are all below the LOC, therefore, there does not appear to be risk to aquatic plants from the proposed uses of aminopyralid (**Table 28**).

Table 28. Risk quotients for aquatic plants exposed to aminopyralid.

Crop Application Rate (lbs. a.e./A)		EEC Peak / (μg/L)	Risk Quotient *Navicula pellicosa* EC_{50} = 18 mg/L
Pasture/Rangeland	0.11	6.38	<0.01

2. Terrestrial Animals

Acute and chronic risk quotients for terrestrial animals were calculated using the T-REX program; background information on the program and its output is contained in **Appendix D**.

Birds

Acute and chronic risk quotients for birds are based on 20-gram birds since they are assumed to consume the highest percentage (115%) of their body weight. Since the acute oral toxicity of aminopyralid (LD_{50}>2250 mg/kg bw) exceeded the highest concentration tested, acute RQ values are less than the calculated value (**Table 29**). The mallard duck chronic toxicity studies elicited no effects at any of the concentrations tested, thus, the NOAEC was determined to be 2623 mg a.e./kg diet. A study evaluating the chronic toxicity of aminopyralid to bobwhite quail failed to establish a NOAEC, although this appears to be an artifact of poor husbandry. The chronic risk quotients do not exceed levels of concern when using the mallard NOAEC, however, there remains uncertainty regarding chronic avian effects due to the bobwhite quail study. Even though using the lowest dose tested in the quail study does not result in RQs that approach the LOC, a new study should be submitted to address this uncertainty. The Agency will re-evaluate the potential chronic risk to bird when that study is submitted.

Table 29. Avian (20-g bird) acute and chronic risk quotients for the proposed uses of aminopyralid based on a bobwhite quail LD_{50} >2,250 mg a.e./kg bw and mallard NOAEC = 2623 mg a.e./kg diet.

Use/App. Method	Application Rate lbs. a.e./A	Food Items	Maximum EEC (mg/kg)[a]	Acute RQ (EEC/LD_{50})	Chronic RQ (EEC/NOAEC)
Pasture/ Rangeland	0.11	Short grass	26.40	<0.01	0.01
		Tall grass	12.10	<0.01	0.01
		Broadleaf plants/small insects	14.85	<0.01	0.01
		Fruits, pods, seeds, and large insects	1.65	<0.01	<0.01
Wheat	0.0089	Short grass	2.16	<0.01	<0.01
		Tall grass	0.99	<0.01	<0.01
		Broadleaf plants/small insects	1.22	<0.01	<0.01
		Fruits, pods, seeds, and large insects	0.14	<0.01	<0.01

Mammals

Consistent with aminopyralid being practically nontoxic to mammals on an acute oral exposure basis (LD_{50}>5,000 mg/kg bw), no acute risk levels of concern (RQ>0.5) are exceeded (**Table 30**) for any size mammal.

Table 30. Acute RQ values for small (15-g), intermediate (35-g) and large (1,000-g) mammals feeding on short or tall grass, broadleaf plants/small insects, fruits/pods/large insects and seeds exposed to aminopyralid following a single application, based on a rat LD_{50} >5,000 mg a.e./kg bw.

Application	Application Rate lbs. a.e./A	Body Weight, g	Mammalian Acute Risk Quotients				
			Short Grass	Tall Grass	Broadleaf Plants/Small Insects	Fruits/pods/ large insects	Seeds
Pasture/ Rangeland	0.11	15	<0.01	<0.01	<0.01	<0.01	<0.01
		35	<0.01	<0.01	<0.01	<0.01	<0.01
		1000	<0.01	<0.01	<0.01	<0.01	<0.01
Wheat	0.0089	15	<0.01	<0.01	<0.01	<0.01	<0.01
		35	<0.01	<0.01	<0.01	<0.01	<0.01
		1000	<0.01	<0.01	<0.01	<0.01	<0.01

Using dose-based RQ values, no chronic risk levels of concern (RQ>1.0) are exceeded for small (15 g), medium (30 g) or large (1,000 g) mammals foraging on short grass, tall grass, broadleaf plants/small insects or seeds based on a NOEC of 1000 mg a.e./kg of diet (**Table 31**).

Table 31. Chronic RQ values for small (15-g), intermediate (35-g) and large (1,000-g) mammals feeding on short or tall grass, broadleaf plants/small insects, fruits/pods/large insects and seeds exposed to aminopyralid following a single application, based on a NOEC of 1,000 mg a.e./kg diet.

Application	Application Rate lbs. a.e./A	Body Weight, g	Mammalian Chronic Risk Quotients				
			Short Grass	Tall Grass	Broadleaf Plants/Small Insects	Fruits/pods/ large insects	Seeds
Pasture/ Rangeland	0.11	15	0.03	0.01	0.01	<0.01	<0.01
		35	0.02	0.01	0.01	<0.01	<0.01
		1000	<0.01	<0.01	<0.01	<0.01	<0.01
Wheat	0.0089	15	<0.01	<0.01	<0.01	<0.01	<0.01
		35	<0.01	<0.01	<0.01	<0.01	<0.01
		1000	<0.01	<0.01	<0.01	<0.01	<0.01

3. Non-target Terrestrial Plants

Acute risk quotients are derived using the TerrPlant model (**Appendix E**) and use the

EC_{25} as the toxicity endpoint. The risk to plants is based on the TIPA salt form of aminopyralid (a.i. rather than a.e.), as this what was tested. Chronic or reproductive risks to plants are not currently evaluated. Additionally, because of the proposed use on rangeland, RQs for direct application of aminopyralid are calculated based on application rate.

For pasture/rangeland applications, acute risk LOCs ($RQ \geq 1.0$) are exceeded for non-listed dicotyledonous plants due to runoff plus drift in areas adjacent to application site following ground and aerial applications of aminopyralid (RQ range: 6.33 to 8.44; **Table 32**). Acute risk LOCs are also exceeded for both non-listed monocots and dicots in semi-aquatic areas with RQ values ranging from 2.84 to 53.81. Acute risk LOCs from drift alone are exceeded for non-listed dicots following ground and aerial applications with RQ values ranging from 3.2 to 15.98. For wheat applications, acute risk LOCs are exceeded in semi-aquatic areas and from drift from aerial application.

For pasture/rangeland, federally listed endangered plant species risk quotients, calculated using the NOEC or EC_{05}, exceeded LOCs by factors ranging from 5.28 to 134.51 for dicots. Endangered plant species LOCs are exceeded for monocots, with RQs ranging from 1.15 to 9.78 (**Table 32**). For wheat applications, LOCs are not exceeded for moncots, but are exceeded for dicots with RQs ranging from 1.28 to 10.84. LOCs for dicots are not exceeded for drift from ground application.

Table 32. Risk quotients for plants and endangered terrestrial plants for ground and aerial application of aminopyralid to pasture/rangeland (0.211 lbs a.i./A).

	Ground Spray			Aerial Spray		
	Adjacent uplands (EEC 0.0127)	Adjacent wetlands (EEC 0.1076)	Drift Only (EEC 0.0021)	Adjacent uplands (EEC 0.0169)	Adjacent wetlands (EEC 0.0739)	Drift Only (EEC 0.0106)
Monocots	0.49[a]	4.14[a]	0.04[b]	0.65[a]	2.84[a]	0.21[b]
Dicots	6.33[c]	53.81[c]	3.20[d]	8.44[c]	36.93[c]	15.98[d]
Endangered Monocots	1.15[e]	9.78[e]	1.32[f]	1.53[e]	6.71[e]	6.59[f]
Endangered Dicots	15.83[g]	134.51[g]	5.28[h]	21.10[g]	92.31[g]	26.38[h]

[a] calculated with EC_{25} for seedling emergence 0.026 lbs. a.i/A
[B] calculated with EC_{25} for vegetative vigor 0.05 lbs. a.i/A
[C] calculated with EC_{25} for seedling emergence 0.002 lbs. a.i/A
[D] calculated with EC_{25} for vegetative vigor 0.00066 lbs. a.i/A
[e] calculated with EC_{05} for seedling emergence 0.011 lbs. a.i./A
[F] calculated with NOEC for vegetative vigor 0.0016 lbs. a.i/A
[g] calculated with NOEC for seedling emergence 0.0008 lbs. a.i./A
[h] calculated with NOEC for vegetative vigor 0.0004 lbs. a.i./A

Using EECs resulting from Tier I AgDRIFT® modeling, RQs were calculated using soybean, the most sensitive plant species tested and the application rate for rangeland. The acute risk and endangered species LOCs are exceeded for sensitive plants out to 900 feet from the use site (**Table 33**) following aerial applications at the proposed rate for pasture/rangeland and are exceeded at distances greater than 100 feet for wheat application. For ground applications, LOCs are also exceeded at distances greater than 100 feet from the application site.

Table 33. Acute and endangered species risk quotients for plants at selected distances from application area using soybean EC_{25} of 0.00066 lbs. a.i./A and NOEC of 0.0004 lbs. a.i./A.

	Use	Max. Single Application Rate lbs. a.e./A	Risk quotients at Specified Distance From Edge of Field (feet)			
			0	100	500	900
Aerial	Pasture/rangeland	0.211	159.85	30.61	6.06	3.94
acute	Wheat	0.017	12.88	2.58	0.45	0.30
Aerial	Pasture/rangeland	0.211	263.75	50.50	10.00	6.50
endangered	Wheat	0.017	21.25	4.25	0.75	0.50
Ground	Pasture/rangeland	0.211	319.70	7.88	1.21	0.45
acute	Wheat	0.017	25.76	0.61	0.11	0.05
Ground	Pasture/rangeland	0.211	527.50	13.00	2.00	0.75
endangered	Wheat	0.017	42.50	1.00	0.18	0.08

RQs for direct application of aminopyralid through use on pasture/rangeland, rights of way and natural areas range from four for non-listed monocots based on vegetative vigor to 528 for listed dicots, also based on vegetative vigor (**Table 34**).

Table 34. Risk quotients for non-listed terrestrial plants from direct application of aminopyralid.

Species	Test	Listed	Non-listed
Soybean (*Glycine max*)	seedling emergence	264	106
Soybean	vegetative vigor	528	319
Onion (*Allium cepa*)	seedling emergence	19	8
Onion	vegetative vigor	132	4

B. Risk Description

Based on the screening-level risk assessment, proposed use of aminopyralid does not appear to present a risk to aquatic or terrestrial animals. Aquatic plants also do not appear to be at risk from proposed uses. Terrestrial plants adjacent to use sites are at risk from aminopyralid use. Because the screening-level assessment uses few surrogate species to estimate risk to all aquatic and terrestrial organisms, it is possible that some species will be affected unexpectedly.

1. Risks to Aquatic Organisms

a. Aquatic Animals

As an auxenic analogue, aminopyralid utilizes plant hormonal pathways to be effective. Since these pathways are absent in animals, it is not surprising that risk to animals from the use of aminopyralid appears to be minimal. Risk to aquatic animals from the proposed uses of aminopyralid is expected to be low. Although there was some evidence of sublethal effects in the rainbow trout study (loss of equilibrium in 7% of the fish in the highest treatment concentration), aminopyralid is classified as practically nontoxic to most of the guideline test species. This assessment found that no acute or chronic risk LOCs are exceeded using the Tier I model GENEEC exposure estimates. While there is uncertainty in the actual dose-response curves derived from aquatic invertebrate data, due to the very low pH in the highest tested concentrations, the endpoints derived from these studies (assuming effects in the highest concentration are due to toxicity) do not indicate a cause for concern.

There is considerable uncertainty in the rate of aerobic degradation of aminopyralid in different soils, since there were useable data for only one soil type. The other four soils tested in the study had material balance deficiencies, and, hence, the data from these four soils was not considered useable. These unuseable data, however, give some indication that the half-life of aminopyralid may be up to five times the value derived from the usable soil. In addition, structurally similar chemicals picloram and clopyralid exhibit longer aerobic soil metabolism half-lives than determined in the one usable soil for aminopyralid. Due to the lack of confidence in the estimation of the aerobic soil metabolism half life, a new study should be submitted to reduce the uncertainty. To attempt to address the effects of this uncertainty, GENEEC modeling was also conducted using a theoretical half-life of 1000 days, and RQs still did not approach the LOCs.

b. Aquatic Plants

Risk quotients for aquatic plants do not exceed the LOCs for either non-listed or Federally listed threatened/endangered aquatic plants. Low exposure values appear to be the primary driver of this low risk finding (coupled with the fact that aminopyralid did not appear to be particularly toxic to aquatic plants). However, the effect of aminopyralid on cyanobacteria remains unresolved due to the lack of usable data (the study on *Anabaena flos-aquae* was unacceptable). (Cyanobacteria are present in almost every aquatic ecosystem and many species are food sources for higher trophic levels and some species are nitrogen-fixers.)

2. Risks to Terrestrial Organisms

a. Animals

As an auxinic analogue, aminopyralid utilizes plant hormonal pathways to be effective. Since these pathways are absent in animals, it is not surprising that risk to animals from the use of aminopyralid appears to be minimal.

No mortality was reported in the acute study of bobwhite quail, although there were transient signs of toxicity (*e.g.*, loss of coordination, lethargy, neck curl) observed at oral doses as low as 23 mg a.e./kg bw. Subacute dietary studies with bobwhite quail and mallard duck do not indicate risk at the highest dose tested. Aminopyralid does not appear to present an acute risk to birds.

The mallard duck study did not indicate any chronic effects at the dietary concentrations tested. While statistically significant effects were observed in bobwhite quail at the lowest dietary concentration tested, these effects did not appear to be dose-related, but rather are believed to be an artifact from mechanical problems with the egg incubator. A new chronic study with bobwhite quail should be submitted to verify that aminopyralid does not pose a chronic risk to birds. The Agency will modify the risk assessment to reflect the new study when it is submitted. Since birds are used by the Agency as surrogate organisms for reptiles, it is also assumed that risk to reptiles would be low. However, actual risk to reptiles remains uncertain.

Treatment with aminopyralid did not result in any acute, subacute or chronic effects in mammals based on laboratory studies. Thus, it is not surprising that no acute or chronic risk LOCs are exceeded for mammals. A review of mammal toxicity tests submitted to the Health Effects Division

Similarly, testing of honeybees indicated no acute or sublethal effects, so aminopyralid is classified as practically nontoxic to insects on an acute exposure basis. Although risk to terrestrial invertebrates is not typically evaluated, the low toxicity of aminopyralid to beneficial insects suggests that the likelihood of adverse effects is also low.

Aminopyralid use may result in unintended effects on ecosystems. It is unclear what the extent of these effects may be, but disruptions in habitat or food sources may occur, at least in areas proximal to aminopyralid use. Effects could include changes in plant communities due to differences in species sensitivity and/or loss of preferred feed. Affected animals might be at any trophic level, and may affect organisms with obligate relationships to plants.

b. Terrestrial Plants

Aminopyralid use may result in unintended adverse effects on non-target terrestrial plants. It is unclear what the extent of these effects may be, but disruptions in habitat or food sources may occur, at least in areas proximal to proposed aminopyralid use sites. Effects could include changes in plant communities due to differences in species sensitivity and/or loss of preferred feed. Animals can be affected indirectly. Affected animals might be at any trophic level, and may affect organisms with obligate relationships to plants.

Proposed application to pastures/rangelands result in the greatest estimated risk, due primarily to the higher application rate. However, even at the much lower proposed application rate for wheat, LOCs are still exceeded in many circumstances. The greatest risk is to dicotyledonous plants, although there are risks to wetland monocots as well.

Of the four monocot species tested, three were in the grass family (Poaceae). The three grasses were unaffected by aminopyralid at the highest dose tested (0.21 lbs a.i./A). However, onion (*Allium cepa*), in the lily family (Liliaceae), was susceptible to reduction in emergence, shoot length and weight at exposure rates as low as 0.0016 lbs a.i./A. Based on the sensitivity of onion, risk to non-target monocots in wetlands exceeds the Agency's levels of concern at application rates proposed for pasture/rangeland uses, with risk to endangered wetland monocots (*e.g.*, orchids) of particular concern.

Dicotyledonous plants appear generally more sensitive to aminopyralid than monocots, although they exhibit a wide range of sensitivities. Soybean (*Glycine max*), a member of the pea family (Fabaceae), was the most sensitive species tested, with reduced emergence and reductions in shoot weight and shoot length in both the emergence and vigor tests. Many members of the pea family are nitrogen-fixing plants and, therefore, play a critical role in the nutrient budgets of ecosystems.

Sugarbeet (*Beta vulgaris*; Chenopodiaceae) and lettuce (*Lactuca sativa*; Asteraceae) are both sensitive enough (seedling emergence) to trigger exceedances for endangered wetland plants, and lettuce is sensitive enough (vegetative vigor) to trigger exceedance for endangered plants exposed to spray drift. Fletcher *et al.* (1990) studied the relationship between taxa regarding their sensitivity to various herbicides. They found sensitivity to be very similar between taxa at the genus level, while sensitivity at the family level was indicative of similar toxicity about 60% of the time. This suggests that, based on guideline testing, at least three ecologically important dicotyledonous families (out of the five tested) are at risk from aminopyralid use, especially on pasture/rangeland. Due to the lower application rate proposed for wheat, this use results in lower risk quotients for non-target plants, although risk is not eliminated.

As described in the Risk Estimation section, terrestrial plants adjacent to a treated field may be at risk from exposure to aminopyralid through runoff and spray drift. Spray drift alone could also pose a risk to non-target plants further from the treated field, depending on the method of application. For instance, a Tier 1 drift assessment with AgDrift indicates that aerial application of aminopyralid to wheat could pose a risk to non-target terrestrial plants over 100 feet from the treated field, while ground application to wheat would only pose a risk to plants directly adjacent to the treated field.

The Tier 1 AgDrift assessment also suggests risk from spray drift from pasture/rangeland and right-of-way uses to a distance much further from the treated field. However, these proposed uses represent different exposure scenarios than the application of an herbicide to an agricultural row crop. Broadcast application of aminopyralid to pasture or rangeland would very likely expose non-target plants to direct spray, resulting in an RQ of 319 for the most sensitive plant tested in submitted toxicity studies. Risk quotients based on drift from aerial application to pastures/rangelands exceed the LOC for locations greater than 900 feet from the treated area, while RQs based on ground application drift exceed the LOC for at least 500 feet. As with the application to wheat, the amount of drift can be minimized through use of drift control measures, including use of a coarse droplet size spectrum (as defined by ASAE S572). However, non-target plants within the treated area would still be exposed unless the proposed uses on pastures and rangelands are meant to be directed spot treatments.

Application to rights-of-way and roadways will also lead to direct overspray of plants, but the clearing of (non-endangered) plants exposed in this manner is intentional. In addition, as with pastures and rangelands, use of aminopyralid to control invasive plant species might affect individual plants, but could benefit native plant populations. AgDRIFT® modeling indicates that spray drift could potentially pose a risk hundreds of feet from rights-of-way or roadsides, but the potential application scenarios are too varied to characterize spray drift exposure simply. For instance, spray drift from application to rights-of-way passing through wooded areas could be greatly reduced by the trees on either side, although the trees themselves might be damaged. Spray drift from application to rights-of-way in more inhabited areas could be hindered by buildings and other man-made structures. Roads would provide an effective spray-drift buffer of varying width on one side of roadside applications.

There are several uncertainties regarding risk to plants. One is whether the default assumption of 5% spray drift (from aerial application) in TerrPlant is sufficiently protective. Estimates made from actual drift assessments range to higher than 20%, which could indicate that risk to plants is underestimated. Another uncertainty regarding the model used in this assessment is an assumption of a 60% 'efficiency factor' to runoff after aerial application. The use of this factor appears to leave about 35% of the applied chemical unaccounted for and it is possible that risk to wetland plants is underestimated.

Further, to what degree the species chosen for testing are representative of the range in potential plant sensitivities found in the ecosystem is uncertain. Plants tested are crop plants, typically subjected to hundreds of years of human selection. It is possible that crop species will be more or less sensitive to aminopyralid than native wild type species. Tests using wild-type species may help reduce this uncertainty, but a critical review paper McKelvey *et al.* (2002) suggests that, in general, crop testing may be sufficiently protective of most plants. However, in light of the Endangered Species Act, considerable uncertainty remains.

Because LOCs are exceeded for both upland and wetland plants, there are potential indirect effects on animal food sources and habitat. The extent to which these effects exists is unclear, but they cannot be dismissed based on this assessment. Additionally, although reproductive effects on plants are not evaluated in screening-level risk assessments, there is some evidence that picloram and clopyralid, chemicals very similar in structure and mode of action to aminopyralid, induce ethylene production in affected plants (Valenzuela-Valenzuela *et al.*, 2001). Because ethylene is another plant hormone, this effect, if produced by aminopyralid, would be of interest since ethylene affects maturing fruit and hence reproduction. It is unclear what, if any, effect this relationship may have on plant populations affected by aminopyralid.

Despite the structural similarity to picloram and clopyralid, the other pyridine carboxylic acid herbicides, there is considerable uncertainty in the fate profile of aminopyralid. Because there are indications that aminopyralid may be as persistent as these chemicals, it is important to be aware of some of the issues that have been identified regarding these chemicals. Clopyralid has been known to persist in grass clippings. When the grass clippings were used as mulch, unintended plant death resulted. The label was subsequently changed to prevent this occurrence. Picloram has been detected in appreciable amounts in groundwater monitoring, as described in the picloram RED. Whether either of these issues will occur with aminopyralid is uncertain. The application rate of aminopyralid may be lower than either clopyralid or picloram.

4. Federally Threatened and Endangered (Listed) Species Concerns

Because LOCs were exceeded for both acute risk and listed plants, all listed plants and animals are considered to potentially be at risk from the proposed uses of aminopyralid. Listed plants may be at direct risk, from runoff or spray drift in wheat use areas, or direct overspray in pasture/rangeland areas. Endangered animals may be at risk due to potential alterations to food sources or habitat. This risk may be direct or indirect. For example, a shift in plant populations could effect the food source or habitat of a listed animal, or an animal population upon which a listed animal depends. Additionally, obligate relationships (where an animal is dependent on a plant species for some part of its life cycle) may exist in some areas where aminopyralid use is proposed.

a. Action Area

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

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

b. Taxonomic Groups Potentially at Risk

The risk quotients (RQs) calculated based on the ratio of estimated environmental concentrations (EECs) to toxicity endpoints, in this case the EC_{05} or NOEL from plant toxicity studies, indicate potential risk to endangered plants exposed to aminopyralid through spray drift or runoff.

Should estimated exposure levels occur in proximity to listed resources, the available screening level information suggests a potential concern for direct effects on listed plant species associated with both the wheat and pasture/rangeland uses of aminopyralid. This Level I screening assessment is based on the initial assumption that listed species within the taxonomic groups of concern are actually present in areas for which the estimated exposure levels used for RQ calculation can be expected to occur. A specific determination of "may affect" for any RQ in excess of listed species LOCs cannot be made until a determination of the co-occurrence of the listed species with the action area has been determined.

c. Indirect Effects Analysis

Because plant RQs are above non-endangered species LOCs, the Agency considers this to be indicative of a potential for adverse effects to those listed species that rely either on a specific plant species (plant species obligate) or multiple plant species (plant dependant) for some important aspect of their life cycle. The extent to which the use of aminopyralid on wheat and pasture/rangeland will indirectly effect listed animal species will require identification of listed species that co-occur in areas of aminopyralid use and an evaluation of critical habit as described below. Because of the national extent of the proposed uses of aminopyralid, a 'may effect' designation is assumed to be possible for all listed animals.

d. Critical Habitat

The screening-level risk assessment has identified potential concerns for indirect effects on listed species for those organisms dependant upon on plants sensitive to aminopyralid. In light of the potential for indirect effects, the next step for EPA and the Service(s) is to identify which listed species and critical habitat are potentially implicated. Analytically, the identification of such species and critical habitat can occur in either of two ways. First, the agencies could determine whether the action area overlaps critical habitat or the occupied range of any listed species. If so, EPA would examine whether the pesticide's potential impacts on non-endangered species would affect the listed species indirectly or directly affect a constituent element of the critical habitat. Alternatively, the agencies could determine which listed species depend on biological resources, or have constituent elements that fall into, the taxa that may be directly or indirectly impacted by the pesticide. Then EPA would determine whether use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA does not permit use of either analytical approach to make a definitive identification of species that are potentially impacted indirectly or critical habitats that is potentially impacted directly by the use of the pesticide. EPA and the Service(s) are working together to conduct the necessary analysis.

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

e. Co-occurrence Analysis

The goal of the analysis for co-location is to determine whether sites of pesticide use are geographically associated with known locations of listed species. At the screening level, this analysis is accomplished using the Agency's LOCATES database. The database uses location information for listed species at the county level and compares it to agricultural census data for crop production at the same county level of resolution. The product is a listing of federally listed species that are located within states known to produce the crop upon which the pesticide will be used. Because the Level I screening assessment considers **both** direct and indirect effects across generic taxonomic groupings, it is not possible to exclude any taxonomic group from a LOCATES database run for a screening risk assessment.

Because aminopyralid is a new chemical, the extent of its use has not yet been determined. Additionally, the LOCATES database does not have a pasture/rangeland co-occurrence search capacity at the present time. Listed species for states where wheat is grown are included in **Appendix H**. As noted previously, at the screening level, with its national scale, it is not possible to evaluate all the potential indirect effects that could impact endangered animals. Therefore, a 'may effect' designation is assumed to be possible for all listed animals.

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

The environmental fate and effects data submitted to the Agency are nearly complete. (A comprehensive list of the status of all data requirements is located in **Appendix I**.). However, because of material-balance and extraction problems in the aerobic soil metabolism study, the results from only one of five test soils could be used in environmental transport modeling. The aerobic soil metabolism half-life observed in some of the other four soils was apparently much longer than the 103.5-day half-life observed in the one acceptable soil. Half-lives in the four invalid soils ranged from 31.5 to 533.2 days when calculated by adding non-extractible residue amounts in with parent concentrations. Therefore, the persistence of aminopyralid may be underestimated in this assessment, and estimated aquatic concentrations may not be conservative. However, GENEEC modeling using longer aerobic soil metabolism half-lives did not result in aquatic concentrations that approach levels-of-concern for aquatic animals and plants. In addition, aminopyralid "degraded" to non-extractable residue in several studies and extraction was not attempted with the harshest means possible. Therefore, if this non-extractable material was more harshly extracted, it is possible that it could be recovered in parent form. The mass of non-extractable material was mathematically treated as parent in aerobic soil metabolism rate calculation, in order to conservatively treat this uncertainty.

There is some uncertainty regarding chronic effects to birds. While the reproduction study using the mallard duck produced a NOEC of 2623 mg a.e./kg diet, the bobwhite quail study did not determine a reliable NOEC. Only the lowest dose tested for two endpoints (hatchling survival per eggs set and 14-day hatchling survival) in the bobwhite quail study were statistically different from controls. However, downward trends in hatchlings per live embryo and hatchlings per pen suggest a possible dose-response relationship with aminopyralid; these effects were not statistically significant ($p>0.05$). A new study should be submitted to address this uncertainty regarding the potential chronic effects of aminopyralid on bobwhite quail reproduction; the Agency will re-evaluate chronic toxicity to birds when that study is received.

Further, the effect of aminopyralid on cyanobacteria is uncertain, due to the submission of an unacceptable study. Cyanobacteria are present in almost every aquatic ecosystem and many species are food sources for higher trophic levels and some species are nitrogen-fixers.

Despite the structural similarity to picloram and clopyralid, the other pyridine carboxylic acid herbicides, there is considerable uncertainty in the fate profile of aminopyralid. Because there are indications that aminopyralid may be as persistent as these chemicals, it is important to be aware of some of the issues that have been identified regarding these chemicals. Clopyralid has been known to persist in grass clippings. When the grass clippings were used as mulch, unintended plant death resulted. The label was subsequently changed to prevent this occurrence. Picloram has been detected in appreciable amounts in groundwater monitoring, as described in the picloram RED. Whether either of these issues will occur with aminopyralid is uncertain. The application rate of aminopyralid may be lower than either clopyralid or picloram.

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Appendix A. Preliminary Data Screen.

