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OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

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CHEMICAL: Chlorfenapyr (PIRATE™, ALERT™, AC 303,630 or CL 303,630)
PC Code: 129093

SUBJECT: Chlorfenapyr (PIRATE™, ALERT™, AC 303,630) Insecticide-Miticide Environmental Fate and Ecological Effects Assessment and Characterization for a Section 3 for Use on Cotton

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Introduction

Attached, with agreed upon principal focus on avian risk, is the EFED environmental fate and ecological effects assessment and risk characterization for the insecticide-miticide chlorfenapyr on cotton. EFED will provide summaries/conclusions of formal guideline environmental fate studies and important supporting or supplemental studies under separate and subsequent cover. Other supplemental studies, and updates, corrections or additions to the registrant's previous studies are incorporated and appropriately cited in our assessment and risk characterization, but may not appear as separate entries elsewhere or in previous reviews.

Risk Conclusions

The results of this risk assessment for uses of chlorfenapyr on cotton consistent with proposed labeling demonstrate the following:

- Terrestrial wildlife dietary residues associated with all label application rates present a substantial risk to avian species for both acute lethal effects and impairment of reproduction. The exposure opportunities for acute lethal effects occur for many days following treatment.

Exposure levels (based on measured residues in avian food items) for all application rates exceed the threshold for reproductive effects for all of the species selected to represent avian receptors in cotton fields by factors up to 60. These exposures extend for multiple weeks after initial chlorfenapyr application. Even when assumed exposures are reduced to levels below those expected for minimal avian use of cotton fields, risks to reproduction are still indicated. Timing of chlorfenapyr applications to the cotton crop coincide with the reproductive window of most of the more than 50 species of birds that the registrant reports to be associated with cotton fields. Many of the bird species included in this risk assessment as representatives of the species found in cotton fields are presently exhibiting downward population trends in cotton-growing states. Further impairment of reproduction and increased individual mortality would further stress populations of these species in one or more cotton-growing states.

- The results of the aquatic organism risk assessment, using water column estimates of chlorfenapyr concentrations, suggest that chlorfenapyr applications to cotton present acute risks to freshwater fish and invertebrates in United States Department of Agriculture (USDA) agricultural census regions 4 (AL, GA, KY, NC, SC, TN, VA), 6 (AR, LA, MO, MS, OK), and 7 (TX). Chronic risks to freshwater fish and invertebrates are not evident from the results of the risk assessment. However, the confidence of this "no chronic risk" finding is low because of the limited chronic testing data for freshwater animals (note: additional chronic freshwater data in the form of sediment toxicity and a valid fish full life-cycle study are requested), the persistence of the chemical in aquatic environments, and a concern for potential accumulation in invertebrates.

- For estuarine and marine organisms, this risk assessment predicts acute and chronic toxicological risks. Chronic risk quotients for marine invertebrates exceed the level of concern by over an order of magnitude.

- Acute risks to sediment-dwelling invertebrates are not evident for freshwater systems receiving cotton field runoff. Levels of concern for these organisms are not exceeded by modeled sediment residues. However, because the persistence of chlorfenapyr suggests that longer term exposures are possible, the lack of a chronic freshwater sediment toxicity test represents an important data gap.

- Preliminary Risk Quotients for sediment-dwelling marine amphipods suggest that acute high risk, restricted use, and endangered species LOCs are exceeded. The high acute risk level of concern is exceeded by factors ranging from 4.7 to 10.8 for aerial and ground applications in Regions 4, 6,7, and 11.

These risk assessment conclusions are consistent with the findings of previous risk assessments for chlorfenapyr use on cotton. However, the confidence of the present avian risk findings is greater than in previous assessments because of the following factors:

- use of measured residue values in seeds, insects, and forage

- assessment of risks to specific species known to occur in cotton fields, including species-specific considerations of life history information, dietary preferences, and metabolic requirements

- incorporation of information specific to the use of cotton fields as a food resource

This risk assessment represents a refinement of the EFED Risk Quotient approach in that it models terrestrial exposures for specific species known to occur in cotton fields on the basis of measured pesticide residues in dietary items and presents those levels of exposure over time. For aquatic organisms, refinements include utilization of exposure modeling techniques that consider variability between use sites within the cotton-growing regions of the United States (e.g. MUSCRAT). In addition, because of previous concerns for potential toxic risks to sediment-dwelling organisms, this risk assessment assesses risks to these organisms in water bodies receiving pesticide runoff from cotton fields

Environmental Fate and Persistence Conclusions

Chlorfenapyr's persistence is typified by a laboratory aerobic soil metabolism half-life of 1.4 years [standard upper 90% confidence limit based on five soils (MRID 44452621), excluding a previous, anomalous, 3.8 year value (MRID 42770243) and its observed, comparable field dissipation "half-life" of 1.3 years [standard upper 90% confidence limit based on five small-plot cotton studies in four cotton states (MRID 43492850)].