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

OFFICE OF
PREVENTION, PESTICIDES, AND
TOXIC SUBSTANCES

DP Barcode: D306647
PCCode: 005100
Date: August 16, 2004

MEMORANDUM:

SUBJECT: EFED Preliminary Screen of Environmental Fate and Ecological Effect Studies of Aminopyralid

To: Joanne Miller, Product Manager
Registration Division

FROM: Kevin Costello, Geologist
John Ravenscroft, Biologist
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THRU: Elizabeth Behl, Branch Chief
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Environmental Fate and Effects Division (7507C)

The Environmental Fate and Effects Division (EFED) has completed its review of the preliminary screen of both environmental fate and ecological effect studies on aminopyralid. There were a total of 9 environmental fate studies (**Table A-1**) and 26 ecological effect studies (**Table A-2**) submitted for aminopyralid. **Tables A-1** and **A-2** list each of the studies and whether there were any issues associated with the study that may limit its utility in ecological risk assessment. In general, all but one of the studies appeared to contain sufficient information on the fate and effects of aminopyralid for EFED to complete data evaluation records and to complete an ecological risk assessment of the chemical.

Ecological effect studies submitted to the Agency in support of the new use registration of aminopyralid are summarized in **Table A-2** and included the required acute and chronic toxicity tests using technical grade active ingredient (XDE-750) with the exception of the vegetative vigor and seedling emergence tests, which used the formulated end product GF-871 (40.6% a.i.). Common problems with the studies seemed minor and included deviations from EPA-recommended water quality parameters (*e.g.*, hardness and pH). In those studies with these deviations, mortality was not observed.

While the array of studies provided by the registrant in support of this chemical's registration, including a chironomus life cycle test, is impressive and commendable, EFED is concerned about the lack of data covering the metabolites of aminopyralid. Aminopyralid is a dichlorinated pyridine and while the amino and carboxyl sidechains should be easily cleaved through chemical and microbial action, the remaining chlorinated ring structure maybe more resistant to further metabolic breakdown.

In the environmental fate studies, summarized in **Table A-1**, there was one study which does not appear to be scientifically valid. The photodegradation in soil study had mass balances of 104 and 106% in the two replicates at the beginning of the study, and mass balances of 88 and 82% at the end of the study, respectively. The inability to account for more than 20% of the material by the end of the study calls the validity of the data into question.

There were several other important guideline deviations which merit closer scrutiny during full review of these studies. The aerobic soil metabolism study was performed on five different soils, but the mass balance was unacceptable for a number of sampling intervals for each soil. Studies for a number of those soils are likely to be invalid. In addition, the study authors claim that the only degradate (other than non-extractable residues) in the aerobic soil metabolism study is CO_2. Additional raw data will be necessary to determine if the broad peaks in the "representative HPLC chromatograms" provided in the study represent only parent aminopyralid, or the parent and additional soil metabolites. Since metabolites are not identified in the aerobic soil metabolism study, the study authors made no attempt to identify degradates in the terrestrial field dissipation studies.

Table A-1. Summary of preliminary screen on environmental fate studies for aminopyralid. (N/A = nonapplicable).

Guideline #	Description	MRID	Title	Does this study have a "fatal flaw"?
161-1	Hydrolysis	46235726	Hydrolysis of XDE-750 at pH 5, 7, and 9.	No
161-2	Photodegradation in Water	46235727	Aqueous Photolysis of XDE-750 in pH 5 Buffer Under Xenon Light.	No
161-3	Photodegradation on Soil	46235728	Photodegradation of XDE-750 on Soil.	Yes- material balance low
162-1	Aerobic Soil Metabolism	46235729	Aerobic Soil Degradation of XDE-750 in Five North American Soils.	No, although most of the studies will be invalid for poor material balance, and degradates likely not identified.
162-3	Anaerobic Aquatic Metabolism	46235730	Anaerobic Aquatic Metabolism of XDE-750.	No
162-4	Aerobic Aquatic Metabolism	46235731	Degradation of XDE-750 in 2 European and 1 US Sediment and Pond Water Systems.	No
163-1	Mobility (Adsorption/Desorption)	46235732	Soil Batch Equilibrium Adsorption/Desorption of XDE-750	No
164-1	Terrestrial Field Dissipation	46235734	Terrestrial Field Dissipation of XDE-750 in the USA	No, although degradate identification was not attempted
164-1	Terrestrial Field Dissipation	46235735	Terrestrial Field Dissipation of XDE-750 in Canada	No, although degradate identification was not attempted
165-4	Accumulation in Laboratory Fish			Not provided

Table A-2. Summary of preliminary screen for ecological effects tests on aminopyralid.

Guideline	MRID Number	Study Title	Does this study have a "fatal flaw"?
71-1	462358-08	XDE-750: An acute oral toxicity study with the Northern Bobwhite	No, although diurnal cycle of 8 light:16 dark; EPA recommends 10:14
71-1	462358-09	XDE-750: An acute oral toxicity study with the Northern Bobwhite	No; is a sublethal effects study to supplement 462358-08; Diurnal cycle of 8 light:16 dark; EPA recommends 10:14
71-2	462358-10	XDE-750: A dietary LC50 study with the Northern Bobwhite	No
71-2	462358-11	XDE-750: A dietary LC50 study with the Mallard	No
71-4	462358-12	Avian reproduction study with XDE-750 in Northern Bobwhite	No
71-4	462358-13	Avian reproduction study with XDE-750 in Mallard	No
72-1	462358-14	XDE-750 Herbicide: An acute toxicity study with the rainbow trout	No, although hardness above EPA recommended range; pH dipped as low as 5.6; D.O. 8.5 – 10.3; no mortality in study; limit test
72-1	462358-15	XDE-750: Acute toxicity to bluegill sunfish	No, although hardness slightly higher than recommended; pH 5.6 – 7.0; D.O. 6.6 – 9.7; no mortality in study; limit test
72-1	462358-16	XDE-750: 96-h acute toxicity to larval amphibians	Limit test, No
72-2	462358-17	XDE-750: An acute toxicity study with the daphnid	No, although hardness 3X EPA recommended level; pH down to 6.2; no mortality noted
72-3b	462358-18	Acute toxicity to Eastern Oyster	No, although aminopyralid recoveries were 84 – 97% of nominal
72-3c	462358-19	Acute toxicity to Mysids	No
72-3	462358-20	Acute toxicity to Sheepshead minnow	No, although mean measured concentration were up to 120% of nominal
72-4a	458196-27	XDE-750: Toxicity to the early life stages of the Fathead minnow	No, although hardness above the recommended range – untreated municipal water used as source (all aquatic tests from this lab have this problem in this submission); juvenile survival in control only 78% and was lower than the 87% in solvent control
72-4b	462358-22	XDE-750: 21-d chronic toxicity with the Daphnid	No, although pH of test vessels ranged from 6.3 to 8.7 (EPA recommended range 7.6 to 8.0). However, deviations of one unit or more appeared to be less than 48 hours; hardness ranged from 154 - 273 mg/L (recommended range: 160 – 180 mg/l)
122-1	462358-24	Effect of GF-871 on vegetative vigor of selected non-target terrestrial plants (tier II)	No; **formulation** (no TGAI studies), 40.6% a.i., 21.1% a.e.
122-1	462358-25	Effect of GF-871 on selected non-target terrestrial plants	No; **formulation** (no TGAI studies), 40.6% a.i., 21.1% a.e.
122-2, 123-2	462358-26	XDE-750: Toxicity to duckweed	No, although source of dilution water not specified;

123-2	462358-27	XDE-750: Acute toxicity to the freshwater diatom	No
122-2, 123-2	462358-28	XDE-750: Growth inhibition test with the marine diatom	No
122-2, 123-2	462358-29	XDE-750: Growth inhibition test with freshwater blue-green alga	No, although source water not specified;
123-2	462358-30	XDE-750: Toxicity to the freshwater green alga	No
141-1	462358-31	XDE-750: Acute contact toxicity test with the honeybee	No. The contact exposure was conducted as a limit test.
141-1	462358-32	XDE-750: Acute oral toxicity test with the honeybee	No. The oral exposure test is a non-guideline test.
N/A	462357-33	14 Day soil exposure acute toxicity to the earthworm	No. The test was conducted as a limit test.
N/A	462358-23	The full life-cycle toxicity to midge under static conditions	No, although pH deviated from 2.8 (corresponding to 0% emergence) in the highest treatment to 8.1 in the control (corresponding to 82%)

Appendix B. Environmental Fate Data.

Abiotic Degradation

Hydrolysis

Aminopyralid is **stable** to hydrolysis at environmentally relevant pH's and temperatures. In a study conducted in darkness for 31 days at 25°C and for 5 days at 50°C, [2,6-^{14}C]aminopyralid (at 0.4 mg a.e./L) did not hydrolyze in sterile pH 5, 7 and 9 aqueous buffer solutions (MRID: 46235726). The submitted study was classified as acceptable and provides adequate data for the risk assessment.

Aqueous Photolysis

Aminopyralid is rapidly photodegraded in water under favorable light conditions. In the guideline study submitted, [2,6-^{14}C]aminopyralid, at 0.2 and 30 mg a.e./L, photodegraded with a half-life of approximately **0.6 days** (corrected for continuous irradiation conditions and natural sunlight; uncorrected laboratory-measured half-live of 0.3 days) in sterile pH 5 aqueous buffered solution maintained at 25°C and irradiated with a xenon lamp for 32 hours (the equivalent of 38 days of summer sunlight at 40 °N latitude) (MRID 46235727). In addition to CO_2, there were two major degradates identified: oxamic acid and malonamic acid. The rest of the degradates were not identified but analysis indicated that they were at least four different 2 and 3 carbon acid amides. Based on the results of the study, photodegradation is expected to be a significant route of dissipation for aminopyralid in the environment when the compound is present in clear, shallow surface water. Due to the lack of identification and quantification of all major degradates, the photodegradation study were classified as supplemental, but still provides useful data for the risk assessment. The thorough identification of all photoproducts of aminopyralid would provide additional useful information for future risk assessments.

Soil Photolysis

Aminopyralid photodegrades moderately slowly on soil. In the guildeline study submitted, [2,6-^{14}C]aminopyralid applied at 5.24 mg a.e./kg soil degraded with a **half-life of 72.2 days** (corrected for natural sunlight and soil metabolism) on silt loam soil maintained at 25°C and 75% of 1/3 bar moisture content, and intermittently irradiated (12 hour irradiation/12 hour dark cycle) with a xenon lamp for 44 days (the equivalent of 28 days of summer sunlight at 40° N latitude) (MRID 46235728). No major transformation products were detected; one or more minor transformation products together present at a maximum of 4.6% of the applied were not identified. [2,6-^{14}C]Aminopyralid degraded into non-extractible residue, CO_2, and acid volatiles. The half-life reported in the study is of questionable value, as it was extrapolated beyond the scope of the data. Also, more than 20% (irradiated soils) and 8% (dark controls) of the applied radioactivity was unaccounted for by the end of the study and the material balance in the dark samples varied from 96.6% to 103.7% of applied throughout the study. This study was classified as supplemental because of this loss in material balance of the irradiated samples and concurrent loss and variability in material balance in the dark samples. It is useful, however, in that it indicates that photodegradation of aminopyralid on soil will be a relatively slow process.

Metabolism

Aerobic Soil Metabolism

Based on the available data, aminopyralid may be metabolized moderately in aerobic soil. The biodegradation of aminopyralid in aerobic soil was studied in one guideline study in five different soils; however, only one of the soils was quantitativly useable due to material balance problems in the other four soils. Based on the results of the study, microbially-mediated metabolism of aminopyralid in aerobic soil may proceed moderately in the environment, however, high uncertainty surrounds the estimate of the aerobic soil metabolism rate given the large range of potential half-lives. Since the aerobic soil metabolism half-life observed in some of the non-useable four soils was apparently much longer than the half-life observed in the one useable soil, the rate of aminopyralid aerobic soil metabolism may be overestimated in this assessment.

In the study, [2,6-^{14}C]aminopyralid, at 0.06 and 0.03 ppm a.e., degraded into CO_2 and non-extractable residues with half-lives calculated by linear regression on log-transformed data ranging from 31.5 to 533.2 days in aerobic loam, sandy loam, silt loam, clay loam, and clay soil that was incubated in the dark at 25 ± 1°C and 75% of 1/3 bar moisture for up to 1 year (MRID 46235729). Residue extraction was attempted by extracting with a relatively mild acetone/1.0 N HCl (90:10, v:v) solution on a horizontal shaker at low speed. Due to these mild extraction procedures implemented in the study, non-extractible residues were assumed to consist of parent which had just not been extracted harshly enough, and their amounts were added to parent concentration in half-life calculation. However, four of the five soils had inadmissable material balances and are not quantitatively used in this assessment. The half-life for the maximum application rate of the only useable soil, conducted on Holdrege silt loam is at **103.5 days**; this value will be used in the risk assessment. Fifty percent transformation occurred in all soils within 60 days, with the exception of Barnes clay loam, where [2,6-^{14}C]aminopyralid was persistent. Also, in all soils except the Barnes clay loam, an initial rapid transformation phase was followed by a second slow transformation phase, with detectable levels of the parent after 365 days. By the end of the study, CO_2 accounted for 65.7-73.2% of the applied in all soils except Barnes clay loam (27-30% of applied). Other volatiles were not monitored. No degradates were detected; all extractable radioactivity was quantified as [2,6-^{14}C]aminopyralid. Non-extractable radioactivity was detected at 0.0-15.7% of the applied by the end of the incubation period in all soils except Houston Black clay (which had non-extractable radioactivity at 23.1-24.3% of applied). This study is classified as supplemental for an aerobic biotransformation study in soil, because of insufficient extraction and low and variable material balances. Only the Holdrege silt loam provides adequate data for the risk assessment. Regent loam, Manning sandy loam, Barnes clay loam, and Houston Black clay data (and accompanying large range of half-life estimates) are not used quantitatively in this assessment because material balances were either low or variable in these four soil types. Additionally, because aerobic soil metabolism in Barnes clay loam was not valid, the Subdivision N requirement that one of the soils tested in the adsorption/desorption study also be tested in the aerobic soil metabolism study was not fulfilled.

Aerobic Aquatic Metabolism

Aminopyralid is metabolized more rapidly in aerobic soil than in aerobic sediment/water systems. The degradation of aminopyralid in aerobic sediment/water systems was studied in three pond systems in the one guideline study submitted. Based on the results of the studies, aminopyralid is expected to essentially stable to microbially-mediated metabolism in the environment.

In the study, [2,6-^{14}C]aminopyralid at 0.04 mg a.e./L dissipated (degradation into CO_2 and non-extractable residues) with statistically significant extrapolated linear total system half-lives of **462.1, 866.4, and 990.2 days** in the three aerobic pond water/sediment systems tested (Italian, French, and US systems, respectively) that were incubated in the dark at 20 ± 1°C for 101 days after treatment (MRID 46235731). [2,6-^{14}C]Aminopyralid degraded extremely slowly in an aerobic aquatic system to form non-extractable residues (from 3-15% of the applied at 101 DAT) and a few minor, unidentified degradates (generally <1% at any sampling interval with the exception of 3% in one replicate). Additionally, a slight amount of mineralization to CO_2 (between 1 and 2.7% at 101 DAT) was observed. No other volatiles were reporteded. No major transformation products were detected in the water or the sediment of any of the test systems. Non-extractable radioactivity in the sediment was detected at 3.2-14.8% of the applied by the end of the incubation period. From 82.6 to 90.5% of parent was present at study termination in the total system. Following application of [2,6-^{14}C]aminopyralid to the water layer, the association of [^{14}C] residues with the sediment increased over the course of the study (water-sediment distribution ratios decreasing from roughly 40:1 at time zero to 1.2:1 through 4:1 by 101 days). This study is classified as supplemental because the three test systems were anaerobic (moderately to strongly reducing water and sediment phases) throughout most of the study. In addition, the half-life values are imprecise (due to extrapolation beyond the time limits of the sampling period). However, the study still provides useful information for the risk assessment, particularly in that it indicates that metabolism of aminopyralid in slightly anaerobic pond water/sediment will be essentially stable. The linearly extrapolated half-lives are most likely conservative estimates of the aerobic aquatic degradation of aminopyralid because submitted studies show that aerobic soil degradation proceeded at a faster rate than degradation in this study while aminopyralid was stable to anaerobic aquatic metabolism. If the conditions of the study had been more aerobic, it is likely that aminopyralid would have degraded more quickly. Although the half-life values calculated from this study are used in the estimation of a conservative aerobic aquatic degradation rate, additional data on the aerobic aquatic metabolism of aminopyralid would help refine the assessment of the environmental fate of the compound.

Anaerobic Aquatic Metabolism

Aminopyralid is **stable** in anaerobic sediment/soil and water systems. The degradation of aminopyralid in anaerobic sediment/soil and water systems was studied in one pond and one flooded soil systems (English and U.S. systems, respectively) in the one guideline study submitted. Based on the results of the study, microbially mediated metabolism of aminopyralid in anaerobic sediment/water systems is not expected to proceed in the environment.

In the study, [2,6-^{14}C]aminopyralid at 0.08 mg a.e./L, incubated in the dark at 19.5 ± 1°C and 25.5 ± 1°C for 120 and 363 days after treatment did not dissipate significantly in two anaerobic sediment/soil and water systems (MRID 46235730). A t-test showed that the slopes of both degradation curves were no different than zero. From 93.2 to 98.1% of parent was present at study termination in the total system. Identification of transformation products was not attempted because there were no transformation products present at greater than 2% of applied in the water or the soil/sediment of either test system. At the end of the study 0.4-0.6% of the applied radioactivity was present as CO_2. No other volatiles were reported. Extractable [^{14}C] residues in the sediment increased from 27.4% at day 0 to 36.9% of the applied radioactivity at the end of the incubation period in the sediment/water system, and decreased from 30.0% at day 0 to 21.5% of the applied radioactivity at the end of the incubation period in the flooded soil system. Non-extractable [^{14}C] residues in the sediment and soil ranged from 0.7% to 2.4% of the applied radioactivity throughout the study for both systems. Following application of [2,6-

[14]C]aminopyralid to the water layer, the association of [[14]C] residues with the sediment stayed fairly constant over the course of the study (water-sediment distribution ratios of about 2.1:1 for the sediment/water system and 2.4:1 for the flooded soil system throughout the study). This study is classified as acceptable for an anaerobic biotransformation study in water-sediment system and provides adequate information for the risk assessment.

Mobility and Persistence

Adsorption/Desorption

Based on soil adsorption coefficient (K_f) values determined using Freundlich adsorption isotherms with batch equilibrium study data, aminopyralid is expected to have high mobility in most soils; thus, it is also generally expected to not bind to aquatic sediments in the water column. One mobility study (batch equilibrium on eight soil types) was submitted for the parent compound.

Soil characteristics and adsorption/desorption study results for aminopyralid are presented in **Table B-1**. The adsorption of aminopyralid was studied in eight soils treated with aminopyralid at five concentrations ranging from 0.05 to 5.0 µg a.e./mL and maintained in the dark at 25 °C for 48 hours (MRID 46235732). After the equilibration period, 0.6-26.7% of applied aminopyralid was adsorbed in the soils. The adsorption K_d values were 0.03-0.72 mL/g; adsorption K_{oc} values were 1.05-24.30 mL/g. These adsorption K values will be used in modelling to estimate environmental concentrations in water. Desorption, following two hours of equilibration, was 0.0-47.6%. The desorption K_d values were 0.00-19.14 mL/g; desorption K_{oc} values were 0.0-1914.5 mL/g. This study was classified as supplemental because none of the test soils had an organic matter content of greater than or equal to 1%, as required by Subdivision N guidelines. However, the study still provides useful data for the risk assessment, in that it indicates that aminopyralid has very low adsorption to soils.

Table B-1. Freundlich adsorption and desorption constants for aminopyralid in eight soils.

Soil type (% organic carbon; pH)	Adsorption					Desorption				
	K_f (mL/g)	1/n	r^2	K_d (mL/g)	K_{oc} (mL/g)	K_f (mL/g)	1/n	r^2	K_d (mL/g)	K_{oc} (mL/g)
silt loam (1.0%, pH 7.8)[1]	0.04	0.79	0.951	0.04	4.49	1.97	0.87	0.888	5.98	598.44
clay (3.2%, pH 7.5)[1]	0.01	0.32	0.215	0.03	1.05	No desorption				
silty clay loam (3.9%, pH 7.8)[1]	0.26	0.87	0.999	0.29	7.39	3.09	1	0.986	3.59	92.16
sand (1.6%, pH 6.6)[1]	0.05	0.75	0.944	0.07	4.59	1.72	0.94	0.991	2.6	162.27
loam (1.0%, pH 6.1)[1]	0.07	0.82	0.956	0.08	7.54	1.24	0.61	0.833	19.14	1914.5
clay (1.5%, pH 6.9)[1]	0.04	1.31	0.879	0.03	2.33	No desorption				
clay loam (3.6%, pH 4.8)[1]	0.73	0.9	0.999	0.72	19.95	2.88	0.94	1	3.8	105.66

Soil type (% organic carbon; pH)	Adsorption					Desorption				
	K_f (mL/g)	1/n	r^2	K_d (mL/g)	K_{oc} (mL/g)	K_f (mL/g)	1/n	r^2	K_d (mL/g)	K_{oc} (mL/g)
loamy sand (0.6%, pH 4.5)[1]	0.13	0.86	0.987	0.15	24.3	2.12	0.94	0.996	2.18	362.78

[1] Data obtained from MRID 46235732.

Terrestrial Field Dissipation

Based on the results of the submitted terrestrial field dissipation studies on US soil, aminopyralid appears to be non-persistent in the field, however, all potential routes of dissipation are not accurately measured. The terrestrial field dissipation of aminopyralid was studied in two bare ground plots at U.S. sites in Mississippi (MS) and California (CA). Field study information and half-life and leaching results are presented in **Table B-2**. The half-lives (32.1 and 20.0 days) determined in the two bare ground plot studies were of questionable value due to high temporal and inter-replicate data variability. Aminopyralid did not appear to leach below the 15-30 cm soil depth, although lack of sampling between 0 and 8 days may not have allowed for detection of leaching during the first week post application. Transformation products were not monitored in either of the studies, because no major degradates were observed in the laboratory metabolism studies. Aminopyralid appears to degrade in a predominantly microbial process leading to mineralization of the molecule and the formation of bound residues.

In one field study, aminopyralid GF-871, applied at 155 g a.e./ha to a bare ground silty loam soil plot in Bosket, MS, dissipated moderately quickly with an half-life estimated by linear regression on log-transformed data of 32.1 days ($R^2 = 0.81$; MRID 46235734). However, the data exhibited high temporal and inter-replicate variability. In the 0-15 cm soil depth, aminopyralid was 77.9 ng/g (range of 32.3-144.2 ng/g) on day 0, 47.4 ng/g (range of 43.4-52.8 ng/g) on day 8, 92.6 ng/g (range of 65.8-119.7 ng/g) on day 15, 35.8 ng/g (27.3-44.2 ng/g) on day 29, and decreased, with variability, to <LOQ (1.5 ng/g) by day 183. Aminopyralid was not detected above the LOD at depths below the 0-15 cm soil layer.This study is classified as supplemental because the high temporal and inter-replicate data variability. However, the study does provide some useful information on leaching and general persistence of the parent compound.

In the second field study, aminopyralid, GF-871, applied at 152 g a.e./ha to a bare ground sandy loam soil plot in Hisperis, CA, dissipated moderately quickly with a log linear half-life of 20.0 days ($R^2 =$ 0.87; MRID 46235734). However, the data exhibited high temporal and inter-replicate variability. In the 0-15 cm soil depth, aminopyralid was 64.8 ng/g (range of 61.9-68.1 ng/g) on day 0, 86.2 ng/g (range of 70.8-104.2 ng/g) on day 9, 48.3 ng/g (range of 38.6-53.5 ng/g) on day 22, and was below the LOQ (1.5 ng/g) by day 91. At 15-30 cm, aminopyralid was at a maximum of 5.1 ng/g at 22 days. Detections above the LOQ in single replicates occurred sporadically throughout the 30-90 cm soil layers.This study is classified as supplemental because the half-life is of questionable validity due to the high temporal and inter-replicate data variability. However, the study does provide some useful information on leaching and general persistence of the parent compound.

Table B-2. Terrestrial field dissipation studies results.

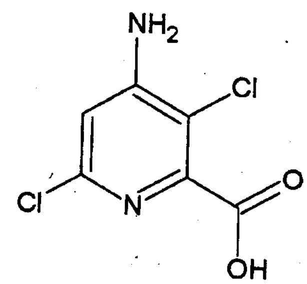
MRID	Soil Texture (pH, organic carbon content)	Applic. Rate (g a.e./ha)	Site	Plot Type	Dissipation Half-life (or DT_{50}) in surface soil and total soil profile (days)	Parent Max. Leaching Depth	Major Degradates & Max. Leaching Depth	Applic. Type/ Formulation
46235734	sandy loam (6.0-6.7; 0.3-0.6%)	150 (target); 152 (actual)	MS	bareground	$t_{1/2} = 32.1$ ($r^2 = 0.81$)[1] $t_{1/2} = 34$	0-15 cm	No major degradates	surface broadcast; single application
46235734	sandy loam (7.2-7.7; 0.1-0.8%)	150 (target); 155 (actual)	CA	bareground	$t_{1/2} = 20.0$ ($r^2 = 0.87$)[1] $t_{1/2} = 26$	15-30 cm	No major degradates	surface broadcast; single application

[1] Half-life is of questionable validity due to high data variability.

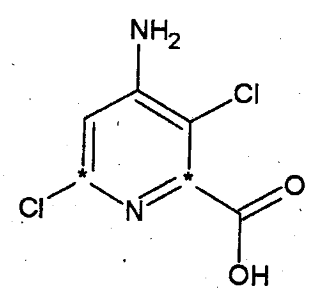
Chemical Structure for Aminopyralid

IUPAC name:	4-Amino-3,6-dichloropyridine-2-carboxylic acid.
CAS name:	2-Pyridinecarboxylic acid, 4-amino-3,6-dichloro.
CAS No.:	150114-71-9.
Synonyms:	XDE-750.
SMILES string:	clc(nc(c(c1N)Cl)C(=O)O)Cl.

Unlabeled aminopyralid



[2,6-^{14}C]aminopyralid



*Position of radiolabel.

Appendix C. Aquatic Exposure Model and Results.

For pesticide aquatic ecological exposure assessment, EFED used the Tier 1 screening model, GENEEC (GENeric Estimated Exposure Concentration, version 2.0, 08/01/01), to calculate the surface water EECs (Estimated Environmental Concentrations). The GENEEC-calculated peak value represents a 1 in 10 year peak value and the maximum 4, 21, 60, and 90-day values represent the 1 in 10 year maximum 4, 21, 60, and 90-day rolling mean, respectively. A summary of the model input parameter values used in, as well as the output concentrations calculated by GENEEC is presented in **Table C-1**. Input parameters were selected in accordance with EFED's "Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides," Version II (2-28-02). Because aminopyralid is a new chemical, monitoring data were not available.

The modeling was conducted to account for the aminopyralid parent compound only. No environmental degradates other than CO_2 and bound residues were observed in the hydrolysis, soil photolysis, or aerobic and anaerobic soil and aquatic metabolism fate studies. The only potentially major degradates of aminopyralid were observed in the aqeuous photolysis study, identified as oxamic acid (CAS#471-47-6) and malonamic acid (CAS# 2345-56-4), plus unidentified degradates 2-3-carbons long, with O, N, etc. substituents. However, the formation of these degradates is likely only in clear, shallow water, under non-cloudy atmospheric conditions, and, therefore, oxamic and malonamic acid will not be included in aquatic exposure modeling. Oxamic and malonamic acids are unlikely to exhibit similar toxicity to the parent. In addition, the Health Effects Division has very low concern regarding the hazard associated with these environmental metabolites. Searches of various hazard databases (*e.g.*, TOXNET, MEDLINE, and others) did not reveal any cause for concern for either chemical. Both chemicals are small amino acid analogs. Following uptake, they are expected to be readily metabolized and/or rapidly excreted without any significant biological effects.

The application rate for rangeland grasses was used in the surface water assessment, because it represents the maximum application rate on the proposed label (*i.e.*, "0.11 lb a.e./A/annual growing season"). This rate is intended to specify the total maximum value for the "annual growing season" (defined as "per year" in a 1-13-05 registrant email located in **Figure C-1**). The maximum label application rate for wheat ("0.0089 lb a.e./A/growing season") was additionally modeled to estimate for comparison maximum concentrations in the environment resulting from aminopyralid application for food use. The current proposed label (3-4-04, located in **Figure C-2**) does not include minimum spray intervals or maximum numbers of applications, although the registrant states in the 1-13-05 email that "it may be possible to determine the effectiveness of the application in 4 to 6 months, at this time, a spot treatment may be appropriate" and that "it is unlikely that there would be more than two applications per year." Therefore, it is likely that either the majority of or the entire maximum rate will be applied in the first application, with relatively minimal spot treatments, if any, applied at an interval of 120 days (4 months) or more. However, because the label does not explicitly provide for minimum application intervals nor maximum number of applications, the EEC values reported here are based on the assumption that the maximum rate will be applied in one application. In the event that the maximum annual rate is applied as more than one application, the associated acute EEC values calculated to represent those application scenarios will be lower than those reported here.

For GENEEC surface water modeling inputs, the soil partition coefficient (K_d) was used instead of the organic carbon partition coefficient (K_{OC}) because correlation of K_d with organic carbon was low ($R^2 =$ 0.3656) for the eight soils tested, suggesting that the adsorption of aminopyralid is not closely related to organic carbon content. Therefore, K_d, the partition coefficient uncorrected for organic carbon, was assumed to better represent partitioning in soil. The values from which the lowest non-sand K_d was chosen are presented in **Table C-2**. The aerobic soil metabolism half-life was calculated by linear regression on log-transformed concentration data (parent plus non-extractable residues) and then that value was multiplied by 3 to account for the uncertainty associated with using a single value. This is intended to approximate the upper 90% confidence bound on the mean, which the input value used when more than one metabolism value is used. The proposed label allows for both ground and aerial spray; but aerial spray was modeled as the method of application in order to be protective of all application scenarios. Generally, aerial application will result in a greater off-site movement and loading to surface waters than ground sprays. The aerobic aquatic metabolism half-lives were calculated using first-order linear regression on log-transformed data, then the 90th percentile of the upper confidence bound on the mean of the three half-lives was calculated. The values from which the aerobic aquatic metabolism half-life input value was calculated are presented in **Table C-3**. The aqueous photolysis study was continuously illuminated and the aqueous photolysis half-life input value was adjusted to reflect photolysis in summer sunlight at 40° N latitude. There was no degradation observed in the dark controls and no dark-control correction necessary.

The GENEEC raw output files are located in **Figure C-3**. Calculated EECs were approximately 12.4 times greater for rangeland applications than for wheat applications.

Table C-1. GENEEC (v2.0) input parameter values and results for aminopyralid applied to rangeland grasses and wheat by aerial spray.

Parameter	Value	Source
Application Rate (lb a.e./A)	0.11 (rangeland) 0.0089 (wheat)	Proposed label.
Number of Applications	1	Email correspondence with registrant, 1-13-15.
Interval between Applications (days)	1	Email correspondence with registrant, 1-13-15.
Soil Partition Coefficient (K_d; mL/g)	0.03	Represents the lowest non-sand value among eight values ranging from 0.03 to 0.72 mL/g; MRID: 46235732.
Aerobic Soil Metabolism Half-life (days)	310.5	Determined by multiplying the calculated half-life (38.7) by 3 to account for the uncertainty associated with using a single value; MRID: 46235729.
Wetted in?	No	Proposed label.
Depth of Incorporation (inches)	0	Proposed label.
Method of Application	aerial spray	Proposed label.
Droplet Size	medium to coarse	Proposed label.
No Spray Zone	0 (none)	
Solubility in Water @ 20 °C, unbuffered (mg/L or ppm)	2480	MRID: 46235701.
Aerobic Aquatic Metabolism Half-life (days)	1073.6	Represents the 90th percentile of the upper confidence bound on the mean of three half-life values (772.9). MRID: 46235731.
Hydrolysis Half-life @ pH 7 (days)	stable	MRID: 46235726.

Aquatic Photolysis Half-life @ pH 5 (days)	0.6	MRID: 46235727.
GENEEC Results (EECs for surface water)	**RANGELAND** **Peak:** **Max. 4-day average:** **Max. 21-day average:** **Max. 60-day average:** **Max. 90-day average:** **WHEAT** **Peak:** **Max. 4-day average:** **Max. 21-day average:** **Max. 60-day average:** **Max. 90-day average:**	 **6.38 ppb** **6.33 ppb** **6.04 ppb** **5.45 ppb** **5.05 ppb** **0.516 ppb** **0.512 ppb** **0.489 ppb** **0.441 ppb** **0.408 ppb**

Table C-2. Soil partition coefficients used to calculate GENEEC (v2.0) input parameter, MRID: 46235732.

Soil	**K_d value (mL/g)**
M599 (Clay, USA)	0.03
M549 (Clay, Europe)	0.03
M546 (Loam, Europe)	0.04
M579 (Sand, Europe)	0.07
M584 (Loam, Europe)	0.08
M617 (Loamy Sand, USA)	0.15
M568 (Silty Clay Loam, Canada)	0.29
M616 (Clay Loam, USA)	0.72

Table C-3. Aerobic aquatic metabolism half-lives used to calculate GENEEC (v2.0) input parameter, MRID: 46235731.

Test System	**Half-life (days)**
French water-sediment system	866.4
Italian water-sediment system	462.1
USA water-sediment system	990.2

<u>Figure C-1: Registrant email, 1-13-05</u>

"Jachetta, John" <jjjachetta@dow.com>
01/13/2005 01:20 PM

To: Joanne Miller/DC/USEPA/US@EPA
cc: "Harris, Brenda" <bjharrisdowagro@dow.com>, Luis Suguiyama/DC/USEPA/US@EPA
Subject: FW: Aminopyralid: Label clarification

Joanne,

I'd be pleased to address EFED's questions in order below:

EFED Question 1: Could you clarify the term "annual growing season"? Would it be fair to interpret the maximum application rate of 0.11 lb. a.e. per acre of GF-871 per annual growing season to mean 0.11 lb. a.e./acre per one year? If, for example, there was both a fall and a spring growing season, this would mean a maximum total of 0.11 lb. a.e./acre is to be used across both growing seasons for the year, instead of 0.11 lb. a.e. for each growing season, correct?

DAS RESPONSE: The rate is meant to be 0.11 lb a.e./A per one year (approximately 12 months). Once aminopyralid has been applied at the maximum rate of 0.11 lb a.e./A, there is no need to return to the area for a follow-up application in that same year. In some areas, there may be spot applications in the following year to control "misses", but a full rate application is not likely to be required for several years after control has been obtained. We state "annual growing season" instead of "one year" on the label to provide reasonable flexibility in scheduling for the land manager.

EFED Question 2: Is there any restriction on the interval between applications? The label says that repeat treatments are allowed, but it does not appear to specify a required interval between applications. Can we get a better idea of any required and/or anticipated interval?

DAS RESPONSE: No interval is recommended on the label for several reasons. The primary reason is that it requires a year (defined as a growing season followed by winter dormancy and spring regrowth) to determine the effectiveness of a perennial weed control application. The effectiveness of such applications are evaluated by the extent of the spring regrowth. In some cases, for example, tropical soda apple infestations in pasture, it may be possible to determine the effectiveness of the application in 4 to 6 months, at this time, a spot treatment may be appropriate. In all cases, the maximum application rate of 0.11 lb a.e./A per growing season must be maintained.

EFED Question 3: Is there a maximum number of applications allowed/anticipated? In most cases, there will be only one application per year (annual growing season).

DAS RESPONSE: As discussed above, in some cases, there may be two applications within a single year not to exceed the maximum application rate of 0.11 lb a.e./A per growing season. In such cases, it is highly likely that the second application would be a spot treatment. It is unlikely that there would be more than two applications per year.

Thank you for the chance to clarify these application directions. Please feel free to ask any additional questions on this or any topic.

Sincerely,
John

John J. Jachetta, Ph.D.
US/ Global Regulatory Leader for R&P/ IVM
Dow AgroSciences L.L.C.

Phone: (317) 337-4686
Fax: (317) 337-4649
E-mail: jjjachetta@dow.com

Figure C-2: Proposed label, 3-4-04

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file: GF-871-XXX 04Mar04d.doc

GF-871

EPA Reg. No. 62719-XXX

Registration Notes:

Proposed Section 3 labeling for GF-871 containing 2 pounds per gallon (240 grams per liter) of aminopyralid.

Some General Information About this Product:
Active Ingredient: triisopropanolammonium salt of aminopyralid 40.6%
Acid Equivalent: aminopyralid (4-amino-3,6-dichloropyridine-2-carboxylic acid) - 21.1% - 2 lb/gal

Acute Toxicity Category by Route of Exposure:
Rote of Exposure Acute Toxicity Acute Toxicity Category
Oral LD50 >5000 mg/kg CAT IV
Dermal LD50 >5000 mg/kg CAT IV
Dermal Irritation very slight erythema CAT IV
Ocular Irritation Minimal effects <48hrs CAT III
Inhalation >5.79 mg/L CAT IV
Dermal Sensitization Negative test Non-sensitizer
Formulation: GF-871
Specific gravity: 9.5 lb/gal
Flash point: >200°F
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(Base label):
(Logo) **Dow AgroSciences**

GF-871

Herbicide

- **For control of annual and perennial broadleaf weeds, including invasive and noxious weeds, on rangeland, permanent grass pastures, Conservation Reserve Program (CRP) acres, non-cropland areas (such as rights-of-way, roadsides and non-irrigation ditch banks), natural areas (such as wildlife management areas, natural recreation areas, campgrounds, trailheads and trails), and grazed areas in and around these sites**
- **For control of annual and perennial broadleaf weeds in wheat (including spring wheat, winter wheat, and durum).**

GROUP 4 HERBICIDE

Active Ingredient:
triisopropanolammonium salt of aminopyralid .. 40.6%
Inert Ingredients 59.4%
Total Ingredients 100.0%
Acid Equivalent: aminopyralid (4-amino-3,6-dichloropyridine-2-carboxylic acid) - 21.1% - 2 lb/gal

Keep Out of Reach of Children

CAUTION

Precautionary Statements
Causes Moderate Eye Irritation
Avoid contact with eyes or clothing.

Personal Protective Equipment (PPE)
Applicators and other handlers must wear:
• Long-sleeved shirt and long pants
• Shoes plus socks
Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.
User Safety Recommendations
Users should:
• Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
• Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

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First Aid
If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice.
Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.
Environmental Hazards
Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate.
Agricultural Use Requirements
Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. Refer to label booklet under "Agricultural Use Requirements" in the "Directions for Use" section for information about this standard.
Notice: Read the entire label. Use only according to label directions. **Before using this product, read Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies at end of label booklet. If terms are unacceptable, return at once unopened.**
In case of emergency endangering health or the environment involving this product, call 1-800-992-5994.
If you wish to obtain additional product information, visit our web site at www.dowagro.com.
Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.
EPA Reg. No. 62719-XXX EPA Est. ______
Dow AgroSciences LLC • Indianapolis, IN 46268 U.S.A.
Net Contents __

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(Datapack cover):
(Logo) **Dow AgroSciences**

GF-871

Herbicide

• For control of annual and perennial broadleaf weeds, including invasive and noxious weeds, on rangeland, permanent grass pastures, Conservation Reserve Program (CRP) acres, non-cropland areas (such as rights-of-way, roadsides and non-irrigation ditch banks), natural areas (such as wildlife management areas, natural recreation areas, campgrounds, trailheads and trails), and grazed areas in and around these sites
• For control of annual and perennial broadleaf weeds in wheat (including

spring wheat, winter wheat, and durum).

GROUP 4 HERBICIDE

Active Ingredient:
triisopropanolammonium salt of aminopyralid .. 40.6%
Inert Ingredients 59.4%
Total Ingredients 100.0%
Acid Equivalent: aminopyralid (4-amino-3,6-dichloropyridine-2-carboxylic acid) - 21.1% - 2 lb/gal

Keep Out of Reach of Children

CAUTION

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. Refer to label booklet under "Agricultural Use Requirements" in the "Directions for Use" section for information about this standard.

Refer to inside of label booklet for additional precautionary information including Personal Protective Equipment (PPE), User Safety Recommendations and Directions for Use including Storage and Disposal.

Notice: Read the entire label. Use only according to label directions. **Before using this product, read Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies at end of label booklet. If**

terms are unacceptable, return at once unopened.

In case of emergency endangering health or the environment involving this product, call 1-800-992-5994.

If you wish to obtain additional product information, visit our web site at www.dowagro.com.

Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

EPA Reg. No. 62719-XXX EPA Est. ______

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(Page 1 through end):

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Precautionary Statements

CAUTION

Causes Moderate Eye Irritation
Avoid contact with eyes or clothing.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.

First Aid

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for
treatment advice.
Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.

Environmental Hazards

Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
Read all Directions for Use carefully before applying.
Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests,
nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training,
decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about Personal Protective Equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

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- Coveralls
- Chemical-resistant gloves made of any waterproof material as polyethylene or polyvinyl chloride
- Shoes plus socks

Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for Agricultural Pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

Entry Restrictions for Non-WPS Uses: For applications on rangeland, permanent grass pastures, and non-cropland areas, do not enter or allow worker entry into treated areas until sprays have dried.

Storage and Disposal

Do not contaminate water, food, feed or fertilizer by storage or disposal. Open dumping is prohibited.

Pesticide Storage: If this product is exposed to subfreezing temperatures, the active ingredient may crystallize and settle out of solution. Under these conditions the product should be warmed to at least 40°F and agitated well to dissolve any crystallized material prior to use.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal (Metal): Do not reuse container. Triple rinse (or equivalent). Puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Container Disposal (Plastic): Do not reuse container. Triple rinse (or equivalent). Puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning.

If burned, stay out of smoke.

General: Consult federal, state or local disposal authorities for approved alternative procedures.

Endangered Species: Use of any pesticide in a manner that may kill or otherwise harm an endangered species or adversely modify their habitat can be a violation of federal law.

This product may have effects on federally listed broadleaf threatened and endangered plants or critical habitat in some counties. When using this product, you must follow the measures contained in the Country Bulletin for the county in which you are applying the pesticide. To determine whether your county has a bulletin, consult *http://www.epa.gov/espp/usa-map.htm.* Bulletins may also be available from local pesticide retailers, extension service offices, or state pesticide agencies.

If an Endangered Species County Bulletin is not available for your specific area, check with the local Department of Natural Resources, or appropriate state agency, to determine if know populations of broadleaf plants occur in the area to be treated. Take all appropriate measures to avoid exposure of the endangered species to this product.

Resistance Management Guidelines

- Use an effective IPM program, integrating tillage or other mechanical methods, crop rotation or other cultural control methods into weed control programs whenever practical.
- Where identified, spreading of resistant weeds to other fields may be prevented by cleaning harvesting and tillage equipment before moving to other areas and by planting clean seed.
- Similar looking biotypes of a given weed species occurring in a field may vary in their susceptibility to a herbicide. Application of a herbicide below its recommended rate may allow more tolerant weeds to survive and a shift to more tolerant biotypes within a field.
- Contact your extension specialist, certified crop consultant, or Dow AgroSciences representative for the latest resistance management information.

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Rangeland, Permanent Grass Pastures and Non-cropland Areas

GF-871 herbicide provides broad-spectrum control of annual and perennial broadleaf weeds, including invasive and noxious weeds, on rangeland, permanent grass pastures, Conservation Reserve Program (CRP) acres, non-cropland areas (such as rights-of-way, roadsides and non-irrigation ditch banks), natural areas (such as wildlife management areas, natural recreation areas, campgrounds, trailheads and
trails), and grazed areas in and around these sites.

Use Precautions and Restrictions

• **Avoiding Injury to Non-target Plants:** Do not apply GF-871 directly to, or allow spray drift to come in contact with any broadleaf crop or other desirable broadleaf plants, including, but not limited to, cotton, flowers, grapes, lettuce, potatoes, radishes, soybeans, sugar beets, sunflowers, tobacco, tomatoes or other broadleaf or vegetable crop, fruit trees, ornamental plants, or soil where sensitive crops will be planted the same season.

Avoid application under conditions that may allow spray drift since very small quantities of spray, which may not be visible, may seriously injure susceptible crops during either active growth periods or dormancy. A spray-thickening agent may be used to further reduce the potential for drift. If a drift control aid is used, follow the use directions and precautions on the manufacturer's label. Do not use a thickening agent with Microfoil or Thru-Valve booms, or other systems that cannot accommodate thick sprays. Also, follow Precautions for Avoiding Spray Drift and Spray Drift Advisory under General Mixing and Application Instructions to minimize the potential for spray drift.

• **GF-871 is highly active against broadleaf plants.** Do not use this product on areas where loss of broadleaf forage plants, including legumes, cannot be tolerated.

• **Chemigation:** Do not apply this product through any type of irrigation system.

• **Do not contaminate water intended for irrigation or domestic purposes.** Do not treat or allow spray drift or run-off to fall onto banks or bottoms of irrigation ditches, either dry or containing water, or other channels that carry water that may be used for irrigation or domestic purposes.

• Do not rotate treated rangeland or permanent pasture areas to crops other than wheat in the year following treatment. A field bioassay is recommended prior to planting any broadleaf crop when applying rates recommended for rangeland and permanent pastures (4 – 7 fl oz/acre).

Field Bioassay Instructions: In fields previously treated with this product, plant short test rows of the intended rotational crop across the original direction of application in a manner to sample variability in field conditions such as soil texture, soil organic matter, soil pH, or drainage. The field bioassay can be initiated at any time between harvest of the treated crop and the planting of the intended rotational crop. Observe the test crop for herbicidal activity, such as poor stand (effect on seed germination) chlorosis (yellowing), and necrosis (dead leaves or shoots), or stunting (reduced growth). If herbicidal symptoms do not occur, the test crop can be grown. If there is apparent herbicidal activity, do not plant the field to the test rotational crop; plant only a labeled crop or crop listed in the table below for which the rotational interval has clearly been met.

• **Do not transfer livestock** from treated grazing areas (or fed treated hay) to areas where sensitive broadleaf crops may be grown without first allowing 3 days of grazing on untreated pasturage or consumption of untreated hay. If livestock are transferred within less than 3 days, urine and manure may contain enough GF-871 to cause injury to sensitive broadleaf plants.

• **Do not** apply this product when wind or weather conditions favor movement from treatment site.

• **Maximum Application Rate:** Do not apply more than 7 fl oz (0.11 lb a.e.) per acre of GF-871 per annual growing season. The total of broadcast application, retreatment and/or spot application per annual growing season cannot exceed 7 fl oz per acre.

• **Grazing Restrictions:** There are no restrictions on grazing of livestock or lactating dairy animals in treated areas.

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General Weed Control Directions

GF-871 may be applied as a broadcast foliar spray or as a spot application for postemergence control of susceptible broadleaf weeds including, but not limited to those listed in this label. For optimum control, apply this product when weeds are small and actively growing. Application should be made before bud stage or early flowering, unless otherwise specified. Where a rate range is given, use a higher rate in rate range for advanced growth stages or under less-than-favorable growing conditions (e.g., drought). In addition to its postemergence activity, GF-871 provides preemergence (soil residual) control of susceptible weeds following application. Suppression or prevention of establishment of susceptible weeds will depend on rate and seasonal timing of application, timeliness of rainfall, and temperature conditions following application.

Best weed control results are obtained when spray volume is sufficient to provide uniform coverage of treated plants. For optimum uptake and translocation of the herbicide, avoid mowing, shredding, burning or soil disturbance in treated areas for at least 7 days following application.

GF-871 may be applied in tank mix combination with other herbicides provided the tank mix product is labeled for the use site to be treated and tank mixing is not prohibited by the label of the tank mix product.

Refer to the Tank Mixing section of this label for use precautions and instructions for tank mixing.

Perennial Weed Control: GF-871 can provide long term control of susceptible perennial weeds through control of perennial plant parts and preemergence control or suppression of germinating seeds. The length of control is dependent on the application rate, condition and growth stage of target weeds, environmental conditions at and following application, and the density and vigor of competing desirable vegetation. Long-term broadleaf weed control is most effective where grass vegetation tolerant to GF-871 is allowed to recover and form a dense competitive canopy. Strong competition from grasses makes any remaining broadleaf weeds, already weakened and suppressed by the herbicide, more susceptible to control. Rangeland and pasture best management practices that promote the competitive recovery of forage grasses are recommended to maximize and extend the benefits of weed control achieved with GF-871. Federal and state agricultural and natural resources specialists can provide guidance on best management practices and development of integrated rangeland or pasture management systems.

Application Methods

Ground or Aerial Broadcast

Apply the recommended rate of GF-871 as a coarse low-pressure spray. Apply 10 or more gallons per acre when using ground broadcast application equipment or 2 or more gallons per acre when using aerial application equipment. Increase spray volume to ensure thorough and uniform coverage when target vegetation is tall and/or dense.

High-Volume Foliar Applications

High volume foliar treatments may be applied at rates equivalent to broadcast up to a maximum of 7 fl oz per acre per annual growing season. Use sufficient spray volume to uniformly wet foliage and stems. To ensure thorough wetting of high volume treatments, an approved agricultural surfactant may be added at the spray mixture at the manufacturer's recommended rate. Repeat treatments may be made, but the total amount of GF-871 applied must not exceed 7 fluid ounces per acre per annual growing season.

Spot Treatment

Use application rates as suggested in specific use directions sections of this label. Spray volume should be sufficient to uniformly wet weed foliage. Apply in a total spray volume equivalent to 20 to 100 gallons per acre. To prevent misapplication, spot treatments should be applied with a calibrated boom or with hand sprayers according to directions provided below. Spot treatments may be applied at an equivalent broadcast rate of up to a maximum use rate of 7 fluid ounces per acre per annual growing season. Repeat treatments may be made, but the total amount of GF-871 applied must not exceed 7 fluid ounces per acre per annual growing season.

Control of Invasive and Noxious Weeds

(Numbers in parentheses (-) refer to footnotes below.)

Weed species
Common name Scientific name
Application timing
Rate
(fl oz/acre) 1

cinquefoil, sulfur *Potentilla recta* prebud 4-6
daisy, oxeye *Chrysanthemum leucanthemum*
prebud 4-6
hawkweed, orange *Hieracium aurantiacum* bolting 4-6
hawkweed, yellow *Hieracium pratense* bolting 4-6
knapweed, diffuse *Centaurea diffusa* bolting 5-7
knapweed, Russian *Acroptilon repens* bud to early bloom or in the fall 4-6
knapweed, spotted *Centaurea maculosa* bolting 5-7
kudzu *Pueraria lobata* flowering 7
starthistle, yellow *Centaurea solstitialis* rosette 4-5
thistle, bull *Cirsium vulgare* rosette to bolting 5-7
thistle, Canada *Cirsium arvense* prebud or in the fall 4-7
thistle, musk *Carduus nutans* rosette to bolting 4-5
thistle, plumeless *Carduus acanthoides* rosette to bolting 5-7
tropical soda apple *Solanum* foliar 7

1 Use a higher rate in the rate range when growing conditions are less than favorable, when weeds are mature, or weed growth is tall and dense. Do not apply more than a maximum rate of up to 7 fl oz per acre per annual growing season.

Control of other Broadleaf Weeds

The following weeds will be controlled at 4 to 7 fl oz/acre. For best results, weeds should be treated when they are actively growing and under conditions favorable for growth. Use a higher rate in the rate range when growing conditions are less than favorable, when weeds are mature, or weed growth is tall and dense. Do not apply more than a maximum rate of up to 7 fl oz per acre per annual growing season.

Common name Scientific name

absinth wormwood *Artemisia absinthium*
amaranth, spiny *Amaranthus spinosus*
ballonvine *Cardospermum halicacabum*
bedstraw *Gallium spp.*
birdsfoot trefoil *Lotus corniculatus*
broomweed, annual *Gutierrezia sarothrae*
burdock, common *Arctium minus*
buttercup *Ranunculus spp.*
camphorweed *Heterotheca latifolia*
chamomile, mayweed *Anthemis cotula*
chamomile, scentless *Matricarta perforata*
chicory *Cichorium intybus*
clover, Mexican *Richardia spp.*
clover, sweet *Melilotus officinalis*
clover, white *Trifolium repens*
cocklebur *Xanthium strumarium*
croton, woolly *Croton capitatus*
crownvetch *Coronilla varia*

cudweed *Gnaphalium spp.*
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daisy, ox-eye *Chrysanthemum leucantheum*
dock, curly *Rumex crispus*
evening primrose, cutleaf *Oenothera laciniata*
false dandelion, Carolina *Tragopogon dubius*
fleabane *Erigeron spp.*
henbit *Lamium amplexicaule*
horsenettle, Carolina *Solanum carolinense*
horseweed/marestail *Conyza canadensis*
ironweed, tall [1] *Veronia altissima*
ironweed, western [1] *Veronia baldwinii*
lambsquarters *Chenopodium album*
lettuce, prickly *Lactuca serriola*
marshelder (sumpweed) *Iva spp.*
medic, black *Medicago spp.*
nightshades *Solanum spp.*
patridgepea *Cassia fasciculata*
pigweed, redroot *Amaranthus retroflexus*
ragweed, common *Ambrosia artemisiifolia*
ragweed, western *Ambrosia psilostachya*
sicklepod *Cassia obtusifolia*
sneezeweed, bitter *Helenium amarum*
sowthistle, perennial *Sonchus arvensis*
sowthistle, prickly *Sonchus asper*
sunflower, common *Helianthus annua*
teasel *Dipsacus spp.*
vetch *Vicia spp.*
vervain, hoary *Verbena stricta*
Wollyleaf bursage (bur ragweed) *Ambrosia grayi*
yarrow, common *Achillea millefolium*
[1] Use 7 fl oz/acre.

Application Directions

Broadleaf Weed Control in Rangeland and Permanent Grass Pastures

GF-871 can be an important component of integrated weed management programs designed to renovate or restore desired rangeland and pasture plant communities. To maximize and extend the benefits of weed control provided by GF-871, it is important that rangeland and pasture management practices, including grazing management, fertilization, prescribed fire, reseeding with desirable plants, etc., be used to increase the competitiveness of desired plant species. Used as part of an integrated management program, GF-871 can serve as a catalyst for rapid improvement of rangelands and pastures by alleviating the adverse competitive effect of weeds on the yield and quality of forages and other desirable plant species.

Agricultural and natural resources specialists with federal and state government agencies can provide guidance on best management practices and development of integrated rangeland or pasture management systems.

GF-871 may be applied to rangeland or established permanent grass pastures as an aerial or ground broadcast treatment, as a spot application, or as a high volume foliar application (See "Application

Methods" section). Refer to Invasive and Noxious Weeds or General Broadleaf Weed Control sections for rates and timing recommendations for specific broadleaf weeds.

Tank Mixing: GF-871 up to 7 fl oz per acre may be mixed with labeled rates of other herbicides registered for application on rangeland and pastures to broaden the spectrum of weeds controlled or to improve control of certain weeds,. See "Tank Mixing Precautions" under "Mixing Instructions". When tank mixing, do not exceed recommended application rates and use only in accordance with the most restrictive precautions and limitations on the respective product labels.

Broadleaf Weed Control in Non-Cropland Areas

GF-871 is recommended for general broadleaf weed control in non-cropland areas, such as non-irrigation
ditch banks, industrial and storage areas, airports, roadsides, railroad and utility rights-of-way, natural areas, and wildlife openings, including grazed areas on these sites.

Application Rates and Timing: GF-871 provides both season-long preemergence and postemergence control of susceptible weeds. For optimum timing for a specific noxious or invasive broadleaf weed species, refer to the Invasive and Noxious Weeds section above.

Tank Mixtures: To broaden the spectrum of weeds controlled or to improve control of certain weeds, up
to 7 fl oz per acre of GF-871 may be applied alone or tank-mixed with Garlon* 4, Garlon 3A, Vista, or 2,4-
D herbicides. See "Tank Mixing Precautions" under "Mixing Instructions". When tank mixing, do not exceed recommended application rates and use only in accordance with the most restrictive precautions
and limitations on the respective product labels.

Broadleaf Weed Control in Conservation Reserve Program (CRP) Acres (For Seeding to Permanent Grasses Only)

Do not use GF-871 if loss of legumes species cannot be tolerated.

GF-871 may be applied to CRP acres seeded to permanent grasses as an aerial or ground broadcast treatment, as a spot application, or as a high volume foliar application (See "Application Methods" section). Refer to Invasive and Noxious Weeds or General Broadleaf Weed Control sections for rates and timing recommendations for specific broadleaf weeds.

During the season of establishment, GF-871 should be applied only after perennial grasses are well established (have developed a good secondary root system and show good vigor). Most perennial grasses are tolerant to GF-871 at this stage of development.

Restriction: Do not apply more than 7 fluid ounces per acre of GF-871 per annual growing season as the
total application rate for broadcast of spot applications.