Chlorfenapyr was essentially stable to laboratory hydrolysis and anaerobic soil metabolism. Under aerobic aquatic conditions, the upper 90% confidence limit for half-life in two German sediment compartments was approximately 1.1 years; in the aqueous compartment, roughly 0.8 year.

Because of the persistence of parent and relatively short study durations, only small amounts of structurally similar metabolites or degradates (AC 303267, AC 303268, AC 312094, AC 322118, AC 322250, AC 325195, some of which exhibit ecotoxicity) were identified in soil in field or lab studies. Concentrations of these, when detected, were typically a few percent each or less of the applied chlorfenapyr. Only AC 312094, the *des*-bromo derivative, sometimes approached or slightly exceeded 10% of total applied. *Relative* concentrations of AC 312094 in the radiolabeled North Carolina study were in the maximum range of 10-16%; relative AC 325195 concentrations in the same study averaged less than 10%. Soil photolysis, with AC 325195 as a characteristic degradate, therefore plays a small role in chlorfenapyr's degradation (laboratory soil photolysis half-life of approximately 0.4 year). In general, transformation products appear to approximate or exceed the persistence of parent. Laboratory photolysis in water produced a major photoisomer AC 357806 (50-70% of total residues); this isomer was never reported as a product in any other lab or field study. Neither mineralization (carbon dioxide evolution) nor volatilization were significant in laboratory studies, and were not monitored in the field.

Because of chlorfenapyr's persistence, uniform, annual use in a given area would result in significant build-up in environmental compartments. Commensurate with their half-lives, all chemicals undergoing first-order degradation come within 3% of their maximum value after a period of time corresponding to five half-lives; after ten half-lives the approach is within 0.1% of the maximum value. Assuming chlorfenapyr's previously cited 1.4 years aerobic soil metabolism half-life (approximately the same as the 1.3 years for field dissipation), the calculated asymptotic first-order value after multiple years of use approaches 2.5 times the annual application amount (1.5 leftover from previous applications plus 1.0 from the current year application). Using the average aerobic soil half-life of 0.96 year, rather than the upper 90% limit of 1.4 years, the asymptotic value becomes 2.0 times the annual amount (1.0 residual plus 1.0 current). Although not defensible scientifically or in a regulatory sense, if the even less conservative average field dissipation half-life of 0.75 year is considered, the asymptotic value is 1.7 times the amount applied annually (0.7 residual plus 1.0 current).

Two supplemental multiyear soil accumulation-dissipation studies lasting approximately 4 1/4 years (five seasons, each with three uniform applications) in small bare soil plots in Italy and the United Kingdom demonstrate the trend towards increasing concentrations over time (MRID 44453624 plus updated summary data and analysis, barcode D246661, no MRID assigned). In both countries, measured first year soil concentrations were approximately 0.1 ppm. Near the end of the studies the maximum concentrations were 0.3 ppm and 0.4 ppm in Italy and England, respectively. Because of severe limitations in study protocol and pronounced oscillations in the data, these numbers are of marginal value, but clearly show significant residual concentrations and the relative trend towards asymptotic increases in annual peak concentrations. Within experimental limits based on *actual* recovery from field soil (approximately 55% when corrected for 84-88% lab procedural recovery), and inclusive of at least some off-plot transport, build-up is realized. Commensurate with half-life, the results approximate theoretical expectations.

Chlorfenapyr has a relatively high soil to water partitioning ratio, typified by an average laboratory batch equilibrium K_{oc} (adsorption coefficient normalized for organic carbon) of about 12,000 mL/g. On this basis little vertical movement in soil would be expected. Confirming this expectation, leaching was not significant in field dissipation studies.

The registrant has provided residue data for chlrofenapyr in avian food items, including weed seeds, weed seed heads, insect adults and larvae. These data are comparable to predicted residue levels developed in earlier EFED risk assessments. These measured residues in avian food items were an important component of exposure estimation models used in the current EFED risk assessment.