Wheat, Including Durum

(Not Underseeded with a Legume)

GF-871 herbicide is recommended for control of annual and perennial broadleaf weeds in wheat (including durum) not underseeded with a legume.

Application Timing and Weeds Controlled

Timing to Crop: Apply as a broadcast treatment to actively growing wheat from the 3 leaf crop growth stage up to early jointing stage (Zadoks scale 30). **Do not use if cereal crop is underseeded with a legume.**

Timing to Weeds: Apply when weeds are actively growing and at recommended growth stages. For best results on perennial weeds such as Canada thistle, apply when the majority of the basal leaves have emerged from the soil up to bud stage. Only weeds emerged at the time of application will be controlled. Unfavorable growing conditions such as drought or temperatures near freezing prior to, at, or following time of application may reduce weed control and increase the risk of crop injury at all stages of growth.

Spot Application: To prevent over-application, spot treatments should be applied at rates and spray volumes equivalent to broadcast application. For spot application, apply the specified rate in a spray volume of 0.5 gal or more per 1000 sq ft.

Note: Numbers in parentheses (-) refer to footnotes below.

Weeds Controlled Weeds Suppressed † Application Rate

buckwheat, wild (2)
chamomile
mayweed (dogfennel)
dock, curly
grape species
horseweed (marestail)
lentils, volunteer
lettuce, prickly
peas, volunteer
sowthistle, annual
sunflower (1)
wormwood, biennial
bindweed, field
knotweed
ladysthumb (1)
lambsquarters
mustard species
pennycress, field
pigweed species
smartweed, green (1)
sowthistle, perennial (3)
thistle, Canada (3)
thistle, Russian

Broadcast: 0.57 fl oz/acre

Spot Treatment:
0.4 ml/1000 sq ft

† **Suppression** is considered to be a reduction in weed competition (reduced weed population or vigor) in treated compared to untreated areas. Tank mixing with a labeled herbicide may be required to achieve consistent control of these weeds.

1. For best results, apply up to the 2 - 4 leaf stage of growth.
2. For best control, apply in the 1 - 3 leaf stage of growth, before vining.
3. For best results, apply from rosette to bud (pre-flower) stage of growth.

Perennial weeds: GF-871 will control top growth and inhibit regrowth of perennial weeds during the season of application (season-long control). GF-871 may cause a reduction in perennial weed shoot growth in the season following application, but effects may be inconsistent due to variability in size and vigor of perennial root systems and growing conditions.

Restrictions:

- Do not apply more than 0.57 fluid ounce per acre of GF-871 per growing season.
- **Preharvest Interval:** Do not apply within 50 days of harvesting of grain and straw. There is no restriction following application of GF-871 on harvest of wheat for hay.

Tank Mixtures (Wheat Including Durum)

To broaden the spectrum of weed control or to improved control of certain weeds, GF-871 may be tank mixed with labeled rates of other herbicides registered for postemergence application in wheat. See "Tank Mixing Precautions" under "Mixing Instructions". When tank mixing, do not exceed recommended application rates and use only in accordance with the most restrictive precautions and limitations on the respective product labels.

The following products may be tank mixed with GF-871 for improved control of listed weeds:

Tank mix Product Broadcast Rate Additional Weeds Controlled

Starane* herbicide ½ pint/acre kochia, bedstraw (cleavers), chickweed,
volunteer flax

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2,4-D ester or amine
(3.8 lb/gal a.e.)
½ to ¾ pint/acre lambsquarters, mustard, pigweed, Canada
thistle, Russian thistle
MCPA ester or amine
(3.8 lb/gal a.e.)
½ to ¾ pint/acre lambsquarters, mustard
Harmony GT
herbicide
3/10 oz/acre lambsquarters, mustard, pigweed, Russian
thistle
Express XP herbicide 1/8 – 1/3 oz/acre mustard, Canada thistle, Russian thistle
Ally XP herbicide 1/10 oz/acre lambsquarters, mustard, pigweed, Russian
thistle

Use Precautions and Restrictions (Wheat, Including Durum)

• **Avoiding Injury to Non-target Plants:** Do not apply GF-871 directly to, or allow spray drift to come in contact with any broadleaf crop or other desirable broadleaf plants, including, but not limited to, cotton, flowers, grapes, lettuce, potatoes, radishes, soybeans, sugar beets, sunflowers, tobacco, tomatoes or other broadleaf or vegetable crop, fruit trees, ornamental plants, or soil where sensitive crops will be planted the same season. Avoid application under conditions that may allow spray drift since very small quantities of spray, which may not be visible, may seriously injure susceptible crops during either active growth periods or dormancy. Follow Precautions for Avoiding Spray Drift and Spray Drift Advisory under General Mixing and Application Instructions to minimize the potential for spray drift.

• Use directions in Dow AgroSciences supplemental labeling for GF-871 may supersede directions or limitations in this labeling.

• Do not contaminate irrigation ditches or water used for domestic purposes.

• **Chemigation:** Do not apply this product through any type of irrigation system.

• **Do not transfer livestock** from treated grazing areas (or feeding of treated hay) to sensitive broadleaf crop areas without first allowing 3 days of grazing on an untreated pasture (or feeding of treated hay). If livestock are transferred within less than 3 days of grazing untreated pasture or eating untreated hay, urine and manure may contain enough aminopyralid to cause injury to sensitive broadleaf plants.

Crop Rotation Intervals

Residues of this product in treated plants, including the treated crop or weeds, which have not completely
decayed may affect succeeding susceptible crops.

Note: Numbers in parenthesis and † refer to footnotes following tables.

Rotation Crops

Rotation Interval (1)
(Months)

wheat (including durum) 0
barley, canola (rapeseed), flax, grasses, field
corn, grain sorghum, oats, mustard, popcorn,
sweet corn
3
safflower 9
crops not listed 18 (2)

1. The above listed crop rotational intervals are based on average annual precipitation, regardless of

irrigation practices. Observance of recommended crop rotation intervals should result in adequate safety to rotational crops. However, GF-871 is dissipated in the soil by microbial activity and the rate of microbial activity is dependent on several interrelated factors including soil moisture, temperature and organic matter. Therefore, accurate prediction of rotational crop safety is not possible. In areas of low organic matter (<2.0%) and less than 15 inches average annual precipitation, potential for crop injury may be reduced by burning or removal of crop residues, supplemental fall irrigation and deep moldboard plowing prior to planting the sensitive crop.

2. A field bioassay is recommended prior to planting any broadleaf crops that are not listed. Do not rotate to unlisted crops prior to 18 months following application without a field bioassay.

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Field Bioassay Instructions: In fields previously treated with this product, plant short test rows of the intended rotational crop across the original direction of application in a manner to sample variability in field conditions such as soil texture, soil organic matter, soil pH, or drainage. The field bioassay can be initiated at any time between harvest of the treated crop and the planting of the intended rotational crop. Observe the test crop for herbicidal activity, such as poor stand (effect on seed germination) chlorosis (yellowing), and necrosis (dead leaves or shoots), or stunting (reduced growth). If herbicidal symptoms do not occur, the test crop can be grown. If there is apparent herbicidal activity, do not plant the field to the test rotational crop; plant only a labeled crop or crop listed in the table below for which the rotational interval has clearly been met.

General Mixing and Application Instructions

Mixing Instructions

GF-871 may be applied in tank-mix combination with labeled rates of other herbicides provided (1) the tank-mix product is labeled for the timing and method of application for the use site to be treated; and (2)
mixing is not prohibited by the label of the tank-mix product.

Tank Mixing Precautions:

• Read carefully and follow all applicable use directions, precautions, and limitations on the respective product labels.

• Do not exceed recommended application rates. If products containing the same active ingredient are mixed, do not exceed the maximum allowable active ingredient use rates.

• For direct injection or other spray equipment where the product formulations will be mixed in undiluted form, special care should be taken to ensure tank mix compatibility.

• Always perform a (jar) test to ensure the compatibility of products to be used in tank mixture.

Tank-Mix Compatibility Testing: A jar test is recommended prior to mixing in a spray tank to ensure compatibility of GF-871 and other pesticides or carriers. Use a clear glass jar with lid and mix ingredients
in the same order and proportions as will be used in the spray tank. The mixture is compatible if the materials mix readily when the jar is inverted several times. The mixture should remain stable after standing for ½ hour or, if separation occurs, should readily mix if agitated. An incompatible mixture is indicated by separation into distinct layers which do not readily remix when agitated and/or the presence of flakes, precipitates, gels, or heavy oily film on the jar.

Mixing with Water: To prepare the spray, add about half the required amount of water in the spray tank.
Then with agitation, add the recommended amount of GF-871 and other registered tank mix herbicides. Finally, with continued agitation, add the rest of the water and additives such as surfactants or drift control
and deposition aids.

Use with Surfactants: Generally, this product does not require the use of a surfactant to achieve satisfactory weed control. However, the addition of a surfactant may optimize herbicidal activity when applications are made under conditions of cool temperature, low relative humidity or drought, or to small,
heavily pubescent weeds.

Mixing With Sprayable Liquid Fertilizer Solutions
GF-871 is compatible with liquid fertilizer solutions. It is anticipated that GF-871 will not require a compatibility agent for mixing with fertilizers, however, a compatibility test (jar test) should be made prior
to mixing. Jar tests are particularly important when a new batch of fertilizer or pesticide is used, when water sources change, or when tank mixture ingredients or concentrations are changed. Compatibility may be determined by mixing the spray components in the desired order and proportions in a clear glass
jar before large scale mixing of spray components in the spray tank. **Note**: The lower the temperature of
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the liquid fertilizer, the greater the likelihood of mixing problems. Use of a compatibility aid such as Unite
or Compex may be required if FG-871 is mixed with a 2,4-D-containing product and liquid fertilizer. **Mixing GF-871 and 2,4-D in N-P or N-P-K liquid fertilizer solutions is more difficult than mixing with straight nitrogen fertilizer and should not be attempted without first conducting a successful
jar test.** Agitation in the spray tank must be vigorous to be comparable with jar test agitation. . Apply the spray mixture the same day it is prepared while maintaining continuous agitation. Rinse the spray tank thoroughly after use.

Note: Foliar-applied liquid fertilizers used as carrier for GF-871 can cause foliar yellowing of forage grasses.

Sprayer Clean-Out Instructions

Do not use spray equipment used to apply GF-871 for other applications to land planted to, or to be planted to susceptible crops or desirable sensitive plants, unless it has been determined that all residues
of this herbicide has been removed by thorough cleaning of equipment.

Equipment used to apply GF-871 herbicide should be thoroughly cleaned before reusing to apply any other chemicals.

1. Rinse and flush application equipment thoroughly after use. Dispose of rinse water in non-cropland area away from water supplies.
2. Rinse a second time, adding 1 quart of household ammonia or tank cleaning agent for every 25 gallons of water. Circulate the solution through the entire system so that all internal surfaces are contacted (15 to 20 minutes). Let the solution stand for several hours, preferably overnight.
3. Flush the solution out the spray tank through the boom.
4. Rinse the system twice with clean water, recirculating and draining each time.
5. Nozzles and screens should be removed and cleaned separately.

Precautions for Avoiding Spray Drift

Avoid application under conditions that may allow spray drift since very small quantities of spray, which may not be visible, may seriously injure susceptible crops. This product should be applied only when the potential for drift to adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g. when wind is blowing away from the
sensitive areas. A spray-thickening agent may be used to further reduce the potential for drift. If a drift control aid is used, follow the use directions and precautions on the manufacturer's label. Do not use a thickening agent with Microfoil or Thru-Valve booms, or other systems that cannot accommodate thick sprays.

Ground Equipment: With ground equipment spray drift can be lessened by keeping the spray boom as low as possible; by applying 10 gallons or more of spray per acre; by keeping the operating spray pressures at the manufacturer's recommended minimum pressures for the specific nozzle type used (low
pressure nozzles are available from spray equipment manufacturers); by spraying when the wind velocity
is low (follow state regulations). Avoid calm conditions which may be conducive to air inversions. Direct

sprays no higher than the tops of target vegetation and keep spray pressures low enough to provide coarse spray droplets to minimize drift.

Aerial Application: Avoid spray drift at the application site. The interaction of many equipment-andweather-
related factors determine the potential for spray drift. Users are responsible for considering all these factors when making decisions.

The following drift management requirements must be followed to avoid off-target drift movement from aerial applications:

1. The distance of the outer most operating nozzles on the boom must not exceed 90% of the wingspan or rotor width.

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2. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.

Where states have more stringent regulations, they should be observed.

The applicator should be familiar with and take into account the information covered in the following **Aerial Drift Reduction Advisory.** [This information is advisory in nature and does not supersede mandatory label requirements.]

Aerial Drift Reduction Advisory

Information On Droplet Size: The most effective way to reduce drift potential is to apply large droplets.

The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

Controlling Droplet Size:

- **Volume** - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** - Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- **Number of Nozzles** - Use the minimum number of nozzles that provide uniform coverage.
- **Nozzle Orientation** - Orienting nozzles so that the spray is released parallel to the airstream produced larger droplets than other orientations and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.
- **Nozzle Type** - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

Boom Length: For some use patterns, reducing the effective boom length to less than 90% of the wingspan or rotor length may further reduce drift without reducing swath width.

Application Height: Applications should not be made at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

Swath Adjustment: When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase, with increasing drift potential (higher wind, smaller drops, etc.)

Wind: Drift potential is lowest between wind speeds of 2-10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given speed. Application should be avoided below 2 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

Temperature And Humidity: When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when

conditions are both hot and dry.
Temperature Inversions: Applications should not occur during a local, low level temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small
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suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement
of the smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

Terms and Conditions of Use

If terms of the following Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies are not acceptable, return unopened package at once to the seller for a full refund of purchase price paid. Otherwise, use by the buyer or any other user constitutes acceptance of the terms under Warranty Disclaimer, Inherent Risks of Use and Limitations of Remedies.

Warranty Disclaimer

Dow AgroSciences warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. Dow AgroSciences MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Crop injury, lack of performance,
or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of Dow AgroSciences or the seller. All such risks shall be assumed by buyer.

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1. Refund of purchase price paid by buyer or user for product bought, or
2. Replacement of amount of product used.

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FigureC-3: GENEEC Output Files

```
RUN No.   1 FOR Aminopyralid     ON   rangeland     * INPUT VALUES *
--------------------------------------------------------------------
   RATE (#/AC)    No.APPS &    SOIL  SOLUBIL   APPL TYPE  NO-SPRAY INCORP
    ONE(MULT)     INTERVAL      Kd   (PPM )    (%DRIFT)   ZONE(FT)  (IN)
--------------------------------------------------------------------
   .110(   .110)   1   1         .0 2480.0   AERL_C(  9.2)     .0     .0

   FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
   METABOLIC  DAYS UNTIL  HYDROLYSIS    PHOTOLYSIS   METABOLIC  COMBINED
    (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)     (POND)     (POND)
--------------------------------------------------------------------
    310.50         2          N/A       .60-    74.40    ******      69.58

   GENERIC EECs (IN MICROGRAMS/LITER (PPB))      Version 2.0 Aug 1, 2001
--------------------------------------------------------------------
       PEAK       MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
       GEEC       AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
--------------------------------------------------------------------
        6.38        6.33           6.04          5.45          5.05
```

```
RUN No.   1 FOR Aminopyralid     ON   wheat         * INPUT VALUES *
--------------------------------------------------------------------
   RATE (#/AC)    No.APPS &    SOIL  SOLUBIL   APPL TYPE  NO-SPRAY INCORP
    ONE(MULT)     INTERVAL      Kd   (PPM )    (%DRIFT)   ZONE(FT)  (IN)
--------------------------------------------------------------------
   .009(   .009)   1   1         .0 2480.0   AERL_C(  9.2)     .0     .0

   FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
   METABOLIC  DAYS UNTIL  HYDROLYSIS    PHOTOLYSIS   METABOLIC  COMBINED
    (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)     (POND)     (POND)
--------------------------------------------------------------------
    310.50         2          N/A       .60-    74.40    ******      69.58

   GENERIC EECs (IN NANOGRAMS/LITER (PPTr))      Version 2.0 Aug 1, 2001
--------------------------------------------------------------------
       PEAK       MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
       GEEC       AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
--------------------------------------------------------------------
     516.00       511.96         488.87        440.89        408.27
```

Appendix D. T-REX (v. 1.1) Terrestrial Exposure and Risk Quotient Model.

Inputs		
Chemical Name:	aminopyralid	
Use	wheat	
Formulation	spray	
Application Rate	0.009	lbs a.e./acre
Half-life	35	days
Application Interval		days
Maximum # Apps./Year	1	
Length of Simulation	1	year
Concentration of Concern		(ppm)
Name of Concentration of Concern		

Upper Bound Kenaga Residues For RQ Calculation

Acute and Chronic RQs are based on the Upper Bound Kenaga Residues.
The maximum single day residue estimation is used for both the acute and reproduction RQs.

Endpoints		
Avian	LD50 (mg/kg bw/d)	2250
	LC50 (ppm)	
	NOAEL (mg/kg bw/d)	5496
	NOAEC (ppm)	2823

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

Mammals	LD50 (mg/kg bw/d)	5000
	LC50 (ppm)	0
	NOAEL (mg/kg bw/d)	973
	NOAEC (ppm)	0

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

EECs	Kenaga Values
Short Grass	2.16
Tall Grass	0.99
Broadleaf plants/sm Insects	1.22
Fruits/pods/lg Insects	0.14

Avian Results

Avian Class	Body Weight	% body wgt consumed
Small	20	114
Mid	100	65
Large	1000	29

Adjusted EECs (mg/kg bw/d)	Avian Classes and Body Weights		
	small 20 g	mid 100 g	large 1000 g
Short Grass	2	1	1
Tall Grass	1	1	0
Broadleaf plants/sm Insects	1	1	0
Fruits/pods/lg Insects	0	0	0

Dose-based RQs (daily dose/LD50)	Acute RQs		
	20 g	100 g	1000 g
Short Grass	0.00	0.00	0.00
Tall Grass	0.00	0.00	0.00
Broadleaf plants/sm Insects	0.00	0.00	0.00

Fruits/pods/lg insects	0.00	0.00	0.00

Dietary-based RQs (EEC/LC50 or NOAEC)	20 g bird		100 g bird		1000 g bird	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Short Grass	#DIV/0!	0.00	#DIV/0!	0.00	#DIV/0!	0.00
Tall Grass	#DIV/0!	0.00	#DIV/0!	0.00	#DIV/0!	0.00
Broadleaf plants/sm insects	#DIV/0!	0.00	#DIV/0!	0.00	#DIV/0!	0.00
Fruits/pods/lg insects	#DIV/0!	0.00	#DIV/0!	0.00	#DIV/0!	0.00

	All Weight Classes	
	Acute	Chronic
Short Grass	#DIV/0!	0.00
Tall Grass	#DIV/0!	0.00
Broadleaf plants/sm insects	#DIV/0!	0.00
Fruits/pods/lg insects	#DIV/0!	0.00

T-REX Version 1.1, October 5, 2004 replaces Ell-Fate (v1.4)

Developed by the terrestrial biology and exposure technical teams.
For information or questions concerning this spreadsheet, please contact John Ravenscroft or Edward Odenkirchen.

Introduction

This spreadsheet based model calculates the decay of a chemical applied to foliar surfaces for single or multiple applications. It uses the same principle as the batch code models FATE and TERREEC for calculating terrestrial estimates exposure (TEEC) concentrations on plant surfaces following application.

A first order decay assumption is used to determine the concentration at each day after initial application based on the concentration resulting from the initial and decay is calculated by from the first order rate equation:

$$CT = Cie\text{-}kT$$

or in log form:

$$\ln (CT/Ci) = kT$$

Where

CT = concentration at time T = day zero.
Ci = concentration, in parts per million (PPM) present initially (on day zero) on the surfaces. Ci is calculated based on the Kanaga nomogram (Hoerger and Kenaga, (1972) as modified Fletcher (1994). For maximum concentration the application rate, in pounds active ingredient per acre, is multiplied by 240 for Short Grass, 110 for Tall Grass, and 135 for Broad leafed plants/small insects and 15 for fruits/pods/lg insects.

Additional applications are converted from pounds active ingredient per acre to PPM on the plant surface and the additional mass added to the mass of the chemical still present on the surfaces on the day of application.

k = If the foliar dissipation data submitted to EFED are found scientifically valid and statistically robust for a specific pesticide, the 90% upper confidence limit of the mean half-lives should be used. When scientifically valid, statistically robust data are not available TETT recommends the using a default half-life value of 35 days. The use of the 35 day half-life is based on the highest reported value (36.9 days) reported by Willis and McDowell (Pesticide persistence on foliage, Environ. Contam. Toxicol, 100:23-73, 1987).

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

The program calculates concentration on each type of surface on a daily interval for one year. The maximum concentration during the year are calculated for both maximum and mean residues.

The inputs used to calculate the amount of the chemical present are in highlighted in light blue on the spread sheet. Outputs are in yellow. The inputs required are:

Application Rate: The maximum label application rate (in pounds a.e./acre)
Half-life: The degradation half-life for the dominate process(in days)
Frequency of Application: The interval between repeated applications, from the label (in days)
Maximum # Application per year: From the label

The calculated concentrations are used to calculate Avian and Mammalian RQ values. The maximum calculated concentration is divided by user input values for acute and chronic endpoints to give RQs for each type of plant surface.

Avian

For calculating dose-based RQs in birds, the maximum and mean Kenaga residue values are adjusted for for avian class and food consumption based on the following scaling factor (USEPA, 1993):

FI (g/d) = 0.648 (g bw)^0.651

For the 3 avian weight classes considered (20, 100 and 1000 g), this results in % body weight consumption of:

Weight(g)	FI	wet FI	% bw consumed
20	4.555599463	22.77799731	114
100	12.98897874	64.94489369	65
1000	58.15338588	290.7669294	29

Dose-based acute RQs are then calculated using the formula:

RQ = adjusted EEC/LD50 or NOAEL

where the adjusted EEC is considered to be the daily dose weighted for % body weight consumed of a given food source.

For dietary-based RQs, two values are given for each food group. First, the consumption-weighted RQ for each weight class (20, 100, and 1000g birds) is displayed and calculated using the equation:

RQ = EEC/((LC50 or NOAEC)/(%bw consumed))

In the second method, no adjustment is made for consumption differences among the weight classes. This RQ is calculated:

RQ = EEC/LC50 or NOAEC

Mammals

For calculating dose-based RQs in mammals, the maximum and mean Kenaga values are adjusted for mammalian class and food consumption (0.95, 0.66 and 0.15 body weight for herbivores and insectivores and 0.21, 0.15, and 0.03 body wt. for granivores). Dose-based acute and chronic RQs are then calculated by dividing the adjusted EECs (daily dose) by the LD50 or NOAEL.

Dietary-based RQs are calculated using the equation:

RQ = EEC/((LC50 or NOAEC)/(% bw consumed))

Graph

A graph of concentration on each plant surface vs time is plotted and a concentration of concern line can be added at a user specified level. The concentration of concern (*e.g.*, avian LC50, mammalian NOAEL) label should be entered in the cell underneath the value. The graph automatically plots a line at this concentration and the label is extracted from that cell. The graph is plotted for the first 100 days post application. Graphs displaying acute and chronic LOCs for both birds and mammals are displayed in the "Graph" worksheet. These graphs may be useful as a visual aid to communicate risk in your assessment and can be copy/pasted into your document. To help with scaling issues on the y axis, you may want to delete one of the endpoints.

New Version Notes

A new look is used in this update in an effort to decrease confusion and increase transparency in the risk assessment process. This version of T-REX (v1.1) incorporates the ability to calculate EECs and RQs for maximum and mean residues. Mean residues are calculated exactly as the maximum residues are, except the corresponding Kenaga values are: 85 for Short Grass, 36 for Tall Grass, and 45 for Broad leafed plants/small insects and 7 for fruits/pods/lg insects.

Fletcher, J.S., J.E. Nellesson and T. G. Pfleeger. 1994. Literature review and evaluation of the EPA food-chain (Kenaga) nomogram, an instrument for estimating pesticide residues on plants. Environ. Tox. and Chem. 13(9):1383-1391

Hoerger, F. and E.E. Kenaga. 1972. Pesticide residues on plants: correlation of respresentative dada as a basis for estimation of their magnitude in the environment. IN: F. Coulston and F. Corte, eds., Environmental Quality and Safety: Chemistry, Toxicology and Technology. Vol 1. Georg Theime Publishers, Stuttgart, Germany. pp. 9-28.

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

Willis and McDowell. 1987.Pesticide persistence on foliage. Environ. Contam. Toxicol. 100:23-73

Appendix E. TerrPlant Model and Results.

Terrestrial Plant EECs and Acute Non Endangered RQs (8/8/01; version 1.0))

Chemical: aminopyra[illegible]

	Input Values	Estimated Environmental Concentrations (EECs) for NON-GRANULAR formulation applications (lbs a.i./acre)				Risk Quotients (RQs) for NON-GRANULAR formulation applications					
		Application Method	Total Loading to Adjacent Areas (EEC= Sheet	Total Loading to Semi-aquatic Areas (EEC=	DRIFT EEC (for ground application rate x	Emergence RQs, Adjacent Areas RQ=		Emergence RQs, Semi-aquatic Areas		Drift RQs RQ=Drift EEC/Vegetative Vigor EC25	
						Monocot	Dicot	Monocot	Dicot	Monocot	Dicot
Application Rate (lb a.i./acre)	0.211										
Runoff Value (0.01, 0.02, or 0.05 if	0.05										
Minimum Incorporation Depth (inches)	1										
		Ground	0.0127	0.1076	0.0021	0.49	6.33	4.14	#####	0.04	3.20
Seed Emerg Monocot	0.026	Ground Incorp	0.0127	0.1076	0.0021	0.49	6.33	4.14	#####	0.04	3.20
Seed Emerg Dicot	0.002	Aerial, Airblast,	0.0169	0.0739	0.0106	0.65	8.44	2.84	#####	0.21	#####
Veg Vigor Monocot	0.05										
Veg Vigor Dicot	0.00066		EECs for GRANULAR formulation applications (lbs			RQs for GRANULAR formulation applications					

Exposure to Terrestrial Plants including Wetlands
(August 8, 2001; version 1.0)

Terrestrial plants inhabiting dry and semi-aquatic (wetland) areas may be exposed to pesticides from runoff and/or spray drift. Semi-aquatic areas are low-lying wet areas that may dry up at times throughout the year.

EFED's runoff scenario is
(1) based on a pesticide's water solubility and the amount of pesticide present on the soil surface and its top one inch,
(2) characterized as "sheet runoff" (one treated acre to an adjacent acre) for dry areas,
(3) characterized as "channel runoff" (10 acres to a distant low-lying acre) for semi-aquatic or wetland areas, and
(4) based on percent runoff values of 0.01, 0.02, and 0.05 for water solubilities of <10, 10-100, and <100 ppm, respectively.

EFED's Spray Drift scenario is assumed as
(1) 1% for ground application, and (2) 5% for aerial, airblast, forced air, and spray chemigation applications.
The spray drift ratio used here is in agreement with the policy procedures at the time the worksheet was designed.

Currently, 1) this worksheet is designed to derive the plant exposure concentrations from a single, maximum application rate only. 2) For pesticide applications with incorporation of depth of less than 1 inch, the total loading EECs derived for the incorporation method will be same as the unincorporated method.