Outstanding Data Requirements

Within the context of our risk assessment and characterization, EFED considers the environmental fate and effects data requirements satisfied except for selected items summarized in Appendix B of the risk assessment. Examples of some important outstanding requirements include:

Analytical methods validations: The registrant should submit soil and water methods of analysis which are suitable for detecting about one-tenth of the trace concentrations with observed ecological effects for EPA laboratory validation. Using this criterion, present procedures for water need to be improved by a factor of five or ten for sensitive species. Additionally, depending on marine, chronic sediment toxicity testing (see below), improvements for sediment/soil may be necessary.

Spray drift data [Droplet Size Spectrum (201-1) and Drift Field Evaluation (202-1)]: The registrant is given the option to satisfy requirements in the near future through the Spray Drift Task Force according to PR Notice 90-3.

Modified avian reproduction test data: In an April 1998 oral presentation before the Agency, the registrant presented preliminary results of an avian reproduction toxicity test that utilized a modified exposure regime. This study used variable dietary concentrations to simulate the decreasing concentrations of chlorfenapyr observed for weed seed head, cotton plant, and insect residues. The oral presentation of the resultant data suggested that some information from the study may be applicable to assessing the risks of field residues of chlorfenapyr to avian reproduction. However, written presentation of these data has not been made available to EFED at this time.

Chronic sediment toxicity testing: At the time EPA requested sediment toxicity testing, the only protocol which had been fully developed was a 10-day acute sediment toxicity test. However, at this time EPA has developed a guideline protocol for a 28-day chronic sediment testing. Although specific criteria for requiring a chronic toxicity test have yet to be published, one criterion will include the persistence of the compound. Because chlorfenapyr has been characterized as an extremely persistent compound, EFED will require a chronic sediment toxicity test with freshwater invertebrates. Furthermore, because of the risk assessment indicates the potential for acute toxic effects in marine/estuarine sediment-dwelling invertebrates, a chronic toxicity test with these organisms is also required.

Other toxicity testing: Invalid acute and/or chronic aquatic tests which need to be repeated at this time are listed below.

GUIDELINE #	STUDY	REASON
72-1	LC_{50} Rainbow trout	**Optional.** To be repeated at the discretion of the registrant (see study description). Invalid test due to failure to measure test concentration on photolytic degradate (Cl 357,806). The purported LC_{50} of 2.6 ppb implies that this compound is more toxic than the parent.
72-3	EC_{50} Oyster Shell Deposition Study	Invalid study due to inadequate shell growth in controls (MRID 434928-17) Since an embryo-larvae study was not conducted, this study must be repeated.
72-4	Sheepshead minnow Early life (marine/estuarine)	Invalid study due to low Dissolved Oxygen level throughout the experiment. The required fish full life-cyle study listed directly below would satisfy this requirement.
72-5	Sheephead minnow Life-cycle Study	The EEC is greater than 0.1 of the NOEL in the fish early life and invertebrate Life-Cycle study. The studies submitted under MRID 443648-02 and MRID 443648-03 need to be repeated due to control contamination.

It should be noted that limited tests were performed on two different degradates of AC 303,630. The major degradate CL 312,094 (the *des*-bromo derivative of AC 303,630), was tested only on bluegill sunfish. The photolytic degradate in water, CL 357,806, however, was tested on rainbow trout and *Daphnia magna*. The purpose of testing these two degradates on different species was not revealed in any of the material submitted. The registrant should explain this selectivity before the EFED considers additional testing on degradates.

Chlorfenapyr
(PIRATE™ , ALERT™, AC 303,630)
Insecticide-Miticide
Environmental Fate and Ecological Effects Assessment and Characterization for a Section 3 for Use on Cotton

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A. Endangered Species Listing for Cotton-Growing Areas

B. Data Requirements for Chlorfenapyr on Cotton

EXECUTIVE SUMMARY

This document presents the results of an Environmental Fate and Effects Division (EFED) assessment of risks of registration of chlorfenapyr for use on cotton to terrestrial and aquatic organisms. The risk assessment builds upon previous EFED risk assessments[1] for this combination of chemical and use site, but incorporates important changes in chlorfenapyr labeling, additional toxicological data (avian, aquatic, and benthic invertebrate), measured residue data in terrestrial wildlife food resources, and new exposure modeling approaches for both terrestrial and aquatic receptors.