To calculate RQ values for Non-Endangered Terrestrial Plants:

Terrestrial Plants Inhabiting Areas Adjacent to Treatment Site:

Emergence RQ = Total Loading to Adjacent Area or EEC/Seedling Emergence EC25
Drift RQ = Drift EEC/Vegetative Vigor EC25

Terrestrial Plants Inhabiting Semi-aquatic Areas Adjacent to Treatment Site:

Emergence RQ = Total Loading to Semi-aquatic Area or EEC/Seedling Emergence EC25
Drift RQ = Drift EEC/Vegetative Vigor EC25

To calculate RQ values for Endangered Terrestrial Plants:

Endangered Terrestrial Plants Inhabiting Areas Adjacent to Treatment Site:

Emergence RQ = Total Loading to Adjacent Area or EEC/Seedling Emergence EC05

Drift RQ = Drift EEC/Vegetative Vigor EC05 or NOAEC

Endangered Terrestrial Plants Inhabiting Semiaquatic Areas Near Treatment Site:

Emergence RQ = Total Loading to Semiaquatic Area or EEC/Seedling Emergence EC05

Drift RQ = Drift EEC/Vegetative Vigor EC05 or NOAEC

Formulas used to calculate EEC values (8/08/01; version 1.0)

To calculate EECs for terrestrial plants inhabiting in areas adjacent to treatment sites

Un-incorporated Ground Application (Non-granular):

Sheet Runoff = Application Rate (lb a.e./A) x Runoff Value
Drift = Application Rate (lb a.e./A) x 0.01
Total Loading = EEC = Sheet Runoff + Drift

Incorporated Ground Application with Drift (Non-granular):

Sheet Runoff = [Application Rate (lb a.e./A)/Incorporation Depth (inch)] x Runoff Value

Drift = Application Rate (lb a.e./A) x 0.01
Total Loading = EEC = Sheet Runoff + Drift

Un-incorporated Ground Application (Granular):

Sheet Runoff = EEC = Application Rate (lb a.e./A) x Runoff Value

Incorporated Ground Application without Drift (Granular):

Sheet Runoff = EEC = [Application Rate (lb a.e./A)/Incorportion Depth (inch)]
x Runoff Value

Aerial/Airblast/Spray Chemigation Applications:

Sheet Runoff = Application Rate (lb a.e./A) x Runoff Value x Application Efficiency of 0.6

Drift = Application Rate (lb a.e./A) x 0.05
Total Loading = EEC = Sheet Runoff + Drift

Runoff Value = 0.01, 0.02, or 0.05 when the solubility of the chemical is <10 ppm, 10-100 ppm, or >100 ppm, respectively

Incorporation Depth: Use the minimum incorporation depth reported on the label.

Appendix F. Ecological Toxicity Data.

Terrestrial Animals

Acute and Subacute Toxicity in Birds

An acute oral toxicity study using aminopyralid acid is required to establish the toxicity of aminopyralid to birds. The preferred test species is either mallard duck (a waterfowl) or bobwhite quail (an upland game bird). In an acute oral toxicity study (MRID 462358-08) of northern bobwhite quail, *Colinus virginianus*, the LD_{50} was greater than the highest dose tested, *i.e.*, >2250 mg a.e./kg body weight (**Table F-1**); therefore, aminopyralid acid is categorized as practically non toxic to avian species on an acute oral exposure basis. No mortality occurred at any treatment levels tested and no treatment-related effects were observed upon terminal necropsy. Clinical signs of toxicity [reduced reaction to external stimuli (sound and movement), ruffled appearance, lethargy, wing droop, loss of coordination, lower limb weakness, prostrate posture, lower limb rigidity, minor muscle fasciculation, convulsions, loss of righting reflex, depression, and/or gaping] were observed in each of the aminopyralid treatments; therefore, the acute oral no-observed effect level is less than the lowest dose tested, *i.e.*, <63 mg a.e./kg body weight. Significant ($p<0.05$) treatment-related effects on body weight gain were observed for both sexes at the 1350 and 2250 mg a.e./kg body weight treatment levels, respectively. Significant ($p<0.05$) treatment-related effects on feed consumption were observed for both sexes at the 2250 mg a.e../kg body weight treatment level. The study (MRID 462358-08) is classified as acceptable and is consistent with Guideline §71-1 avian acute oral test requirements.

A second acute oral toxicity study (MRID 462358-09) conducted with northern bobwhite quail, *Colinus virginianus*, and aminopyralid acid was submitted to provide supplemental data to the previously-conducted primary acute toxicity study (MRID 462358-08), in which a NOEL was not established. In the second acute oral toxicity study (MRID 462358-09), the LD_{50} was greater than the highest dose tested, *i.e.*, >292 mg a.e./kg body weight (**Table F-1**); as the highest dose tested was well below the limit concentration of 2000 mg a.e../kg bw, an accurate Toxicity Category could not be assigned to the aminopyralid acid in this study. Clinical signs of toxicity (ruffled appearance, loss of coordination, reduced reaction to external stimuli (sound and movement), lethargy, neck curl, prostrate posture, and/or lower limb weakness) were observed in the 23 mg a.e./kg body weight through 292 mg a.e./kg body weight aminopyralid treatments; therefore, the acute oral no-observed effect level is 14 mg a.e./kg body weight. No treatment-related effects on body weight changes or feed consumption were observed. The study (MRID 462358-09) is classified as supplemental since the study was not designed to fulfill guideline requirements, but rather to supplement the primary acute toxicity study to northern bobwhite quail (MRID 462358-08).

Table F-1. Avian acute oral toxicity for technical grade aminopyralid.

Species	% a.e.	LD_{50} (mg a.e./kg bw)	Toxicity Category	MRID Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	94.5 Technical	>2250	Practically non-toxic	462358-08 Gallagher, *et al.*, 2001	Acceptable
Northern bobwhite quail *(Colinus virginianus)*	94.5 Technical	>292	Not classifiable	462358-09 Gallagher, *et al.*, 2003	Supplemental

Two subacute dietary studies using the acid are required to establish the toxicity of aminopyralid to birds. The preferred test species are mallard duck, *Anas platyrhynchos*, and bobwhite quail, *Colinus virginianus*. Subacute dietary toxicity testing with both bobwhite quail (MRID 462358-10) and mallard ducks (MRID 462358-11) indicated that the 8-day LC_{50} values exceeded the maximum concentrations tested (measured), *i.e.*, >5556 mg a.e./kg of diet and >5496 mg a.e./kg of diet, respectively (**Table F-2**). No effects were noted for either species; therefore the subacute dietary NOECs for bobwhite quail and mallard ducks are the highest concentrations tested, *i.e.*, 5556 mg a.e./kg of diet and 5496 mg a.e./kg of diet, respectively (**Table VI-2**). Since the LC_{50} values for both species is greater than 5000 mg a.e./kg of diet, aminopyralid acid is classified as practically non-toxic on an subacute dietary exposure basis. Both studies (MRIDs 462358-10 and 462358-11) are classified as acceptable and are consistent with Guideline §71-2 avian subacute dietary test requirements.

Table F-2. Avian subacute dietary toxicity for technical grade aminopyralid.

Species	% a.e.	LC_{50} (mg a.e./kg diet) (measured)	Toxicity Category	MRID Author/Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	94.5 Technical	>5556	Practically non-toxic	462358-10 Gallagher, *et al.*, 2001	Acceptable
Mallard duck *(Anas platyrhynchos)*	94.5 Technical	>5496	Practically non-toxic	462358-11 Gallagher, *et al.*, 2001	Acceptable

Chronic Toxicity to Birds

Avian reproduction studies using the acid are required for aminopyralid because the following condition is met: aminopyralid is proposed for use outdoors and may be applied multiple times preceding or during the breeding season. The preferred test species are mallard duck, *Anas platyrhynchos*, and bobwhite quail, *Colinus virginianus*. In the mallard duck study (MRID 462358-13) there were no treatment-related effects on any adult or offspring parameter. Thus, the chronic NOEC is the maximum concentration tested (measured), *i.e.*, 2623 mg a.e./kg of diet (**Table F-3**). This avian reproduction study is classified as acceptable and fulfills Guideline §71-4 testing requirements.

In the study of bobwhite quail (MRID 462358-12), there were statistically significant differences found in the lowest dose tested for two survival endpoints (hatchling survival per eggs set and 14-day hatchling survival), but it is unclear whether these were treatment-related effects. Together with apparent downward trends in hatchling per live embryos and hatchlings per pen, it is uncertain that the study authors conclusion that these effects are not treatment related can be supported. At the very least, the husbandry during the study can be called into question. Therefore, the study did not determine a NOEC for these endpoints. This avian reproduction study is scientifically sound, but is not consistent with the guideline requirements and is classified as supplemental.

Table F-3. Avian reproduction for technical grade aminopyralid.

Species	% a.e.	NOAEC (mg a.e./kg diet) (measured)	LOAEC (mg a.e./kg diet)/	MRID Author/Year	Study Classification
Mallard duck *(Anas platyrhynchos)*	94.5 Technical	2623	>2623	462358-13 Mach, 2003	Acceptable
Northern bobwhite quail *(Colinus virginianus)*	94.5 Technical	Not determined	Not determined	462358-12 Mach, 2003	Supplemental

Acute and Chronic Toxicity to Mammals

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, rat and rabbit toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. An acute oral toxicity study on Fischer rats (MRID 462356-03), resulted in an oral LD_{50} for both males and females greater than 5000 mg a.e./kg body weight (**Table F-4**). This study was submitted to and reviewed by HED, where it was classified as acceptable. Based on the reported results, aminopyralid is classified as practically non-toxic to terrestrial mammals.

In a 2-generation rat reproduction study, reviewed by PMRA and classified acceptable, XDE-750 (aminopyralid formulation, purity 94.5%, was administered to 30 Sprague Dawley rats per sex per group in the diet at concentrations of 0, 50, 250 or 1000 mg a.e./kg bw/day (equal to 0, 52.0, 259 or 1030 mg a.e./kg bw/day for males, and 0, 49.3, 245 or 973 mg a.e./kg bw/day for females). Each female in each generation was mated to produce one litter.

For parent animals, there were no treatment-related effects on mortality, clinical signs, body weight and body weight gain, food intake, reproductive function, reproductive parameters or histopathology. Full and/or empty cecal weights were increased in the P_1 generation, in the 250 and 1000 mg a.e./kg bw/day groups, both sexes. In the P_2 generation, full and empty cecal weights were increased in the 1000 mg a.e./kg bw/day group, both sexes, and in the 50 and 250 mg a.e./kg bw/day groups, males only. At gross necropsy, cecal size was increased in the P_1 and P_2 generations, in the 250 and 1000 mg a.e./kg bw/day groups, both sexes (**Table F-4**). In the absence of any histopathological changes to the ceca, and in the absence of any other treatment-related parental findings, the cecal findings were considered to be adaptive changes and were not considered to be adverse. For pups, there were no treatment-related effects on clinical signs, viability/litter parameters, pup body weight and body weight gain, organ weights or gross pathology

Table F-4. Mammalian toxicity for aminopyralid.

Species	% a.e.	Test Type	Toxicity Category	Affected Endpoints	MRID No.	Classification
Fischer Rat *Ratus* ratus	94.5%	Acute Oral LD_{50} >5000 mg a.e./kg bw	practically non-toxic	none	462356-03	Acceptable
CD Rat *Ratus ratus*	94.5%	NOAEL=1000 mg.a.e./kg/day	–	none	PMRA 4.5.2.1	Acceptable

Toxicity to Insects

A honey bee acute contact toxicity study is required for aminopyralid because outdoor uses may result in honey bee exposure. In a 48-hour contact toxicity study with aminopyralid acid (MRID 462358-31), the LD_{50} value exceeded the maximum dose tested, *i.e.*, >100 µg a.e./bee (**Table F-5**). Since the LD_{50} is greater than 100 µg a.e./bee, aminopyralid is categorized as practically non-toxic to pollinators on an acute contact basis. The acute contact toxicity study (MRID 462358-31) is classified as acceptable and is consistent with Guideline §141-1 testing recommendations.

A 48-hour acute oral toxicity study was also submitted (MRID 462358-32); the LC_{50} for aminopyralid acid is >117 µg a.e./bee. By 48 hours, there was 3, 7, 0, 0, and 0% mortality at the 6.0, 16, 28, 32, and 117 µg a.e./bee treatment concentrations, respectively, compared to 3% control mortality. No sub-lethal effects were observed in the control or treatments. The acute oral toxicity study (MRID 462358-32) is classified as supplemental since the study does not fulfill an OPP guideline requirement.

Table F-5. Nontarget insect acute contact toxicity for technical grade aminopyralid.

Species	% a.e.	LD_{50} (µg a.e./bee)	Toxicity Category	MRID No. Author/Year	Study Classification
Honey bee (*Apis mellifera*)	94.5 Technical	>100 (contact)	Practically non-toxic	462358-31 Aufderheide, 2001	Acceptable

Aquatic Animals

Acute Toxicity to Freshwater Fish

Two freshwater fish toxicity studies are required to establish the toxicity of aminopyralid to fish. The preferred test species are the rainbow trout, *Oncorhynchus mykiss* (a coldwater fish) and bluegill sunfish, *Lepomis macrochirus* (a warmwater fish). In a 96-hour acute limit toxicity test with rainbow trout (MRID 462358-14), the LC_{50} value exceeded 100 mg a.e./L (**Table F-6**). Partial loss of equilibrium was observed in 7% of the fish in the treatment group. The rainbow trout study (MRID 462358-14) is classified as acceptable and partially fulfills Guideline §72-1 testing requirements. In the 96-hour acute limit toxicity test with bluegill sunfish (MRID 462358-15), the LC_{50} value also exceeded 100 mg a.e./L (**Table F-6**); no mortality or sublethal effects were observed in the treatment group. The bluegill sunfish study (MRID 462358-15) is classified as supplemental since the size of fish (0.18-0.92 g) used was less than the recommended range of 0.5 to 5 g. For both species, the LC_{50} values were higher than 100 mg a.e./L, and aminopyralid is classified as practically non-toxic to freshwater fish on an acute exposure basis. Although only one of the submitted freshwater fish acute toxicity studies was classified as acceptable, EFED is not recommending that the bluegill sunfish study (MRID 462358-15) be repeated at this time.

Table F-6. Freshwater fish and amphibian acute toxicity for technical grade aminopyralid.

Species/ static or flow-through	% a.e.	96-hour LC_{50} mg a.e./L (measured)	Toxicity Category	MRID No. Author/Year	Study Classification
Rainbow trout (*Oncorhynchus mykiss*)/ Static	94.5 Technical	>100 (limit test)	Practically non- toxic	462358-14 Marino *et al.*, 2001	Acceptable
Bluegill sunfish (*Lepomis macrochirus*)/ Static	94.5 Technical	>100 (limit test)	Practically non- toxic	462358-15 Machado, 2003	Supplemental

Species/ static or flow-through	% a.e.	96-hour LC_{50} mg a.e./L (measured)	Toxicity Category	MRID No. Author/Year	Study Classification
Northern leopard frog (*Rana pipiens*)/ static	94.5 Technical	>95.2 (limit test)	Practically non- toxic	462358-16 Henry *et al.*, 2003	Supplemental

A 96-hour static acute toxicity study of amphibian larvae using aminopyralid acid was also submitted in support of aminopyralid registration (MRID 462358-16), and was evaluated based on guidelines §72-1. In the 96-hour acute limit toxicity test with northern leopard frog (*Rana pipiens*) larvae, the LC_{50} value exceeded 95.2 mg a.e./L (**Table F-6**); no mortality or sublethal effects were observed in the treatment or control group. The study (MRID 462358-16) is classified as supplemental since the study does not fulfill an OPP guideline requirement.

Chronic Toxicity to Freshwater Fish

A fish early life-stage test (Guideline 72-4a) is required for aminopyralid because the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent, and because aminopyralid is expected to be persistent (stable) in natural water bodies. In an early life-stage toxicity study of fathead minnow (MRID 462358-21), percent post-hatch (larval) survival and growth (wet weight and length) were significantly ($p<0.05$) reduced at 2.44 mg a.e./L relative to pooled controls (**Table F-7**). Percent post-hatch (larval) survival was reduced by 33-100% at the 2.44 mg a.e./L through 11.4 mg a.e./L (measured) treatments. Wet weight was reduced by 28% and 78% at the 2.44 mg a.e./L and 3.89 mg a.e./L (measured) treatments, respectively. Length was reduced by 7.8% and 32% at the 2.44 mg a.e./L and 3.89 mg a.e./L treatments, respectively. Growth parameters were not applicable at the two highest treatments due to 100% post-hatch (larval) mortality. Sub-lethal clinical effects were observed at the ≥2.44 mg a.e./L levels and included pale coloration, immobility, deformed or underdeveloped bodies, and scoliosis; however, it was unclear how the study authors derived the reported values for each treatment level from the provided data, and therefore, the NOAEC and LOAEC values were not verified. The study (MRID 462358-21) is classified as supplemental since replicate data for the days-to-mean hatch and sub-lethal effects were not submitted and could not be verified by EFED; EFED recommends that these data be submitted, which may allow the study to be upgraded.

Table F-7. Early life-stage toxicity of technical grade aminopyralid to freshwater fish.

Species/ static or flow-through	% a.e.	NOAEC mg a.e./L (measured)	LOAEC mg a.e./L (measured)	Endpoints Affected	MRID No. Author/Year	Study Classification
Fathead minnow (*Pimphales promelas*)/ Flow-through	94.5 Technical	1.36	2.44	Post-hatch survival, growth (wet-weight and length), and sub-lethal effects	462358-21 Marino *et al.*, 2002	Supplemental

Acute Toxicity to Freshwater Invertebrates

A freshwater aquatic invertebrate toxicity test is required to establish the toxicity of aminopyralid to aquatic invertebrates. The preferred test species is the waterflea, *Daphnia magna*. Acute limit toxicity testing under static conditions with waterfleas resulted in a 48-hour EC_{50} that exceeded 98.6 mg a.e./L (**Table F-8**); no mortality or sublethal effects were observed during the 48-hour study period. Aminopyralid is classified as practically non-toxic to the freshwater invertebrates on an acute exposure basis. The study (MRID 462358-17) is classified as acceptable and is consistent with Guideline §72-2 testing requirements.

Table F-8. Freshwater invertebrate acute toxicity for technical grade aminopyralid.

Species/Static or Static renewal	% a.e.	48-hour EC_{50} mg a.e./L (measured)	Toxicity Category	MRID No. Author/Year	Study Classification
Waterflea *(Daphnia magna)* Static	94.5 Technical	>98.6 (limit test)	Practically non-toxic	462358-17 Marino *et al.*, 2001	Acceptable

Chronic Toxicity to Freshwater Invertebrates

A freshwater aquatic invertebrate life-cycle test is required for aminopyralid because the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent, and because aminopyralid is expected to be persistent (stable) in natural water bodies. The preferred test species is the waterflea. In a 21-day static-renewal life cycle test (MRID 462358-22), no treatment-related effects on mortality, growth (length), or reproduction (mean number of young per reproductive day) were observed up to and including the highest concentration tested, *i.e.*, 102 mg a.e./L (**Table F-9**); therefore, the NOEC is 102 mg a.e./L. The study (MRID 462358-22) is classified as supplemental due to excessive water hardness, low dissolved oxygen (31%), and reduced replicate size.

Table F-9. Freshwater invertebrate full life-cycle toxicity for technical grade aminopyralid.

Species Type of study/ static or flow-through	% a.e.	NOAEC/LOAEC mg a.e./L (measured)	Endpoints Affected	MRID Author/Year	Study Classification
Waterflea *(Daphnia magna)* Static-renewal	94.5 Technical	21-day: 102/>102	None	462358-22 Henry *et al*, 2003	Supplemental

A 28-day chronic toxicity study of aminopyralid acid using the midge, *Chironomus riparius*, was carried out under static conditions in a water-sediment system where the overlying water was spiked (MRID 462358-23). Aminopyralid concentrations ranged from 87-112% of nominal throughout the study in overlying water. Pore water and sediment concentrations were determined at three (of five) test levels only. Recoveries in pore water were 17-18% of nominal overlying water concentrations on Day 0, and increased to 81-93% of nominal at 7 and 28 Days. Recoveries in sediment were 7-15% of nominal at Day 0, 35-40% at Day 7, and 16-68% at Day 28. Results are reported in terms of EFED-calculated sediment concentrations as a percentage of overlying water (based on 7- and 28-day data for only three concentration levels). Under the conditions tested, mean percent emergence (the most sensitive endpoint) was significantly-reduced at 88 mg a.e./L compared to the negative control (**Table F-10**). In addition, mean development rate of males was significantly-reduced at 186 mg a.e./L. The study (MRID 462358-23) is not a guideline data requirement and is classified as supplemental.

Table F-10. Freshwater Invertebrate 28-day chronic toxicity study of technical grade aminopyralid in sediment-water system using the midge, *Chironomus riparius*.

Species Type of study/ static or flow-through	% a.e.	28-day NOAEC/ LOAEC mg a.e./L (sediment)	Endpoints Affected	MRID Author/Year	Study Classification
Midge (*Chironomus riparius*) Static	94.5 Technical	33/88	Total Emergence, male development rate	462358-23 Putt, 2002	Supplemental

Acute Toxicity to Estuarine and Marine Fish

Acute toxicity testing with estuarine/marine fish is required for aminopyralid because the end-use product may reach coastal environments due to its proposed use to control broadleaf weeds in non-cropland areas (*e.g.*, airports, roadsides, and natural areas). The preferred test species is sheepshead minnow, *Cyprinodon variegatus*. In a 96-hour acute toxicity study with sheepshead minnow (MRID 462358-20), the 96-hour LC_{50} value exceeded 120 mg a.e./L (**Table F-11**); no mortality or sublethal effects were observed in the treatment groups. Aminopyralid is classified as practically non-toxic to estuarine/marine fish on an acute exposure basis. The study (MRID 462358-20) is classified as acceptable and is consistent with Guideline §72-3a testing requirements. However, this study was conducted using marine salinity (33-35‰). If salinity were to be found to affect the activity of aminopyralid, a study reflecting estuarine salinity would be necessary to address the salinity difference between estuarine and marine habitats.

Table F-11. Estuarine/marine fish acute toxicity for technical grade aminopyralid.

Species/Static or Flow-through	% a.e.	96-hour LC_{50} (mg a.e./L) (measured)	Toxicity Category	MRID No. Author/Year	Study Classification
Sheepshead minnow (*Cyprinodon variegatus*) Static	94.5 Technical	>120	practically non-toxic	462358-20 Machado, 2002	Acceptable

Chronic Toxicity to Estuarine and Marine Fish

An estuarine/marine fish early life-stage test (Guideline 72-4a) is not required for aminopyralid because the 96-hour aquatic acute LC_{50} of the estuarine/marine fish species exceeds 1,000 µg/L. The preferred test species for these tests are the silverside (*Menidia menidia*, *Menidia beryllina*, and *Menidia peninsulae*) and sheepshead minnow, *Cyprinodon variegatus*. No chronic toxicity data were available for estuarine/marine fish.

Acute Toxicity to Estuarine and Marine Invertebrates

Acute toxicity testing with estuarine/marine invertebrates is required for aminopyralid because the end-use product may reach coastal environments due to its proposed use to control broadleaf weeds in non-cropland areas (*e.g.*, airports, roadsides, and natural areas). The preferred species are the mysid shrimp (*Americamysis bahia*) and eastern oyster (*Crassostrea virginica*). In a 96-hour acute toxicity study of mysid shrimp (MRID 462358-19), no mortality or sub-lethal effects were observed for controls or aminopyralid-treated groups at up to the limit concentration of 100 mg a.e./L. The 96-hour LC_{50} value exceeded 100 mg a.e./L (**Table F-12**), and aminopyralid is classified as practically non-toxic to the estuarine/marine mysids on an acute exposure basis. The study (MRID 462358-19) is classified as acceptable and is consistent with Guideline §72-3c testing recommendations.

In the acute shell deposition toxicity study of eastern oysters (MRID 462358-18), no mortality or sub-lethal effects were observed for controls or aminopyralid-treated groups at up to 89 mg a.e./L, the highest concentration tested. The 96-hour EC_{50} value exceeded 89 mg a.e./L (**Table F-12**) and aminopyralid is classified as slightly toxic to the estuarine/marine mollusk on an acute exposure basis. The study (MRID 462358-18) is classified as acceptable and is consistent with Guideline 72-3b testing recommendations. If additional data are submitted showing that the 96-hour EC_{50} value exceeds the limit concentration of 100 mg a.e./L, an adjustment to the toxicity category may be made.

Table F-12. Estuarine/marine invertebrate acute toxicity for technical grade aminopyralid.

Species	% a.e.	96-hour LC_{50} mg a.e./L (measured)	Toxicity Category	MRID Author/Year	Study Classification
Eastern oyster shell deposition *(Crassostrea virginica)* Flow-through	94.5 Technical	>89	slightly toxic	462358-18 Cafarella, 2002	Acceptable
Mysid *(Americamysis bahia)* Static	94.5 Technical	>100	practically non-toxic	462358-19 Machado, 2002	Acceptable

Chronic Toxicity to Estuarine and Marine Invertebrates

The estuarine/marine aquatic invertebrate life-cycle test (Guideline 72-4c) is not required for aminopyralid because the 96-hour aquatic acute LC_{50} of the estuarine/marine invertebrate species exceeds 1,000 µg/L. The preferred test species is the mysid shrimp. No chronic toxicity data were available for estuarine/marine invertebrates.

Toxicity to Plants

Terrestrial Plants

Terrestrial plant testing (seedling emergence and vegetative vigor) is required for herbicides that have terrestrial non-residential outdoor use patterns and or may have endangered or threatened plant species associated with the application site. Seedling emergence and vegetative vigor testing of the following plant species and groups should be conducted: (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*). Tier II tests measure the response of plants at five or more test chemical concentrations relative to a control.

Tier II seedling emergence and vegetative vigor studies using formulated aminopyralid (GF-871) were submitted to fulfill both Tier I and Tier II data requirements. Tier II seedling emergence testing with aminopyralid (**Table F-13**) indicated that onion was the most sensitive monocot (fresh shoot weight EC_{25}=29 g a.i./ha; 0.026 lbs a.i./A); the EC_{05} for onion fresh shoot weight was 13 g a.i./ha (0.011 lbs a.i/A). Soybeans were the most sensitive dicot (fresh shoot weight EC_{25}=2.7 g a.i./ha; 0.002 lbs a.i./A); the EC_{05} for soybean fresh shoot weight was 0.91 g a.i/h (0.0008 lbs a.i./A). The study (MRID 462358-

24) is classified as supplemental because soil surface watering occurred without report of test substance mobility characteristics, and because Thiram was applied to sugar beet without further explanation.

Table F-13. Terrestrial plant Tier II seedling emergence[1] toxicity testing for formulated aminopyralid.

Crop	Emergence			Shoot length			Shoot fresh weight			Most sensitive para-meter
	NOAEC	EC_{05}	EC_{25}/ (slope)	NOAEC	EC_{05}	EC_{25}/ (slope)	NOAEC	EC_{05}	EC_{25}/ (slope)	
Barnyard grass-monocot	230.8	ND	>230.8/ N/A	230.8	>230.8	>230.8/ N/A	230.8	30	>230.8/0 .822	None
Corn-monocot	230.8	>230.8	>230.8/ N/A	230.8	>230.8	>230.8/ N/A	230.8	>230.8	>230.8/ N/A	None
Onion-monocot	57.7	24	46/3.40	28.9	16	93/1.25	57.7	13	29/2.62	Fresh Weight
Wheat-monocot	230.8	44	>230.8/0 .288	230.8	>230.8	>230.8/ N/A	230.8	ND	>230.8/ N/A	None
Cucumber-dicot	>57.7	0.014	>57.7/0. 140	57.7	ND	>57.7/N/ A	57.7	41	>57.7/3. 53	None
Soybean-dicot	7.21	5.8	17/ 2.1	3.61	1.1	4.4/1.64	0.9	0.91	2.7/2.08	Fresh Weight
Sugar Beet-dicot	57.7	>57.7	>57.7/N/ A	7.21	6	21/1.75	14.43	5.7	14/2.55	Fresh Weight
Lettuce-dicot	57.7	31	76/2.52	>57.7	22	60/2.21	14.43	11	20/3.87	Fresh Weight
Oilseed Rape-dicot	230.8	>230.8	>230.8/ N/A	230.8	0	>230.8/0 .052	57.7	4.9	49/0.972	Fresh Weight
Radish-dicot	230.8	>230.8	>230.8/ N/A	230.8	ND	>230.8/ N/A	230.8	8.0e-08	>230.8/0 .0821	None

[1] All NOAEC, EC_{05} and EC_{25} values are reported in g a.i./ha.

Tier II vegetative vigor testing with aminopyralid (**Table F-14**) indicated that onion was again the most sensitive monocot (fresh shoot weight EC_{25}=53 g a.i./ha; 0.05 lbs a.i./A); the EC_{05} for onion fresh shoot weight was 0.012 g a.i./ha (1.0e^{-5} lbs a.i./A). Similarly, soybeans were the most sensitive dicot (fresh shoot length EC_{25}=0.75 g a.i./ha; 6.6e^{-4} lbs a.i/A); the EC_{05} for soybean fresh shoot length was 0.027 g a.i./h (2.4e^{-5} lbs a.i./A). The study (MRID 462358-25) is classified as supplemental because Thiram was applied to sugar beet without further explanation, and because both corn and radish were grown under very low light conditions, which may have affected the results.

Table F-14. Terrestrial plant Tier II vegetative vigor[1] toxicity testing for formulated aminopyralid.

Crop	Shoot length			Shoot fresh weight			Most sensitive parameters
	NOAEC	EC_{05}	EC_{25}/ (slope)	NOAEC	EC_{05}	EC_{25}/ (slope)	
Barnyard grass-monocot	230.8	>230.8	>230.8/N/A	230.8	ND	>230.8/N/A	None
Corn-monocot	230.8	>230.8	>230.8/N/A	230.8	>230.8	>230.8/N/A	None
Onion-monocot	1.8	78	>230.8/1.06	1.8	0.012	53/0.266	Fresh weight
Wheat-monocot	230.8	>230.8	>230.8/N/A	230.8	>230.8	>230.8/N/A	None
Cucumber-dicot	7.21	5.2	12/2.58	7.21	19	26/6.82	Shoot length
Soybean-dicot	0.45	0.027	0.75/0.676	0.45	0.22	1.4/1.20	Shoot length
Sugar Beet-dicot	28.9	36	56/4.95	3.61	0.15	8.4/0.553	Fresh weight
Lettuce-dicot	3.61	1.7	6.4/1.67	28.9	1.4	3.3/2.66	Fresh weight
Oilseed Rape-dicot	230.8	>230.8	>230.8/N/A	230.8	>230.8	>230.8/N/A	None
Radish-dicot	115.4	76	>115.4/2.93	7.21	8.7	54/1.22	Fresh weight

[1] All NOAEC, EC_{05} and EC_{25} values are reported in g a.i/ha.

Aquatic Plants

Aquatic Tier II studies are required for all low dose herbicides (those with the maximum use rate of 0.5 lbs a.e./A or less). The following species should be tested at Tier II: green algae (*Pseudokirchneriella subcapitata),* duck weed (*Lemna gibba*), marine diatom (*Skeletonema costatum*), blue-green algae (*Anabaena flos-aquae*), and a freshwater diatom (*Navicula pelliculosa*). In a 96-hour static acute toxicity study with the freshwater algae *Pseudokirchneriella subcapitata* (MRID 462358-30), cell density (0-96 hours) was significantly ($p<0.05$) inhibited by 99% at the measured 46 and 94 mg a.e./L treatment concentrations compared to the pooled control. The EC_{50} (with 95% C.I.) was 32 (9.4-110) mg a.e./L based on linear regression (**Table F-15**). Growth rates (0-72 hour) and biomass (0-72 hour) were significantly ($p<0.05$) inhibited by 101% or more at the 46 and 94 mg a.e./L treatment concentrations compared to the pooled control. The EC_{50} (with 95% C.I.) for growth rates was 30 (11-79) mg a.e./L and the EC_{50} (with 95% C.I.) for biomass was 32 (7.6-130) mg a.e./L based on linear regression (**Table F-15**). EC_{05} values could not be determined for any endpoint. Growth rate was the most sensitive endpoint; *i.e.*, EC_{50} of 30 mg a.e./L (**Table F-15**). It was not clear from the study if the endpoints were affected by the dosage or the pH levels at the higher doses, but was assumed to be a treatment-related effect. The study (MRID 462358-30) is classified as acceptable and fulfills Guideline §123-2 testing requirements.

In a 14-day static acute toxicity test with the freshwater vascular plant duckweed, *Lemna gibba* (MRID 462358-26), the number of fronds was significantly ($p<0.05$) inhibited by 13% at the highest concentration tested (88 mg a.e./L) compared to the solvent control. The EC_{05} (with 95% C.I.) was 7.7 (0.41-140) mg a.e./L with a probit slope of 0.515±0.293 and the EC_{50} exceeded the highest concentration tested, *i.e.*, >88 mg a.e./L (**Table F-15**). Growth rates and plant biomass (dry weight) were not significantly inhibited compared to the pooled control up to and including the highest concentration tested, *i.e.*, 88 mg a.e./L. The study (MRID 462358-26) is classified as acceptable and fulfills Guideline §123-2 testing requirements.

In a 120-hour static acute toxicity study with the marine diatom *Skeletonema costatum* (MRID 462358-28), growth rates (0-72 hours) and biomass (0-72 hours) were significantly ($p<0.05$) inhibited by 14% or more at the 25, 50, and 100 mg a.e./L treatment concentrations compared to the pooled control. The EC_{05} (with 95% C.I.) for growth rates was 12 (1.7-82) mg a.e./L with a probit slope of 1.12±0.485 and the EC_{50} exceeded the highest concentration tested, *i.e.*, 100 mg a.e./L (**Table F-15**). The EC_{05} (with 95% C.I.) for biomass was 7.7 (1.2-49) mg a.e./L and the EC_{50} (with 95% C.I.) was 70 (41-120) mg a.e./L with a probit slope of 1.71±0.627 (**Table F-15**). Cell density (0-120 hours) was not significantly ($p>0.05$) inhibited compared to the pooled control up to and including the highest concentration tested, *i.e.*, 100 mg a.e./L. Biomass was the most sensitive endpoint; *i.e.*, EC_{50} of 70 mg a.e./L (**Table F-15**). The study (MRID 462358-28) is classified as acceptable and fulfills Guideline §123-2 testing requirements.

In a 120-hour static acute toxicity study with the freshwater diatom *Navicula pelliculosa* (MRID 462358-27), cell density (0-120 hours) and biomass (0-72 hours) were significantly ($p<0.05$) inhibited by 21% or more at the measured 12 mg a.e./L through 100 mg a.e./L treatment concentrations compared to the pooled and solvent control, respectively. The EC_{50} (with 95% C.I.) was 22 (6.0-81) mg a.e./L for cell density and 18 (5.4-59) mg a.e./L for biomass based on linear regression (**Table F-15**). Growth rates (0-72 hours) were significantly ($p<0.05$) inhibited by 133% or more at the 48 mg a.e./L and 100 mg a.e./L treatment concentrations compared to the solvent control. EC_{05} values could not be determined for any endpoint. Biomass was the most sensitive endpoint; *i.e.*, EC_{50} of 18 mg a.e./L (**Table F-15**). The study (MRID 462358-27) is classified as acceptable and fulfills Guideline §123-2 testing requirements.

Unacceptable data were submitted for *Anabaena flos-aquae* (MRID 462358-29).

Table F-15. Nontarget aquatic plant toxicity (Tier II) for technical grade aminopyralid.

Species/ static or static renewal (duration)	% a.e..	Most sensitive endpoint, EC_{05}/EC_{50} mg a.e./L (measured)	MRID Author/Year	Study Classification
Freshwater algae *Pseudokirchneriella subcapitata* Static (96 hours)	94.5 Technical	Growth rate (0-72 hour), not determined/30	462358-30 Hoberg, 2003	Acceptable
Aquatic vascular plant (duckweed) *Lemna gibba* Static (14 days)	94.5 Technical	Number of fronds, 7.7/>88	462358-26 Hoberg, 2003	Acceptable
Marine diatom *Skeletonema costatum* Static (120 hours)	94.5 Technical	Biomass (0-72 hour), 7.7/70	462358-28 Hoberg, 2002	Acceptable
Freshwater diatom *Navicula pelliculosa* Static (120 hours)	94.5 Technical	Biomass (0-72 hour), not determined/18	462358-27 Hoberg, 2002	Acceptable

Appendix G. Description of RQs and Levels of Concern.

Risk is estimated by using measures of exposure and measure of effect. Estimated exposure and effects are integrated to calculate risk quotients (RQs) for non-target endangered/threatened and non-endangered animals and plants. These RQs are compared to predetermined levels-of-concern (LOCs) to screen out those taxa to which aminopyralid appears not to pose unacceptable risk.

Table G-1. Levels of concern for each measurement endpoint.

Risk presumptions for terrestrial animals

Risk Presumption	Risk Quotient (RQ)	Level of Concern (LOC)
	Birds	
Acute Risk	EEC[1]/LC_{50} or LD_{50}/sqft[2] or LD_{50}/day[3]	0.5
Acute Restricted Use	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEC	1
	Wild Mammals	
Acute Risk	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.5
Acute Restricted Use	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEC	1

[1] abbreviation for Estimated Environmental Concentration (ppm) on avian/mammalian food items

[2] $\frac{mg/ft^2}{LD_{50} * \text{wt. of bird}}$ [3] $\frac{\text{mg of toxicant consumed/day}}{LD_{50} * \text{wt. of bird}}$

Risk presumptions for aquatic animals

Risk Presumption	RQ	LOC
Acute Risk	EEC[1]/LC_{50} or EC_{50}	0.5
Acute Restricted Use	EEC/LC_{50} or EC_{50}	0.1
Acute Endangered Species	EEC/LC_{50} or EC_{50}	0.05
Chronic Risk	EEC/NOAEC	1

[1] EEC = (ppm or ppb) in water

Risk presumptions for plants

Risk Presumption	RQ	LOC
	Plants Inhabiting Terrestrial and Semi-Aquatic Areas	
Acute Risk	EEC^1/EC_{25}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1
	Aquatic Plants	
Acute Risk	EEC^2/EC_{50}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1

[1] EEC = lbs a.e./A

[2] EEC = (ppb or ppm) in water

Table G-2. Measurement endpoints for aminopyralid.

Taxa/ assessment endpoint	Measurement endpoint[1]	Endpoint value
Birds:		
survival, reproduction, growth	northern bobwhite LD50	>2250 mg a.e./kg body weight
	northern bobwhite LC50	>5556 mg a.e./kg diet
	mallard LC50	>5496 mg a.e./kg diet
	northern bobwhite chronic NOEC	Not determined
	northern bobwhite chronic LOEC	640 mg a.e./kg diet
	mallard chronic NOEC	2623 mg a.e./kg diet
	mallard chronic LOEC	>2623 mg a.e./kg diet
Mammals:		
survival, reproduction, growth	laboratory rat LD50	>5,000 mg a.e./kg body weight
	rat chronic NOAEC and LOAEC	>1,000 mg a.e./kg body weight/day
Freshwater fish and invertebrates:		
survival, reproduction, growth	rainbow trout LC50	>100 mg/L
	bluegill sunfish LC50	>100 mg/L
	waterflea EC50	>98.6 mg/L
	fathead chronic NOAEC	1.36 mg/L
	waterflea chronic NOAEC and LOAEC	102 mg/L
Estuarine/marine fish and invertebrates:		
survival	sheepshead minnow LC50	>120 mg/L
	Eastern oyster EC50	>89 mg/L
	mysid LC50	>100 mg/L
Terrestrial plants:		

Taxa/ assessment endpoint	Measurement endpoint[1]	Endpoint value
perpetuation of nontarget (crop and noncrop) species	monocot (onion) EC25 for seedling emergence	0.026 lbs a.e./A
	monocot (onion) NOEC (EC05) for seedling emergence	0.011 lbs a.e./A
	dicot (soybean) EC25 for seedling emergence	0.002 lbs a.e./A
	dicot (soybean) NOEC for seedling emergence	0.0008 lbs a.e./A
	monocot (onion) EC25 for vegetative vigor	0.05 lbs a.e./A
	monocot (onion) NOEC for vegetative vigor	0.0016 lbs a.e./A
	dicot (soybean) EC25 for vegetative vigor	0.00066 lbs a.e./A
	dicot (soybean) NOEC for vegetative vigor	0.0004 lbs a.e./A
Aquatic plants:		
maintenance and growth of standing crop or biomass	vascular species (duckweed) EC50	>88 mg a.e./L
	vascular species (duckweed) NOEC	44 mg a.e./L
	non-vascular algae EC50	30 mg a.e./L
	marine diatom EC50	70 mg a.e./L
	freshwater diatom EC50	18 mg a.e./L
Beneficial insects:		
survival of populations	honey bee acute oral LD50	>117 ug a.e./bee
	honey bee acute contact LD50	>100 ug a.e./bee

[1] LD50 = lethal dose to 50% of test population

NOAEC = no observed adverse effect concentration

LOAEC = lowest observed adverse effect concentration

LC50 = lethal concentration to 50% of the test population

EC50 (or EC25) = effect concentration to 50% (or 25%) of the test population

Appendix H. Threatened and Endangered Plant Species by State.

The following pages present a state-by-state breakdown of threatened and endangered plant species in wheat-growing regions of the United States as found in the USEPA 'Locates' database.

Species Details by State for Preliminary Assessment

Wheat, all (320)

Minimum of 1 Acre.

Alabama (15species)

BARBARA'S BUTTONS, MOHR'S	Asteraceae	Critical Habitat	Plant
BLADDERPOD, LYRATE	Brassicaceae	Critical Habitat	Plant
FERN, AMERICAN HART'S-TONGUE	Aspleniaceae	Critical Habitat	Plant
GRASS, TENNESSEE YELLOW-EYED	Xyridaceae	Critical Habitat	Plant
HARPERELLA	Apiaceae	Critical Habitat	Plant
LEATHER-FLOWER, ALABAMA	Ranunculaceae	Critical Habitat	Plant
LEATHER-FLOWER, MOREFIELD'S	Ranunculaceae	Critical Habitat	Plant
PITCHER-PLANT, ALABAMA CANEBRAKE	Sarraceniaceae	Critical Habitat	Plant
PITCHER-PLANT, GREEN	Sarraceniaceae	Critical Habitat	Plant
POTATO-BEAN, PRICE'S	Fabaceae	Critical Habitat	Plant
PRAIRIE-CLOVER, LEAFY	Fabaceae	Critical Habitat	Plant
QUILLWORT, LOUISIANA	Isoetaceae	Critical Habitat	Plant
SUNFLOWER, EGGERT'S	Asteraceae	Critical Habitat	Plant
TRILLIUM, RELICT	Liliaceae	Critical Habitat	Plant
WATER-PLANTAIN, KRAL'S	Alismataceae	Critical Habitat	Plant

Arizona (8species)

AGAVE, ARIZONA	Agavaceae	Critical Habitat	Plant
BLUE-STAR, KEARNEY'S	Apocynaceae	Critical Habitat	Plant
CACTUS, ARIZONA HEDGEHOG	Cactaceae	Critical Habitat	Plant

CACTUS, NICHOL'S TURK'S HEAD	Cactaceae	Critical Habitat	Plant
CACTUS, PIMA PINEAPPLE	Cactaceae	Critical Habitat	Plant
CLIFFROSE, ARIZONA	Rosaceae	Critical Habitat	Plant
DOCK, CHIRICAHUA	Polygonaceae	Critical Habitat	Plant
UMBEL, HUACHUCA WATER	Apiaceae	Critical Habitat	Plant

Arkansas (4species)

BLADDERPOD, MISSOURI	Brassicaceae	Critical Habitat	Plant

GEOCARPON MINIMUM	Caryophyllaceae	Critical Habitat	Plant
HARPERELLA	Apiaceae	Critical Habitat	Plant
PONDBERRY	Lauraceae	Critical Habitat	Plant

California (107species)

ADOBE SUNBURST, SAN JOAQUIN	Asteraceae	Critical Habitat	Plant
AMBROSIA, SAN DIEGO	Asteraceae	Critical Habitat	Plant
Amole, Camatta Canyon	Liliaceae	Critical Habitat	Plant
AMOLE, PURPLE	Liliaceae	Critical Habitat	Plant
ASTER, DEL MAR SAND	Asteraceae	Critical Habitat	Plant
BACCHARIS, ENCINITAS	Asteraceae	Critical Habitat	Plant
BARBERRY, NEVIN'S	Berberidaceae	Critical Habitat	Plant
BIRD'S-BEAK, PALMATE-BRACTED	Scrophulariaceae	Critical Habitat	Plant
BIRD'S-BEAK, SALT MARSH	Scrophulariaceae	Critical Habitat	Plant
BIRD'S-BEAK, SOFT	Scrophulariaceae	Critical Habitat	Plant
BLADDERPOD, SAN BERNARDINO MOUNTAINS	Brassicaceae	Critical Habitat	Plant
BLUECURLS, HIDDEN LAKE	Lamiaceae	Critical Habitat	Plant
BLUEGRASS, SAN BERNARDINO	Poaceae	Critical Habitat	Plant
BRODIAEA, THREAD-LEAVED	Liliaceae	Critical Habitat	Plant
BUCKWHEAT, CUSHENBURY	Polygonaceae	Critical Habitat	Plant
BUCKWHEAT, SOUTHERN MOUNTAIN WILD	Polygonaceae	Critical Habitat	Plant
BUTTON-CELERY, SAN DIEGO	Apiaceae	Critical Habitat	Plant

CACTUS, BAKERSFIELD	Cactaceae	Critical Habitat	Plant
CEANOTHUS, COYOTE	Rhamnaceae	Critical Habitat	Plant
CEANOTHUS, VAIL LAKE	Rhamnaceae	Critical Habitat	Plant
CHECKER-MALLOW, KECK'S	Malvaceae	Critical Habitat	Plant
CHECKER-MALLOW, PEDATE	Malvaceae	Critical Habitat	Plant
CLARKIA, PISMO	Onagraceae	Critical Habitat	Plant
CLARKIA, PRESIDIO	Onagraceae	Critical Habitat	Plant
CLARKIA, SPRINGVILLE	Onagraceae	Critical Habitat	Plant
CLOVER, MONTEREY	Fabaceae	Critical Habitat	Plant
CROWN-BEARD, BIG-LEAVED	Asteraceae	Critical Habitat	Plant
CROWNSCALE, SAN JACINTO VALLEY	Chenopodiaceae	Critical Habitat	Plant
CYPRESS, GOWEN	Cupressaceae	Critical Habitat	Plant

DAISY, PARISH'S	Asteraceae	Critical Habitat	Plant
DUDLEYA, CONEJO	Crassulaceae	Critical Habitat	Plant
DUDLEYA, SANTA CLARA VALLEY	Crassulaceae	Critical Habitat	Plant
DUDLEYA, SANTA MONICA MOUNTAINS	Crassulaceae	Critical Habitat	Plant
DUDLEYA, VERITY'S	Crassulaceae	Critical Habitat	Plant
EVENING-PRIMROSE, ANTIOCH DUNES	Onagraceae	Critical Habitat	Plant
EVENING-PRIMROSE, SAN BENITO	Onagraceae	Critical Habitat	Plant
FIDDLENECK, LARGE-FLOWERED	Boraginaceae	Critical Habitat	Plant
FLANNELBUSH, MEXICAN	Sterculiaceae	Critical Habitat	Plant
GILIA, MONTEREY	Polemoniaceae	Critical Habitat	Plant
GOLDEN SUNBURST, HARTWEG'S	Asteraceae	Critical Habitat	Plant
GOLDFIELDS, CONTRA COSTA	Asteraceae	Critical Habitat	Plant
GRASS, CALIFORNIA ORCUTT	Poaceae	Critical Habitat	Plant
GRASS, COLUSA	Poaceae	Critical Habitat	Plant
GRASS, HAIRY ORCUTT	Euphorbiaceae	Critical Habitat	Plant
GRASS, SACRAMENTO ORCUTT	Euphorbiaceae	Critical Habitat	Plant
GRASS, SAN JOAQUIN VALLEY ORCUTT	Poaceae	Critical Habitat	Plant
GRASS, SLENDER ORCUTT	Euphorbiaceae	Critical Habitat	Plant
GRASS, SOLANO	Poaceae	Critical Habitat	Plant

JEWELFLOWER, CALIFORNIA	Brassicaceae	Critical Habitat	Plant
LAYIA, BEACH	Asteraceae	Critical Habitat	Plant
LUPINE, CLOVER	Fabaceae	Critical Habitat	Plant
LUPINE, NIPOMO MESA	Fabaceae	Critical Habitat	Plant
MALACOTHRIX, SANTA CRUZ ISLAND	Asteraceae	Critical Habitat	Plant
MALLOW, KERN	Malvaceae	Critical Habitat	Plant
MANZANITA, DEL MAR	Ericaceae	Critical Habitat	Plant
MANZANITA, MORRO	Ericaceae	Critical Habitat	Plant
MANZANITA, PALLID	Ericaceae	Critical Habitat	Plant
MEADOWFOAM, BUTTE COUNTY	Limnanthaceae	Critical Habitat	Plant
MILK-VETCH, BRAUNTON'S	Fabaceae	Critical Habitat	Plant
MILK-VETCH, COACHELLA VALLEY	Fabaceae	Critical Habitat	Plant
MILK-VETCH, COASTAL DUNES	Fabaceae	Critical Habitat	Plant
MILK-VETCH, CUSHENBURY	Fabaceae	Critical Habitat	Plant
MILK-VETCH, LANE MOUNTAIN	Fabaceae	Critical Habitat	Plant
MILK-VETCH, PIERSON'S	Fabaceae	Critical Habitat	Plant

MILK-VETCH, TRIPLE-RIBBED	Fabaceae	Critical Habitat	Plant
MILK-VETCH, VENTURA MARSH	Fabaceae	Critical Habitat	Plant
MINT, OTAY MESA	Lamiaceae	Critical Habitat	Plant
MINT, SAN DIEGO MESA	Lamiaceae	Critical Habitat	Plant
MONARDELLA, WILLOWY	Lamiaceae	Critical Habitat	Plant
MOUNTAINBALM, INDIAN KNOB	Hydrophyllaceae	Critical Habitat	Plant
MUSTARD, SLENDER-PETALED	Brassicaceae	Critical Habitat	Plant
NAVARRETIA, FEW-FLOWERED	Polemoniaceae	Critical Habitat	Plant
NAVARRETIA, MANY-FLOWERED	Polemoniaceae	Critical Habitat	Plant
NAVARRETIA, SPREADING	Polemoniaceae	Critical Habitat	Plant
ONION, MUNZ'S	Liliaceae	Critical Habitat	Plant
OWL'S-CLOVER, FLESHY	Scrophulariaceae	Critical Habitat	Plant
OXYTHECA, CUSHENBURY	Polygonaceae	Critical Habitat	Plant
PAINTBRUSH, ASH-GREY INDIAN	Scrophulariaceae	Critical Habitat	Plant
PAINTBRUSH, TIBURON	Scrophulariaceae	Critical Habitat	Plant

PENTACHAETA, LYON'S	Asteraceae	Critical Habitat	Plant
PHLOX, YREKA	Polemoniaceae	Critical Habitat	Plant
PIPERIA, YADON'S	Orchidaceae	Critical Habitat	Plant
POTENTILLA, HICKMAN'S	Rosaceae	Critical Habitat	Plant
PUSSYPAWS, MARIPOSA	Portulacaceae	Critical Habitat	Plant
SANDWORT, BEAR VALLEY	Caryophyllaceae	Critical Habitat	Plant
SANDWORT, MARSH	Caryophyllaceae	Critical Habitat	Plant
SEA-BLITE, CALIFORNIA	Chenopodiaceae	Critical Habitat	Plant
SPINEFLOWER, MONTEREY	Polygonaceae	Critical Habitat	Plant
SPINEFLOWER, ORCUTT'S	Polygonaceae	Critical Habitat	Plant
SPINEFLOWER, ROBUST	Polygonaceae	Critical Habitat	Plant
SPINEFLOWER, SLENDER-HORNED	Polygonaceae	Critical Habitat	Plant
SPURGE, HOOVER'S	Euphorbiaceae	Critical Habitat	Plant
STONECROP, LAKE COUNTY	Crassulaceae	Critical Habitat	Plant
TARAXACUM, CALIFORNIA	Asteraceae	Critical Habitat	Plant
TARPLANT, OTAY	Asteraceae	Critical Habitat	Plant
TARPLANT, SANTA CRUZ	Asteraceae	Critical Habitat	Plant
THISTLE, CHORRO CREEK BOG	Asteraceae	Critical Habitat	Plant
THISTLE, FOUNTAIN	Asteraceae	Critical Habitat	Plant
THISTLE, LA GRACIOSA	Asteraceae	Critical Habitat	Plant

THISTLE, SUISUN	Asteraceae	Critical Habitat	Plant
THORNMINT, SAN DIEGO	Lamiaceae	Critical Habitat	Plant
TUCTORIA, GREEN'S	Euphorbiaceae	Critical Habitat	Plant
WALLFLOWER, CONTRA COSTA	Brassicaceae	Critical Habitat	Plant
WALLFLOWER, MENZIE'S	Brassicaceae	Critical Habitat	Plant
WATERCRESS, GAMBEL'S	Brassicaceae	Critical Habitat	Plant
WOOLLY-STAR, SANTA ANA RIVER	Polemoniaceae	Critical Habitat	Plant
WOOLLY-THREADS, SAN JOAQUIN	Asteraceae	Critical Habitat	Plant

Colorado (9species)

BLADDERPOD, DUDLEY BLUFFS	Brassicaceae	Critical Habitat	Plant

BUTTERFLY PLANT, COLORADO	Onagraceae	Critical Habitat	Plant
CACTUS, KNOWLTON	Cactaceae	Critical Habitat	Plant
CACTUS, MESA VERDE	Cactaceae	Critical Habitat	Plant
CACTUS, UINTA BASIN HOOKLESS	Cactaceae	Critical Habitat	Plant
LADIES'-TRESSES, UTE	Orchidaceae	Critical Habitat	Plant
MILK-VETCH, MANCOS	Fabaceae	Critical Habitat	Plant
TWINPOD, DUDLEY BLUFFS	Brassicaceae	Critical Habitat	Plant
WILD-BUCKWHEAT, CLAY-LOVING	Polygonaceae	Critical Habitat	Plant

Delaware (2species)

PINK, SWAMP	Liliaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant

Florida (10species)

BONAMIA, FLORIDA	Convolvulaceae	Critical Habitat	Plant
BUCKWHEAT, SCRUB	Polygonaceae	Critical Habitat	Plant
CAMPION, FRINGED	Caryophyllaceae	Critical Habitat	Plant
CHAFFSEED, AMERICAN	Scrophulariaceae	Critical Habitat	Plant
GOOSEBERRY, MICCOSUKEE (FLORIDA)	Saxifragaceae	Critical Habitat	Plant
MINT, LONGSPURRED	Lamiaceae	Critical Habitat	Plant
PINKROOT, GENTIAN	Loganiaceae	Critical Habitat	Plant
POLYGALA, LEWTON'S	Polygalaceae	Critical Habitat	Plant
RHODODENDRON, CHAPMAN	Ericaceae	Critical Habitat	Plant

TORREYA, FLORIDA	Taxaceae	Critical Habitat	Plant

Georgia (18species)

AMPHIANTHUS, LITTLE	Scrophulariaceae	Critical Habitat	Plant
BARBARA'S BUTTONS, MOHR'S	Asteraceae	Critical Habitat	Plant
CAMPION, FRINGED	Caryophyllaceae	Critical Habitat	Plant
DROPWORT, CANBY'S	Apiaceae	Critical Habitat	Plant

GRASS, TENNESSEE YELLOW-EYED	Xyridaceae	Critical Habitat	Plant
HARPERELLA	Apiaceae	Critical Habitat	Plant
PITCHER-PLANT, GREEN	Sarraceniaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant
PONDBERRY	Lauraceae	Critical Habitat	Plant
QUILLWORT, BLACK-SPORED	Isoetaceae	Critical Habitat	Plant
QUILLWORT, MAT-FORMING	Isoetaceae	Critical Habitat	Plant
RATTLEWEED, HAIRY	Fabaceae	Critical Habitat	Plant
SKULLCAP, LARGE-FLOWERED	Lamiaceae	Critical Habitat	Plant
SPIRAEA, VIRGINIA	Rosaceae	Critical Habitat	Plant
SUMAC, MICHAUX'S	Anacardiaceae	Critical Habitat	Plant
TORREYA, FLORIDA	Taxaceae	Critical Habitat	Plant
TRILLIUM, RELICT	Liliaceae	Critical Habitat	Plant
WATER-PLANTAIN, KRAL'S	Alismataceae	Critical Habitat	Plant

Idaho (4species)

CATCHFLY, SPALDING'S	Caryophyllaceae	Critical Habitat	Plant
FOUR-O'CLOCK, MACFARLANE'S	Nyctaginaceae	Critical Habitat	Plant
HOWELLIA, WATER	Campanulaceae	Critical Habitat	Plant
PEPPERGRASS, SLICK SPOT	Brassicaceae	Critical Habitat	Plant

Illinois (8species)

ASTER, DECURRENT FALSE	Asteraceae	Critical Habitat	Plant
BUSH-CLOVER, PRAIRIE	Fabaceae	Critical Habitat	Plant
DAISY, LAKESIDE	Asteraceae	Critical Habitat	Plant
MILKWEED, MEAD'S	Asclepiadaceae	Critical Habitat	Plant
ORCHID, EASTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant

POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant
POTATO-BEAN, PRICE'S	Fabaceae	Critical Habitat	Plant
PRAIRIE-CLOVER, LEAFY	Fabaceae	Critical Habitat	Plant

Indiana (2species)

CLOVER, RUNNING BUFFALO	Fabaceae	Critical Habitat	Plant
THISTLE, PITCHER'S	Asteraceae	Critical Habitat	Plant

Iowa (5species)

BUSH-CLOVER, PRAIRIE	Fabaceae	Critical Habitat	Plant
MILKWEED, MEAD'S	Asclepiadaceae	Critical Habitat	Plant
MONKSHOOD, NORTHERN WILD	Ranunculaceae	Critical Habitat	Plant
ORCHID, EASTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant
ORCHID, WESTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant

Kansas (2species)

MILKWEED, MEAD'S	Asclepiadaceae	Critical Habitat	Plant
ORCHID, WESTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant

Kentucky (9species)

CLOVER, RUNNING BUFFALO	Fabaceae	Critical Habitat	Plant
GOLDENROD, SHORT'S	Asteraceae	Critical Habitat	Plant
POTATO-BEAN, PRICE'S	Fabaceae	Critical Habitat	Plant
ROCK-CRESS, LARGE (=BRAUN'S)	Brassicaceae	Critical Habitat	Plant
ROCK-CRESS, SMALL	Brassicaceae	Critical Habitat	Plant
ROSEMARY, CUMBERLAND	Lamiaceae	Critical Habitat	Plant
SANDWORT, CUMBERLAND	Caryophyllaceae	Critical Habitat	Plant
SPIRAEA, VIRGINIA	Rosaceae	Critical Habitat	Plant
SUNFLOWER, EGGERT'S	Asteraceae	Critical Habitat	Plant

Maine (2species)

LOUSEWORT, FURBISH	Scrophulariaceae	Critical Habitat	Plant
ORCHID, EASTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant

Maryland (6species)

BULRUSH, NORTHEASTERN (=BARBED BRISTLE)	Cyperaceae	Critical Habitat	Plant
DROPWORT, CANBY'S	Apiaceae	Critical Habitat	Plant
GERARDIA, SANDPLAIN	Scrophulariaceae	Critical Habitat	Plant
HARPERELLA	Apiaceae	Critical Habitat	Plant
JOINT-VETCH, SENSITIVE	Fabaceae	Critical Habitat	Plant
PINK, SWAMP	Liliaceae	Critical Habitat	Plant

Michigan (7species)

FERN, AMERICAN HART'S-TONGUE	Aspleniaceae	Critical Habitat	Plant
GOLDENROD, HOUGHTON'S	Asteraceae	Critical Habitat	Plant
IRIS, DWARF LAKE	Iridaceae	Critical Habitat	Plant
MONKEY-FLOWER, MICHIGAN	Scrophulariaceae	Critical Habitat	Plant
ORCHID, EASTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant
THISTLE, PITCHER'S	Asteraceae	Critical Habitat	Plant

Minnesota (4species)

BUSH-CLOVER, PRAIRIE	Fabaceae	Critical Habitat	Plant
LILY, MINNESOTA TROUT	Liliaceae	Critical Habitat	Plant
ORCHID, WESTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant
ROSEROOT, LEEDY'S	Crassulaceae	Critical Habitat	Plant

Mississippi (2species)

PONDBERRY	Lauraceae	Critical Habitat	Plant
POTATO-BEAN, PRICE'S	Fabaceae	Critical Habitat	Plant

Missouri (8species)

ASTER, DECURRENT FALSE	Asteraceae	Critical Habitat	Plant

BLADDERPOD, MISSOURI	Brassicaceae	Critical Habitat	Plant
CLOVER, RUNNING BUFFALO	Fabaceae	Critical Habitat	Plant
GEOCARPON MINIMUM	Caryophyllaceae	Critical Habitat	Plant
MILKWEED, MEAD'S	Asclepiadaceae	Critical Habitat	Plant

ORCHID, WESTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant
PONDBERRY	Lauraceae	Critical Habitat	Plant
SNEEZEWEED, VIRGINIA	Asteraceae	Critical Habitat	Plant

Montana (2species)

CATCHFLY, SPALDING'S	Caryophyllaceae	Critical Habitat	Plant
HOWELLIA, WATER	Campanulaceae	Critical Habitat	Plant

Nebraska (3species)

BUTTERFLY PLANT, COLORADO	Onagraceae	Critical Habitat	Plant
ORCHID, WESTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant
PENSTEMON, BLOWOUT	Scrophulariaceae	Critical Habitat	Plant

New Jersey (4species)

BEAKED-RUSH, KNIESKERN'S	Cyperaceae	Critical Habitat	Plant
CHAFFSEED, AMERICAN	Scrophulariaceae	Critical Habitat	Plant
JOINT-VETCH, SENSITIVE	Fabaceae	Critical Habitat	Plant
PINK, SWAMP	Liliaceae	Critical Habitat	Plant

New Mexico (4species)

CACTUS, KUENZLER HEDGEHOG	Cactaceae	Critical Habitat	Plant
CACTUS, SNEED PINCUSHION	Cactaceae	Critical Habitat	Plant
IPOMOPSIS, HOLY GHOST	Polemoniaceae	Critical Habitat	Plant
SUNFLOWER, PECOS	Asteraceae	Critical Habitat	Plant

New York (6species)

AMARANTH, SEABEACH	Amaranthaceae	Critical Habitat	Plant
FERN, AMERICAN HART'S-TONGUE	Aspleniaceae	Critical Habitat	Plant
GERARDIA, SANDPLAIN	Scrophulariaceae	Critical Habitat	Plant
MONKSHOOD, NORTHERN WILD	Ranunculaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant
ROSEROOT, LEEDY'S	Crassulaceae	Critical Habitat	Plant

North Carolina (22species)

AMARANTH, SEABEACH	Amaranthaceae	Critical Habitat	Plant
AVENS, SPREADING	Rosaceae	Critical Habitat	Plant
BITTERCRESS, SMALL-ANTHERED	Brassicaceae	Critical Habitat	Plant
BLAZING STAR, HELLER'S	Asteraceae	Critical Habitat	Plant
CHAFFSEED, AMERICAN	Scrophulariaceae	Critical Habitat	Plant
CONEFLOWER, SMOOTH	Asteraceae	Critical Habitat	Plant
DROPWORT, CANBY'S	Apiaceae	Critical Habitat	Plant
GOLDENROD, BLUE RIDGE	Asteraceae	Critical Habitat	Plant
HARPERELLA	Apiaceae	Critical Habitat	Plant
HEARTLEAF, DWARF-FLOWERED	Aristolochiaceae	Critical Habitat	Plant
HEATHER, MOUNTAIN GOLDEN	Cistaceae	Critical Habitat	Plant
IRISETTE, WHITE	Iridaceae	Critical Habitat	Plant
JOINT-VETCH, SENSITIVE	Fabaceae	Critical Habitat	Plant
LICHEN, ROCK GNOME	Cladoniaceae	Critical Habitat	Plant
LOOSESTRIFE, ROUGH-LEAVED	Primulaceae	Critical Habitat	Plant
MEADOWRUE, COOLEY'S	Ranunculaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant
PONDBERRY	Lauraceae	Critical Habitat	Plant
SEDGE, GOLDEN	Cyperaceae	Critical Habitat	Plant
SPIRAEA, VIRGINIA	Rosaceae	Critical Habitat	Plant
SUMAC, MICHAUX'S	Anacardiaceae	Critical Habitat	Plant
SUNFLOWER, SCHWEINITZ'S	Asteraceae	Critical Habitat	Plant

North Dakota (1species)

ORCHID, WESTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant

Ohio (4species)

CLOVER, RUNNING BUFFALO	Fabaceae	Critical Habitat	Plant
DAISY, LAKESIDE	Asteraceae	Critical Habitat	Plant
MONKSHOOD, NORTHERN WILD	Ranunculaceae	Critical Habitat	Plant
ORCHID, EASTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant

Oklahoma (1species)

ORCHID, WESTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant

Oregon (12species)

CATCHFLY, SPALDING'S	Caryophyllaceae	Critical Habitat	Plant
CHECKER-MALLOW, NELSON'S	Malvaceae	Critical Habitat	Plant
DAISY, WILLAMETTE	Asteraceae	Critical Habitat	Plant
FOUR-O'CLOCK, MACFARLANE'S	Nyctaginaceae	Critical Habitat	Plant
FRITILLARY, GENTNER'S	Liliaceae	Critical Habitat	Plant
LOMATIUM, BRADSHAW'S	Apiaceae	Critical Habitat	Plant
LOMATIUM, COOK'S	Apiaceae	Critical Habitat	Plant
LUPINE, KINCAID'S	Fabaceae	Critical Habitat	Plant
MEADOWFOAM, LARGE-FLOWERED WOOLY	Limnanthaceae	Critical Habitat	Plant
MILK-VETCH, APPLEGATE'S	Fabaceae	Critical Habitat	Plant
POPCORNFLOWER, ROUGH	Boraginaceae	Critical Habitat	Plant
THELYPODY, HOWELL'S SPECTACULAR	Brassicaceae	Critical Habitat	Plant

Pennsylvania (2species)

BULRUSH, NORTHEASTERN (=BARBED BRISTLE)	Cyperaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant

South Carolina (18species)

AMARANTH, SEABEACH	Amaranthaceae	Critical Habitat	Plant
AMPHIANTHUS, LITTLE	Scrophulariaceae	Critical Habitat	Plant
ARROWHEAD, BUNCHED	Alismataceae	Critical Habitat	Plant
CHAFFSEED, AMERICAN	Scrophulariaceae	Critical Habitat	Plant
CONEFLOWER, SMOOTH	Asteraceae	Critical Habitat	Plant
DROPWORT, CANBY'S	Apiaceae	Critical Habitat	Plant
HARPERELLA	Apiaceae	Critical Habitat	Plant
HEARTLEAF, DWARF-FLOWERED	Aristolochiaceae	Critical Habitat	Plant
IRISETTE, WHITE	Iridaceae	Critical Habitat	Plant
LOOSESTRIFE, ROUGH-LEAVED	Primulaceae	Critical Habitat	Plant
PINK, SWAMP	Liliaceae	Critical Habitat	Plant
PITCHER-PLANT, MOUNTAIN SWEET	Sarraceniaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant
PONDBERRY	Lauraceae	Critical Habitat	Plant

QUILLWORT, BLACK-SPORED	Isoetaceae	Critical Habitat	Plant
SUNFLOWER, SCHWEINITZ'S	Asteraceae	Critical Habitat	Plant
TRILLIUM, PERSISTENT	Liliaceae	Critical Habitat	Plant
TRILLIUM, RELICT	Liliaceae	Critical Habitat	Plant

South Dakota (1species)

ORCHID, WESTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant

Tennessee (16species)

ASTER, RUTH'S GOLDEN	Asteraceae	Critical Habitat	Plant
AVENS, SPREADING	Rosaceae	Critical Habitat	Plant
BLADDERPOD, SPRING CREEK	Brassicaceae	Critical Habitat	Plant
CONEFLOWER, TENNESSEE PURPLE	Asteraceae	Critical Habitat	Plant
FERN, AMERICAN HART'S-TONGUE	Aspleniaceae	Critical Habitat	Plant

GROUND-PLUM, GUTHRIE'S	Fabaceae	Critical Habitat	Plant
LICHEN, ROCK GNOME	Cladoniaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant
POTATO-BEAN, PRICE'S	Fabaceae	Critical Habitat	Plant
PRAIRIE-CLOVER, LEAFY	Fabaceae	Critical Habitat	Plant
ROCK-CRESS, LARGE (=BRAUN'S)	Brassicaceae	Critical Habitat	Plant
ROSEMARY, CUMBERLAND	Lamiaceae	Critical Habitat	Plant
SANDWORT, CUMBERLAND	Caryophyllaceae	Critical Habitat	Plant
SKULLCAP, LARGE-FLOWERED	Lamiaceae	Critical Habitat	Plant
SPIRAEA, VIRGINIA	Rosaceae	Critical Habitat	Plant
SUNFLOWER, EGGERT'S	Asteraceae	Critical Habitat	Plant

Texas (13species)

AMBROSIA, SOUTH TEXAS	Asteraceae	Critical Habitat	Plant
AYENIA, TEXAS	Sterculiaceae	Critical Habitat	Plant
CACTUS, BLACK LACE	Cactaceae	Critical Habitat	Plant
CACTUS, SNEED PINCUSHION	Cactaceae	Critical Habitat	Plant
CACTUS, TOBUSCH FISHHOOK	Cactaceae	Critical Habitat	Plant
LADIES'-TRESSES, NAVASOTA	Orchidaceae	Critical Habitat	Plant
MANIOC, WALKER'S	Euphorbiaceae	Critical Habitat	Plant

POPPY-MALLOW, TEXAS	Malvaceae	Critical Habitat	Plant
RUSH-PEA, SLENDER	Fabaceae	Critical Habitat	Plant
SNOWBELLS, TEXAS	Styracaceae	Critical Habitat	Plant
SPIDERLING, MATHIS	Nyctaginaceae	Critical Habitat	Plant
SUNFLOWER, PECOS	Asteraceae	Critical Habitat	Plant
WILD-RICE, TEXAS	Poaceae	Critical Habitat	Plant

Utah (16species)

CACTUS, SAN RAFAEL	Cactaceae	Critical Habitat	Plant
CACTUS, UINTA BASIN HOOKLESS	Cactaceae	Critical Habitat	Plant
CACTUS, WINKLER	Cactaceae	Critical Habitat	Plant

CACTUS, WRIGHT FISHHOOK	Cactaceae	Critical Habitat	Plant
CYCLADENIA, JONES	Apocynaceae	Critical Habitat	Plant
DAISY, MAGUIRE	Asteraceae	Critical Habitat	Plant
LADIES'-TRESSES, UTE	Orchidaceae	Critical Habitat	Plant
MILK-VETCH, DESERET	Fabaceae	Critical Habitat	Plant
MILK-VETCH, HELIOTROPE	Fabaceae	Critical Habitat	Plant
PHACELIA, CLAY	Hydrophyllaceae	Critical Habitat	Plant
PRIMROSE, MAGUIRE	Primulaceae	Critical Habitat	Plant
REED-MUSTARD, BARNEBY	Brassicaceae	Critical Habitat	Plant
REED-MUSTARD, SHRUBBY	Brassicaceae	Critical Habitat	Plant
RIDGE-CRESS (=PEPPER-CRESS), BARNEBY	Brassicaceae	Critical Habitat	Plant
SEDGE, NAVAJO	Cyperaceae	Critical Habitat	Plant
TOWNSENDIA, LAST CHANCE	Asteraceae	Critical Habitat	Plant

Virginia (10species)

BITTERCRESS, SMALL-ANTHERED	Brassicaceae	Critical Habitat	Plant
BULRUSH, NORTHEASTERN (=BARBED BRISTLE)	Cyperaceae	Critical Habitat	Plant
CONEFLOWER, SMOOTH	Asteraceae	Critical Habitat	Plant
JOINT-VETCH, SENSITIVE	Fabaceae	Critical Habitat	Plant
ORCHID, EASTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant
PINK, SWAMP	Liliaceae	Critical Habitat	Plant
POGONIA, SMALL WHORLED	Orchidaceae	Critical Habitat	Plant
ROCK-CRESS, SHALE BARREN	Brassicaceae	Critical Habitat	Plant

SNEEZEWEED, VIRGINIA	Asteraceae	Critical Habitat	Plant
SUMAC, MICHAUX'S	Anacardiaceae	Critical Habitat	Plant

Washington (6species)

CATCHFLY, SPALDING'S	Caryophyllaceae	Critical Habitat	Plant
CHECKER-MALLOW, NELSON'S	Malvaceae	Critical Habitat	Plant
CHECKER-MALLOW, WENATCHEE MOUNTAINS	Malvaceae	Critical Habitat	Plant

HOWELLIA, WATER	Campanulaceae	Critical Habitat	Plant
LUPINE, KINCAID'S	Fabaceae	Critical Habitat	Plant
STICKSEED, SHOWY	Boraginaceae	Critical Habitat	Plant

West virginia (3species)

BULRUSH, NORTHEASTERN (=BARBED BRISTLE)	Cyperaceae	Critical Habitat	Plant
HARPERELLA	Apiaceae	Critical Habitat	Plant
ROCK-CRESS, SHALE BARREN	Brassicaceae	Critical Habitat	Plant

Wisconsin (6species)

BUSH-CLOVER, PRAIRIE	Fabaceae	Critical Habitat	Plant
IRIS, DWARF LAKE	Iridaceae	Critical Habitat	Plant
LOCOWEED, FASSETT'S	Fabaceae	Critical Habitat	Plant
MONKSHOOD, NORTHERN WILD	Ranunculaceae	Critical Habitat	Plant
ORCHID, EASTERN PRAIRIE FRINGED	Orchidaceae	Critical Habitat	Plant
THISTLE, PITCHER'S	Asteraceae	Critical Habitat	Plant

Wyoming (1species)

BUTTERFLY PLANT, COLORADO	Onagraceae	Critical Habitat	Plant

Animal Species Details by State for Preliminary Assessment

Wheat, all (320)

Minimum of 1 Acre.

Alabama (34 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
CAMPELOMA, SLENDER	Snail	No
CAVEFISH, ALABAMA	Fish	Yes

CHUB, SPOTFIN	Fish	Yes
DARTER, BOULDER	Fish	No
DARTER, SLACKWATER	Fish	Yes
DARTER, SNAIL	Fish	No
EAGLE, BALD	Bird	No
ELIMIA, LACY	Snail	No
MOUSE, ALABAMA BEACH	Mammal	Yes
MOUSE, PERDIDO KEY BEACH	Mammal	Yes
PLOVER, PIPING	Bird	Yes
RIVERSNAIL, ANTHONY'S	Snail	No
ROCKSNAIL, PAINTED	Snail	No
ROCKSNAIL, PLICATE	Snail	No
SALAMANDER, FLATWOODS	Amphibian	No
SALAMANDER, RED HILLS	Amphibian	No
SCULPIN, PYGMY	Fish	No
SHINER, BLUE	Fish	No
SHINER, CAHABA	Fish	No
SHINER, PALEZONE	Fish	No
SNAIL, ARMORED	Snail	No
SNAIL, TULOTOMA	Snail	No
SNAKE, EASTERN INDIGO	Reptile	No
STORK, WOOD	Bird	No
STURGEON, ALABAMA	Fish	No
STURGEON, GULF	Fish	Yes
TORTOISE, GOPHER	Reptile	No
TREEFROG, PINE BARRENS	Amphibian	No
TURTLE, ALABAMA RED-BELLIED	Reptile	No
TURTLE, FLATTENED MUSK	Reptile	No

TURTLE, LOGGERHEAD SEA	Reptile	No
WOODPECKER, RED-COCKADED	Bird	No

Arizona (23 species)

	Group	Critical Habitat
BAT, LESSER (=SANBORN'S) LONG-NOSED	Mammal	No
BOBWHITE, MASKED	Bird	No
CHUB, BONYTAIL	Fish	Yes
Chub, Gila	Fish	No
EAGLE, BALD	Bird	No
FLYCATCHER, SOUTHWESTERN WILLOW	Bird	Yes
FROG, CHIRICAHUA LEOPARD	Amphibian	No
JAGUAR	Mammal	No
Jaguarundi, Sinaloan	Mammal	No
MINNOW, LOACH	Fish	Yes
OCELOT	Mammal	No
OWL, MEXICAN SPOTTED	Bird	Yes
PELICAN, BROWN	Bird	No
PLOVER, MOUNTAIN	Bird	No
PRONGHORN, SONORAN	Mammal	No
PUPFISH, DESERT	Fish	Yes
PYGMY-OWL, CACTUS FERRUGINOUS	Bird	Yes
RAIL, YUMA CLAPPER	Bird	No
SPIKEDACE	Fish	Yes
SQUIRREL, MOUNT GRAHAM RED	Mammal	Yes
SUCKER, RAZORBACK	Fish	Yes
TOPMINNOW, GILA (YAQUI)	Fish	No
TROUT, APACHE	Fish	No

Arkansas (10 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
BAT, OZARK BIG-EARED	Mammal	No
BEETLE, AMERICAN BURYING	Insect	No
CAVEFISH, OZARK	Fish	No
EAGLE, BALD	Bird	No
SHAGREEN, MAGAZINE MOUNTAIN	Snail	No
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No
WOODPECKER, RED-COCKADED	Bird	No

California (78 species)

	Group	Critical Habitat
BEETLE, DELTA GREEN GROUND	Insect	Yes
BEETLE, VALLEY ELDERBERRY LONGHORN	Insect	Yes
BUTTERFLY, BAY CHECKERSPOT	Insect	Yes
BUTTERFLY, CALLIPPE SILVERSPOT	Insect	No
BUTTERFLY, LANGE'S METALMARK	Insect	No
BUTTERFLY, QUINO CHECKERSPOT	Insect	Yes
BUTTERFLY, SMITH'S BLUE	Insect	No
CHUB, BONYTAIL	Fish	Yes
CHUB, COWHEAD LAKE TUI	Fish	No
CHUB, MOHAVE TUI	Fish	No
CONDOR, CALIFORNIA	Bird	Yes
EAGLE, BALD	Bird	No
FLY, DELHI SANDS FLOWER-LOVING	Insect	No
FLYCATCHER, SOUTHWESTERN WILLOW	Bird	Yes

FOX, SAN JOAQUIN KIT	Mammal	No
FROG, CALIFORNIA RED-LEGGED	Amphibian	No
FROG, MOUNTAIN YELLOW-LEGGED	Amphibian	No
GNATCATCHER, COASTAL CALIFORNIA	Bird	Yes
GOBY, TIDEWATER	Fish	Yes
KANGAROO RAT, FRESNO	Mammal	Yes
KANGAROO RAT, GIANT	Mammal	No
KANGAROO RAT, MORRO BAY	Mammal	Yes
KANGAROO RAT, SAN BERNARDINO	Mammal	Yes
KANGAROO RAT, STEPHENS'	Mammal	No
KANGAROO RAT, TIPTON	Mammal	No
LIZARD, BLUNT-NOSED LEOPARD	Reptile	No
LIZARD, COACHELLA VALLEY FRINGE-TOED	Reptile	Yes
LIZARD, ISLAND NIGHT	Reptile	No
MOTH, KERN PRIMROSE SPHINX	Insect	No
MOUSE, PACIFIC POCKET	Mammal	No
MOUSE, SALT MARSH HARVEST	Mammal	No
MURRELET, MARBLED	Bird	Yes
OTTER, SOUTHERN SEA	Mammal	No
OWL, NORTHERN SPOTTED	Bird	Yes
PELICAN, BROWN	Bird	No
PLOVER, MOUNTAIN	Bird	No
PLOVER, WESTERN SNOWY	Bird	No
PUPFISH, DESERT	Fish	Yes
RABBIT, RIPARIAN BRUSH	Mammal	No
RAIL, CALIFORNIA CLAPPER	Bird	No
RAIL, LIGHT-FOOTED CLAPPER	Bird	No
RAIL, YUMA CLAPPER	Bird	No

SALAMANDER, CALIFORNIA TIGER	Amphibian	No
SALAMANDER, DESERT SLENDER	Amphibian	No
SALAMANDER, SANTA CRUZ LONG-TOED	Amphibian	No
SALMON, CHINOOK (CENTRAL VALLEY SPRING RUN)	Fish	Yes
SALMON, CHINOOK (SACRAMENTO RIVER WINTER RUN)	Fish	No
SALMON, COHO (SOUTHERN OR/NORTHERN CA COAST)	Fish	No
SHEEP, PENINSULAR BIGHORN	Mammal	Yes
SHREW, BUENA VISTA	Mammal	No
SKIPPER, CARSON WANDERING	Insect	No
SKIPPER, LAGUNA MOUNTAIN	Insect	No
SMELT, DELTA	Fish	No
SNAIL, MORRO SHOULDERBAND	Snail	Yes
SNAKE, GIANT GARTER	Reptile	No
SQUAWFISH, COLORADO	Fish	Yes
STEELHEAD, CALIFORNIA CENTRAL VALLEY POP	Fish	Yes
STEELHEAD, CENTRAL CALIFORNIA POPULATION	Fish	Yes
STEELHEAD, NORTHERN CALIFORNIA POPULATION	Fish	No
STEELHEAD, SOUTH-CENTRAL CALIFORNIA POP	Fish	Yes
STEELHEAD, SOUTHERN CALIFORNIA POPULATION	Fish	Yes
STICKLEBACK, UNARMORED THREESPINE	Fish	Yes
SUCKER, LOST RIVER	Fish	No
SUCKER, MODOC	Fish	Yes
SUCKER, RAZORBACK	Fish	Yes
SUCKER, SANTA ANA	Fish	Yes
SUCKER, SHORTNOSE	Fish	No
TERN, CALIFORNIA LEAST	Bird	No
TOAD, ARROYO SOUTHWESTERN	Amphibian	Yes
TORTOISE, DESERT	Reptile	No

TROUT, LAHONTAN CUTTHROAT	Fish	No
TROUT, LITTLE KERN GOLDEN	Fish	Yes
TROUT, PAIUTE CUTTHROAT	Fish	No
TURTLE, OLIVE (PACIFIC) RIDLEY SEA	Reptile	No
VIREO, LEAST BELL'S	Bird	Yes
VOLE, AMARGOSA	Mammal	Yes
WHIPSNAKE (=striped racer), ALAMEDA	Reptile	Yes
WOODRAT, RIPARIAN	Mammal	No

Colorado (13 species)

	Group	Critical Habitat
BUTTERFLY, UNCOMPAHGRE FRITILLARY	Insect	No

CHUB, BONYTAIL	Fish	Yes
CHUB, HUMPBACK	Fish	Yes
CRANE, WHOOPING	Bird	Yes
EAGLE, BALD	Bird	No
FERRET, BLACK-FOOTED	Mammal	No
MOUSE, PREBLE'S MEADOW JUMPING	Mammal	Yes
OWL, MEXICAN SPOTTED	Bird	Yes
PLOVER, MOUNTAIN	Bird	No
SKIPPER, PAWNEE MONTANE	Insect	No
SQUAWFISH, COLORADO	Fish	Yes
SUCKER, RAZORBACK	Fish	Yes
TROUT, GREENBACK CUTTHROAT	Fish	No

Delaware (6 species)

	Group	Critical Habitat
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
SQUIRREL, DELMARVA PENINSULA FOX	Mammal	No
STURGEON, SHORTNOSE	Fish	No
TURTLE, BOG (NORTHERN POPULATION)	Reptile	No
WHALE, NORTHERN RIGHT	Mammal	Yes

Florida (17 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
EAGLE, BALD	Bird	No
JAY, FLORIDA SCRUB	Bird	No
KITE, EVERGLADE SNAIL	Bird	Yes
MOUSE, PERDIDO KEY BEACH	Mammal	Yes

PLOVER, PIPING	Bird	Yes
SALAMANDER, FLATWOODS	Amphibian	No
SKINK, SAND	Reptile	No
SNAKE, EASTERN INDIGO	Reptile	No
STORK, WOOD	Bird	No
STURGEON, GULF	Fish	Yes
TURTLE, GREEN SEA	Reptile	Yes
TURTLE, LEATHERBACK SEA	Reptile	Yes
TURTLE, LOGGERHEAD SEA	Reptile	No
WHALE, NORTHERN RIGHT	Mammal	Yes
WOODPECKER, RED-COCKADED	Bird	No

Georgia (18 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
BEETLE, AMERICAN BURYING	Insect	No
DARTER, AMBER	Fish	Yes
DARTER, CHEROKEE	Fish	No
DARTER, ETOWAH	Fish	No
DARTER, GOLDLINE	Fish	No
EAGLE, BALD	Bird	No
LOGPERCH, CONASAUGA	Fish	Yes
PLOVER, PIPING	Bird	Yes
SALAMANDER, FLATWOODS	Amphibian	No
SHINER, BLUE	Fish	No
SNAKE, EASTERN INDIGO	Reptile	No
STORK, WOOD	Bird	No
STURGEON, GULF	Fish	Yes

STURGEON, SHORTNOSE	Fish	No
TURTLE, LOGGERHEAD SEA	Reptile	No
WOODPECKER, RED-COCKADED	Bird	No

Idaho (17 species)

	Group	Critical Habitat
BEAR, GRIZZLY	Mammal	No
CARIBOU, WOODLAND	Mammal	No
EAGLE, BALD	Bird	No
LIMPET, BANBURY SPRINGS	Snail	No
SALMON, CHINOOK (SNAKE RIVER FALL RUN)	Fish	No
SALMON, CHINOOK (SNAKE RIVER SPRING/SUMMER)	Fish	Yes
SALMON, SOCKEYE (SNAKE RIVER POPULATION)	Fish	No
SNAIL, BLISS RAPIDS	Snail	No
SNAIL, SNAKE RIVER PHYSA	Snail	No
SNAIL, UTAH VALVATA	Snail	No
SPRINGSNAIL, BRUNEAU HOT	Snail	No
SPRINGSNAIL, IDAHO	Snail	No
SQUIRREL, NORTHERN IDAHO GROUND	Mammal	No
STEELHEAD, SNAKE RIVER BASIN POPULATION	Fish	Yes
STURGEON, WHITE	Fish	Yes
TROUT, BULL	Fish	No
WOLF, GRAY	Mammal	Yes

Illinois (9 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
BUTTERFLY, KARNER BLUE	Insect	No

DRAGONFLY, HINES EMERALD	Insect	No
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
SNAIL, IOWA PLEISTOCENE	Snail	No
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

Indiana (7 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
BUTTERFLY, KARNER BLUE	Insect	No
BUTTERFLY, MITCHELL'S SATYR	Insect	No
EAGLE, BALD	Bird	No
SNAKE, NORTHERN COPPERBELLY WATER	Reptile	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

Iowa (7 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
SHINER, TOPEKA	Fish	Yes
SNAIL, IOWA PLEISTOCENE	Snail	No
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

Kansas (12 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No

BEETLE, AMERICAN BURYING	Insect	No
CRANE, WHOOPING	Bird	Yes
EAGLE, BALD	Bird	No
FERRET, BLACK-FOOTED	Mammal	No
MADTOM, NEOSHO	Fish	No
PLOVER, MOUNTAIN	Bird	No
PLOVER, PIPING	Bird	Yes
SHINER, ARKANSAS RIVER	Fish	Yes
SHINER, TOPEKA	Fish	Yes
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

Kentucky (9 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
DACE, BLACKSIDE	Fish	No
DARTER, BLUEMASK (=JEWEL)	Fish	No
DARTER, RELICT	Fish	No
EAGLE, BALD	Bird	No
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No
WOODPECKER, RED-COCKADED	Bird	No

Louisiana (9 species)

	Group	Critical Habitat
BEAR, AMERICAN BLACK	Mammal	No
BEAR, LOUISIANA BLACK	Mammal	Yes
EAGLE, BALD	Bird	No

PELICAN, BROWN	Bird	No
PLOVER, PIPING	Bird	Yes
STURGEON, PALLID	Fish	No
TERN, CALIFORNIA LEAST	Bird	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No
WOODPECKER, RED-COCKADED	Bird	No

Maine (3 species)

	Group	Critical Habitat
EAGLE, BALD	Bird	No
LYNX, CANADA	Mammal	No
WHALE, NORTHERN RIGHT	Mammal	Yes

Maryland (10 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes
BEETLE, NORTHEASTERN BEACH TIGER	Insect	No
BEETLE, PURITAN TIGER	Insect	No
DARTER, MARYLAND	Fish	Yes
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
SQUIRREL, DELMARVA PENINSULA FOX	Mammal	No
STURGEON, SHORTNOSE	Fish	No
TURTLE, BOG (NORTHERN POPULATION)	Reptile	No
WHALE, NORTHERN RIGHT	Mammal	Yes

Michigan (9 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes
BEETLE, HUNGERFORD'S CRAWLING WATER	Insect	No

BUTTERFLY, KARNER BLUE	Insect	No
BUTTERFLY, MITCHELL'S SATYR	Insect	No
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
SNAKE, NORTHERN COPPERBELLY WATER	Reptile	No
WARBLER (WOOD), KIRTLAND'S	Bird	No
WOLF, GRAY	Mammal	Yes

Minnesota (3 species)

	Group	Critical Habitat
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
WOLF, GRAY	Mammal	Yes

Mississippi (11 species)

	Group	Critical Habitat
BEAR, LOUISIANA BLACK	Mammal	Yes
DARTER, BAYOU	Fish	No
EAGLE, BALD	Bird	No
SNAKE, EASTERN INDIGO	Reptile	No
STURGEON, GULF	Fish	Yes
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No
TORTOISE, GOPHER	Reptile	No
TURTLE, RINGED SAWBACK	Reptile	No
TURTLE, YELLOW-BLOTCHED MAP	Reptile	No
WOODPECKER, RED-COCKADED	Bird	No

Missouri (14 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No

BAT, INDIANA	Mammal	Yes
BEETLE, AMERICAN BURYING	Insect	No
CAVEFISH, OZARK	Fish	No
CAVESNAIL, TUMBLING CREEK	Snail	No
CHUB, HUMPBACK	Fish	Yes
DARTER, NIANGUA	Fish	Yes
EAGLE, BALD	Bird	No
MADTOM, NEOSHO	Fish	No
PLOVER, PIPING	Bird	Yes
SHINER, TOPEKA	Fish	Yes
STURGEON, GULF	Fish	Yes
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

Montana (10 species)

	Group	Critical Habitat
BEAR, GRIZZLY	Mammal	No
CRANE, WHOOPING	Bird	Yes
EAGLE, BALD	Bird	No
FERRET, BLACK-FOOTED	Mammal	No
PLOVER, MOUNTAIN	Bird	No
PLOVER, PIPING	Bird	Yes
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No
TROUT, BULL	Fish	No
WOLF, GRAY	Mammal	Yes

Nebraska (8 species)

	Group	Critical Habitat

CRANE, WHOOPING	Bird	Yes
EAGLE, BALD	Bird	No
FERRET, BLACK-FOOTED	Mammal	No
PLOVER, MOUNTAIN	Bird	No
PLOVER, PIPING	Bird	Yes
SHINER, TOPEKA	Fish	Yes
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

Nevada (5 species)

	Group	Critical Habitat
DACE, DESERT	Fish	Yes
EAGLE, BALD	Bird	No
PLOVER, MOUNTAIN	Bird	No
TROUT, BULL	Fish	No
TROUT, LAHONTAN CUTTHROAT	Fish	No

New Jersey (6 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
STURGEON, SHORTNOSE	Fish	No
TURTLE, BOG (NORTHERN POPULATION)	Reptile	No
WHALE, NORTHERN RIGHT	Mammal	Yes

New Mexico (17 species)

	Group	Critical Habitat
EAGLE, BALD	Bird	No
FALCON, NORTHERN APLOMADO	Bird	No
FERRET, BLACK-FOOTED	Mammal	No

FROG, CHIRICAHUA LEOPARD	Amphibian	No
GAMBUSIA, PECOS	Fish	No
MINNOW, RIO GRANDE SILVERY	Fish	Yes
OWL, MEXICAN SPOTTED	Bird	Yes
PLOVER, MOUNTAIN	Bird	No
SHINER, BEAUTIFUL	Fish	Yes
SHINER, PECOS BLUNTNOSE	Fish	Yes
Snail, Koster's Tryonia	Snail	No
Snail, Pecos Assiminea	Snail	No
SPRINGSNAIL, ALAMOSA	Snail	No
Springsnail, Roswell	Snail	No
SPRINGSNAIL, SOCORRO	Snail	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No
WOLF, GRAY	Mammal	Yes

New York (9 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes
BUTTERFLY, KARNER BLUE	Insect	No
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
SNAIL, CHITTENANGO OVATE AMBER	Snail	No
STURGEON, SHORTNOSE	Fish	No
TERN, ROSEATE	Bird	No
TURTLE, BOG (NORTHERN POPULATION)	Reptile	No
WHALE, NORTHERN RIGHT	Mammal	Yes

North Carolina (17 species)

	Group	Critical Habitat

BAT, INDIANA	Mammal	Yes
BUTTERFLY, SAINT FRANCIS' SATYR	Insect	No
CAHOW	Bird	No
EAGLE, BALD	Bird	No
MANATEE, WEST INDIAN (FLORIDA)	Mammal	Yes
PLOVER, PIPING	Bird	Yes
SHINER, CAPE FEAR	Fish	Yes
SILVERSIDE, WACCAMAW	Fish	Yes
SPIDER, SPRUCE-FIR MOSS	Arachnid	Yes
SQUIRREL, CAROLINA NORTHERN FLYING	Mammal	No
STORK, WOOD	Bird	No
STURGEON, SHORTNOSE	Fish	No
TERN, ROSEATE	Bird	No
TURTLE, LOGGERHEAD SEA	Reptile	No
WHALE, NORTHERN RIGHT	Mammal	Yes
WOLF, RED	Mammal	No
WOODPECKER, RED-COCKADED	Bird	No

North Dakota (5 species)

	Group	Critical Habitat
CRANE, WHOOPING	Bird	Yes
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes.
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

Ohio (6 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes

DRAGONFLY, HINES EMERALD	Insect	No
EAGLE, BALD	Bird	No
MADTOM, SCIOTO	Fish	No
SNAKE, LAKE ERIE WATER	Reptile	No
SNAKE, NORTHERN COPPERBELLY WATER	Reptile	No

Oklahoma (16 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
BAT, OZARK BIG-EARED	Mammal	No
BEETLE, AMERICAN BURYING	Insect	No
CAVEFISH, OZARK	Fish	No
CRANE, WHOOPING	Bird	Yes
CURLEW, ESKIMO	Bird	No
DARTER, LEOPARD	Fish	Yes
EAGLE, BALD	Bird	No
MADTOM, NEOSHO	Fish	No
PLOVER, MOUNTAIN	Bird	No
PLOVER, PIPING	Bird	Yes
SHINER, ARKANSAS RIVER	Fish	Yes
TERN, INTERIOR (POPULATION) LEAST	Bird	No
VIREO, BLACK-CAPPED	Bird	No
WOODPECKER, RED-COCKADED	Bird	No

Oregon (29 species)

	Group	Critical Habitat
BUTTERFLY, FENDER'S BLUE	Insect	No
BUTTERFLY, OREGON SILVERSPOT	Insect	Yes

CHUB, HUTTON TUI	Fish	No
CHUB, OREGON	Fish	No
DACE, FOSKETT SPECKLED	Fish	No
DEER, COLUMBIAN WHITE-TAILED	Mammal	No
EAGLE, BALD	Bird	No
MURRELET, MARBLED	Bird	Yes
OWL, NORTHERN SPOTTED	Bird	Yes
PELICAN, BROWN	Bird	No
PLOVER, WESTERN SNOWY	Bird	No
SALMON, CHINOOK (LOWER COLUMBIA RIVER)	Fish	Yes
SALMON, CHINOOK (SNAKE RIVER FALL RUN)	Fish	No
SALMON, CHINOOK (SNAKE RIVER SPRING/SUMMER)	Fish	Yes
SALMON, CHINOOK (UPPER COLUMBIA RIVER SPRING)	Fish	Yes
SALMON, CHINOOK (UPPER WILLAMETTE RIVER)	Fish	Yes
SALMON, CHUM (COLUMBIA RIVER POPULATION)	Fish	Yes
SALMON, COHO (OREGON COAST POPULATION)	Fish	Yes
SALMON, COHO (SOUTHERN OR/NORTHERN CA COAST)	Fish	No
SALMON, SOCKEYE (SNAKE RIVER POPULATION)	Fish	No
STEELHEAD, LOWER COLUMBIA RIVER POPULATION	Fish	Yes
STEELHEAD, MIDDLE COLUMBIA RIVER POPULATION	Fish	Yes
STEELHEAD, SNAKE RIVER BASIN POPULATION	Fish	Yes
STEELHEAD, UPPER COLUMBIA RIVER POPULATION	Fish	Yes
STEELHEAD, UPPER WILLAMETTE RIVER POPULATION	Fish	Yes
SUCKER, LOST RIVER	Fish	No
SUCKER, SHORTNOSE	Fish	No
SUCKER, WARNER	Fish	Yes
TROUT, BULL	Fish	No

Pennsylvania (5 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes
EAGLE, BALD	Bird	No
PLOVER, PIPING	Bird	Yes
SQUIRREL, DELMARVA PENINSULA FOX	Mammal	No
TURTLE, BOG (NORTHERN POPULATION)	Reptile	No

South Carolina (12 species)

	Group	Critical Habitat
EAGLE, BALD	Bird	No
MANATEE, WEST INDIAN (FLORIDA)	Mammal	Yes
PLOVER, PIPING	Bird	Yes
SALAMANDER, FLATWOODS	Amphibian	No
SNAKE, EASTERN INDIGO	Reptile	No
STORK, WOOD	Bird	No
STURGEON, SHORTNOSE	Fish	No
TREEFROG, PINE BARRENS	Amphibian	No
TURTLE, LOGGERHEAD SEA	Reptile	No
WHALE, NORTHERN RIGHT	Mammal	Yes
WOLF, RED	Mammal	No
WOODPECKER, RED-COCKADED	Bird	No

South Dakota (8 species)

	Group	Critical Habitat
BEETLE, AMERICAN BURYING	Insect	No
CRANE, WHOOPING	Bird	Yes
EAGLE, BALD	Bird	No
FERRET, BLACK-FOOTED	Mammal	No
PLOVER, PIPING	Bird	Yes

SHINER, TOPEKA	Fish	Yes
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

Tennessee (25 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
CHUB, SLENDER	Fish	Yes
CHUB, SPOTFIN	Fish	Yes
DACE, BLACKSIDE	Fish	No
DARTER, AMBER	Fish	Yes
DARTER, BOULDER	Fish	No
DARTER, DUSKYTAIL	Fish	No
DARTER, SLACKWATER	Fish	Yes
DARTER, SNAIL	Fish	No
EAGLE, BALD	Bird	No
LOGPERCH, CONASAUGA	Fish	Yes
MADTOM, PYGMY	Fish	No
MADTOM, SMOKY	Fish	Yes
MADTOM, YELLOWFIN	Fish	Yes
MARSTONIA, ROYAL (=ROYAL SNAIL)	Snail	No
RIVERSNAIL, ANTHONY'S	Snail	No
SHINER, BLUE	Fish	No
SNAIL, PAINTED SNAKE COILED FOREST	Snail	No
SPIDER, SPRUCE-FIR MOSS	Arachnid	Yes
SQUIRREL, CAROLINA NORTHERN FLYING	Mammal	No
STURGEON, PALLID	Fish	No
TERN, INTERIOR (POPULATION) LEAST	Bird	No

WOLF, RED	Mammal	No
WOODPECKER, RED-COCKADED	Bird	No

Texas (46 species)

	Group	Critical Habitat
BEAR, LOUISIANA BLACK	Mammal	Yes
BEETLE, COFFIN CAVE MOLD	Insect	No
BEETLE, COMAL SPRINGS DRYOPID	Insect	No
BEETLE, COMAL SPRINGS RIFFLE	Insect	No
BEETLE, HELOTES MOLD	Insect	Yes
BEETLE, KRETSCHMARR CAVE MOLD	Insect	No
BEETLE, TOOTH CAVE GROUND	Insect	No
CICURINA VENII (NCN)	Arachnid	Yes
CRANE, WHOOPING	Bird	Yes
DARTER, FOUNTAIN	Fish	Yes
EAGLE, BALD	Bird	No
FALCON, NORTHERN APLOMADO	Bird	No
GAMBUSIA, CLEAR CREEK	Fish	No
GAMBUSIA, PECOS	Fish	No
GAMBUSIA, SAN MARCOS	Fish	Yes
HARVESTMAN, BEE CREEK CAVE	Arachnid	No
HARVESTMAN, BONE CAVE	Arachnid	No
HARVESTMAN, ROBBER BARON CAVE	Arachnid	Yes
JAGUARUNDI, Gulf Coast	Mammal	No
OCELOT	Mammal	No
PELICAN, BROWN	Bird	No
PLOVER, MOUNTAIN	Bird	No
PLOVER, PIPING	Bird	Yes
PRAIRIE-CHICKEN, ATTWATER'S GREATER	Bird	No

PSEUDOSCORPION, TOOTH CAVE	Arachnid	No
PUPFISH, LEON SPRINGS	Fish	Yes
RHADINE EXILIS (NCN)	Insect	Yes
RHADINE INFERNALIS (NCN)	Insect	Yes
SALAMANDER, BARTON SPRINGS	Amphibian	No
SALAMANDER, SAN MARCOS	Amphibian	Yes
SALAMANDER, TEXAS BLIND	Amphibian	No
SHINER, ARKANSAS RIVER	Fish	Yes
Snail, Pecos Assiminea	Snail	No
SNAKE, CONCHO WATER	Reptile	Yes
SPIDER, GOVERNMENT CANYON CAVE	Arachnid	Yes
SPIDER, MADLA'S CAVE	Arachnid	Yes
SPIDER, ROBBER BARON CAVE	Arachnid	Yes
SPIDER, TOOTH CAVE	Arachnid	No
SPIDER, VESPER CAVE	Arachnid	Yes
TERN, INTERIOR (POPULATION) LEAST	Bird	No
TOAD, HOUSTON	Amphibian	Yes
TURTLE, KEMP'S (ATLANTIC) RIDLEY SEA	Reptile	No
TURTLE, LOGGERHEAD SEA	Reptile	No
VIREO, BLACK-CAPPED	Bird	No
WARBLER (WOOD), GOLDEN-CHEEKED	Bird	No
WOODPECKER, RED-COCKADED	Bird	No

Utah (12 species)

	Group	Critical Habitat
CHUB, BONYTAIL	Fish	Yes
CHUB, HUMPBACK	Fish	Yes
EAGLE, BALD	Bird	No

FERRET, BLACK-FOOTED	Mammal	No
OWL, MEXICAN SPOTTED	Bird	Yes
PLOVER, MOUNTAIN	Bird	No
PRAIRIE DOG, UTAH	Mammal	No
SQUAWFISH, COLORADO	Fish	Yes
SUCKER, JUNE	Fish	Yes
SUCKER, RAZORBACK	Fish	Yes
TORTOISE, DESERT	Reptile	No
TROUT, LAHONTAN CUTTHROAT	Fish	No

Vermont (2 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes
EAGLE, BALD	Bird	No

Virginia (12 species)

	Group	Critical Habitat
BAT, INDIANA	Mammal	Yes
BAT, VIRGINIA BIG-EARED	Mammal	Yes
BEETLE, NORTHEASTERN BEACH TIGER	Insect	No
EAGLE, BALD	Bird	No
LOGPERCH, ROANOKE	Fish	No
PLOVER, PIPING	Bird	Yes
SALAMANDER, SHENANDOAH	Amphibian	No
SNAIL, VIRGINIA FRINGED MOUNTAIN	Snail	No
SQUIRREL, DELMARVA PENINSULA FOX	Mammal	No
TURTLE, LOGGERHEAD SEA	Reptile	No
WHALE, NORTHERN RIGHT	Mammal	Yes
WOODPECKER, RED-COCKADED	Bird	No

Washington (20 species)

	Group	Critical Habitat
BEAR, GRIZZLY	Mammal	No
DEER, COLUMBIAN WHITE-TAILED	Mammal	No
EAGLE, BALD	Bird	No
MURRELET, MARBLED	Bird	Yes
OWL, NORTHERN SPOTTED	Bird	Yes
RABBIT, PYGMY	Mammal	No
SALMON, CHINOOK (LOWER COLUMBIA RIVER)	Fish	Yes
SALMON, CHINOOK (PUGET SOUND)	Fish	Yes
SALMON, CHINOOK (SNAKE RIVER FALL RUN)	Fish	No
SALMON, CHINOOK (SNAKE RIVER SPRING/SUMMER)	Fish	Yes
SALMON, CHINOOK (UPPER COLUMBIA RIVER SPRING)	Fish	Yes
SALMON, CHUM (COLUMBIA RIVER POPULATION)	Fish	Yes
SALMON, SOCKEYE (SNAKE RIVER POPULATION)	Fish	No
STEELHEAD, LOWER COLUMBIA RIVER POPULATION	Fish	Yes
STEELHEAD, MIDDLE COLUMBIA RIVER POPULATION	Fish	Yes
STEELHEAD, SNAKE RIVER BASIN POPULATION	Fish	Yes
STEELHEAD, UPPER COLUMBIA RIVER POPULATION	Fish	Yes
STEELHEAD, UPPER WILLAMETTE RIVER POPULATION	Fish	Yes
TROUT, BULL	Fish	No
WOLF, GRAY	Mammal	Yes

West virginia (7 species)

	Group	Critical Habitat
BAT, GRAY	Mammal	No
BAT, INDIANA	Mammal	Yes
BAT, VIRGINIA BIG-EARED	Mammal	Yes

EAGLE, BALD	Bird	No
SALAMANDER, CHEAT MOUNTAIN	Amphibian	No
SQUIRREL, CAROLINA NORTHERN FLYING	Mammal	No
SQUIRREL, VIRGINIA NORTHERN FLYING	Mammal	No

Wisconsin (5 species)

	Group	Critical Habitat
BUTTERFLY, KARNER BLUE	Insect	No
DRAGONFLY, HINES EMERALD	Insect	No
EAGLE, BALD	Bird	No
WARBLER (WOOD), KIRTLAND'S	Bird	No
WOLF, GRAY	Mammal	Yes

Wyoming (7 species)

	Group	Critical Habitat
BEAR, GRIZZLY	Mammal	No
DACE, MOAPA	Fish	No
EAGLE, BALD	Bird	No
FERRET, BLACK-FOOTED	Mammal	No
MOUSE, PREBLE'S MEADOW JUMPING	Mammal	Yes
PLOVER, MOUNTAIN	Bird	No
WOLF, GRAY	Mammal	Yes

Appendix I. Data Requirements.

Table I-1. Status of environmental fate data adequacy for aminopyralid.

Guideline #		Data Requirement	Are Data Adequate for Risk Assessment?	MRID #'s	Study Classification
161-1	835.212	Hydrolysis	Yes	46235726	Acceptable
161-2	835.224	Photodegradation in Water	Yes	46235727	Supplemental[1]
161-3	835.241	Photodegradation on Soil	Yes	46235728	Supplemental[2]
161-4	835.237	Photodegradation in Air	—	—	—
162-1	835.41	Aerobic Soil Metabolism	Yes (Holdrege) No (Regent, Manning, Barnes, Houston Black)	46235729	Supplemental[3]
162-2	835.42	Anaerobic Soil Metabolism	—	—	—
162-3	835.44	Anaerobic Aquatic Metabolism	Yes	46235730	Acceptable
162-4	835.43	Aerobic Aquatic Metabolism	Yes	46235731	Supplemental[4]
163-1	835.1240 835.1230	Leaching-Adsorption/Desorption	Yes	46235732	Supplemental[5]
163-2	835.141	Laboratory Volatility	—	—	—
164-1	835.61	Terrestrial Field Dissipation	Yes	46235734	Supplemental[6]
164-2	835.62	Aquatic Field Dissipation	—	—	—
164-3	835.63	Forestry Dissipation	—	—	—
164-4	835.64	Combination Products and Tank Mixes Dissipation	—	—	—
165-4	850.173	Accumulation in Fish	—	—	—
165-5	850.195	Accumulation – Aquatic Non-target Organisms	—	—	—

166-1	835.71	Groundwater – Small Prospective	—	—	—
201-1	840.11	Droplet Size Spectrum	—	—	—
202-1	840.12	Drift Field Evaluation	—	—	—

[1]Study classified as supplemental because not all degradation products over 10% of applied radioactivity were individually identified and quantified in all sampling intervals.

[2] Study classified as supplemental because there was loss in material balance of the irradiated samples and concurrent loss and variability in material balance in the dark samples.

[3]Study classified as supplemental because material balances were either low or variable in four of five soil types.

[4]Study classified as supplemental because the three test systems were anaerobic (moderately to strongly reducing water and sediment phases) throughout most of the study.

[5]Study classified as supplemental because none of the test soils had an organic content of <1%, as required by Subdivision N guidelines.

[6]Study classified as supplemental because both temporal and inter-replicate data variability (especially at times 0, 15 and 57 days at the MS site and 9 days at the CA site) make the half-lives of questionable value.

Table I-2. Status of ecological effects data adequacy for aminopyralid.

Guideline	Date Requirements	Are Data Adequate for Ecological Risk Assessment?	MRID	Study Classification
71-1(a)(b)	Avian Acute Oral LD_{50} Bobwhite Quail	Yes	462358-08 462358-09	Acceptable Supplemental[1]
71-2(a)	Avian Subacute Dietary Bobwhite Quail	Yes	462358-10	Acceptable
71-2(b)	Avian Subacute Dietary Mallard Duck	Yes	462358-11	Acceptable
71-4(a)	Avian Reproduction Bobwhite Quail	No	462358-12	Supplemental[2]
71-4(b)	Avian Reproduction Mallard Duck	Yes	462358-13	Acceptable
72-1(a)	Warmwater Fish Acute Toxicity LC_{50} Bluegill sunfish	Yes	462358-15	Supplemental[3]
72-1(c)	Coldwater Fish Acute Toxicity LC_{50} Rainbow Trout	Yes	462358-14	Acceptable
Non-guideline (based on 72-1a)	Amphibian Larvae Acute Toxicity LC_{50} Northern leopard frog, *Rana pipiens*	Not required	462358-16	Supplemental[4]
72-2(a)	Freshwater Invertebrate Acute Toxicity EC_{50} Water flea	Yes	462358-17	Acceptable
Non-guideline	Midge Chronic Toxicity	Not required	462358-23	Supplemental[4]
72-3(a)	Estuarine/Marine Fish Acute Toxicity LC_{50} Sheepshead Minnow	Yes	462358-20	Acceptable

Guideline	Date Requirements	Are Data Adequate for Ecological Risk Assessment?	MRID	Study Classification
72-3(b)	Estuarine/Marine Invertebrate Acute Toxicity EC_{50} Eastern Oyster	Yes	462358-18	Acceptable
72-3(c)	Estuarine/Marine Invertebrate Acute Toxicity LC_{50} Mysid Shrimp	Yes	462358-19	Acceptable
72-4(a)	Freshwater Fish Early Life Stage Fathead minnow	Yes	462358-21	Supplemental[5]
72-4(a)	Estuarine/Marine Fish Early Life Stage Silverside or Sheepshead Minnow	No		
72-4(b)	Freshwater Invertebrate Life Cycle Water flea	Yes	462358-22	Supplemental[6]
72-4(c)	Estuarine/Marine Invertebrate Life Cycle Mysid Shrimp	No		
123-1(a)	Tier II Terrestrial Plant Seedling Emergence (GF 871)	Yes	462358-24	Supplemental[7]
123-1(b)	Tier II Terrestrial Plant Vegetative Vigor (GF 871)	Yes	462358-25	Supplemental[8]
123-2	Tier II Aquatic Plant Growth Green Algae, *Pseudokirchneriella subcapitata*	Yes	462358-30	Acceptable
123-2	Tier II Aquatic Plant Growth (Vascular) Duckweed, *Lemna gibba*	Yes	462358-26	Acceptable
123-2	Tier II Aquatic Plant Growth Marine diatom, *Skeletonema costatum*	Yes	462358-28	Acceptable
123-2	Tier II Aquatic Plant Growth Freshwater diatom, *Navicula pelliculosa*	Yes	462358-27	Acceptable
123-2	Tier II Aquatic Plant Growth Blue-Green algae, *Anabaena flos-aquae*	No	462358-29	Unacceptable[9]
141-1	Honey Bee Acute Contact Toxicity	Yes	462358-31	Acceptable
Non-guideline	Honey Bee Acute Oral Toxicity	Not required	462358-32	Supplemental[4]

[1] The study was submitted in support of MRID 462358-08.

[2] Statistically significant differences found in the lowest dose tested for two survival endpoints (hatchling survival per eggs set and 14-day hatchling survival), but it is unclear whether these were treatment-related effects. Together with apparent downward trends in hatchling per live embryos and hatchlings per pen, it is uncertain that the study authors conclusion that these effects are not treatment related can be supported.

[3] Study classified as supplemental since the size of fish (0.18-0.92 g) used was less than the recommended range of 0.5 to 5 g.

[4] Non-guideline study; does not fulfill an OPP guideline.

[5] Replicate data for the days-to-mean hatch and sub-lethal effects were not submitted and could not be verified by EFED

[6] Study classified as supplemental due to excessive water hardness, low dissolved oxygen (31%) and reduced replicate size.

[7] Study classified as supplemental because soil surface watering occurred without report of test substance mobility characteristics and Thiram was applied to sugar beet without further explanation.

[8] Study classified as supplemental because Thiram was applied to sugar beet without further explanation. Both corn and radish were grown under very low light conditions, which may have affected the results.

[9] Study classified as unacceptable because the ability to detect treatment-related effects was compromised by high variability in the controls.