The results of this risk assessment for uses of chlorfenapyr consistent with proposed labeling demonstrate the following:

- Terrestrial wildlife dietary residues present a substantial risk to avian species. Exposure levels for all application rates exceed the threshold for reproductive effects for all of the species selected to represent avian receptors in cotton fields. Terrestrial wildlife exposures above reproductive levels of concern extend for multiple weeks after initial chlorfenapyr application. All proposed application rates also result in dietary residues that pose acute lethal risks to birds for many days after treatment. Even when assumed exposures are reduced to levels below those expected for minimal avian use of cotton fields, risks to reproduction are still indicated. Timing of chlorfenapyr applications to the cotton crop coincide with the reproductive window of most of the more than 50 species of birds that the registrant reports to be associated with cotton fields.

- Chlorfenapyr applications to cotton present acute risks to freshwater fish and invertebrates in United States Department of Agriculture (USDA) agricultural census regions 4 (AL, GA, KY, NC, SC, TN, VA), 6 (AR, LA, MO, MS, OK), and 7 (TX). Chronic risks to freshwater fish and invertebrates are not expected. However, for estuarine and marine organisms, this risk assessment predicts acute

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[1]EFED risk assessment documents for chlorfenapyr use on cotton include: Ecological Risk Assessment Briefing Packet for Chlorfenapyr, May 1, 1997; Section 3 EFED Assessment (DP Barcode: 210808)

and chronic toxicological risks. Chronic risk quotients for marine invertebrates exceed the level of concern by over an order of magnitude.

- Acute risks to sediment-dwelling invertebrates are not evident for freshwater systems receiving cotton field runoff. Levels of concern for these organisms are not exceeded by modeled sediment residues. However, because the persistence of chlorfenapyr suggests that longer term exposures are possible, the lack of a chronic freshwater sediment toxicity test represents an important data gap.

- Preliminary Risk Quotients for sediment-dwelling marine amphipods suggest that acute high risk, restricted use, and endangered species LOCs are exceeded by factors ranging from 2.4 to 5.4 for aerial and ground applications in Regions 4, 6,7, and 11.

These risk assessment conclusions are consistent with the findings of previous risk assessments for chlorfenapyr use on cotton. However, the confidence of the present avian risk findings is greater than in previous assessments because of the following factors:

- use of measured residue values in seeds, insects, and forage

- assessment of risks to specific species known to occur in cotton fields, including species-specific considerations of life history information, dietary preferences, and metabolic requirements

- incorporation of information specific to the use of cotton fields as a food resource

Where appropriate, this risk assessment has utilized information presented in the registrant's ecological risk assessments for terrestrial (MRID 444779-01) and aquatic (444526-02) organisms. This information primarily related to aspects of exposure characterization.

This risk assessment represents a change to the EFED Risk Quotient approach in that it models terrestrial exposures for specific species known to occur in cotton fields on the basis of measured ("real") pesticide residues in dietary items and presents levels of exposure over time. For aquatic organisms, the registrant used the Multiple Scenario Risk Assessment Tool (MUSCRAT) for exposure modeling. MUSCRAT is otherwise identical to the PRZM/EXAMS model (the current EFED standard), except that it is statistically weighted to take into account spatial and temporal variability between use sites within the cotton-growing regions of the United States. Since use of MUSCRAT is provisional in EFED, EFED has computed concentrations using both MUSCRAT and the PRZM/EXAMS standard cotton scenario. Results are comparable (see Aquatic Organism Exposure Assessment). Therefore, to provide a methodology consistent with that which the registrant used, on an *ad hoc* basis, EFED has selected MUSCRAT concentrations for aquatic risk assessment purposes. In addition to water column estimates, because of previous concerns for potential toxic risks to sediment-dwelling organisms, this risk assessment evaluates risks to these organisms from water bodies receiving pesticide runoff from cotton fields.

For assessing risks to avian and mammalian species, the approach considers dietary exposures only. The assessment does not quantify exposures associated with oral ingestion during preening, ingestion of pesticide via drinking water, dermal exposures due to contact with treated surfaces, inhalation of pesticide volatilized to air or associated with suspended particulate. The assessment uses the most sensitive avian toxicological endpoint as the toxicological threshold, regardless of species, without modification to account for potential interspecies differences in sensitivity. The avian and mammalian risk assessments do not factor in the impacts of local environmental conditions as they relate to the spacial and temporal distribution of pesticide residues in the field. By using an alternative method for estimating dietary exposures than normally used by EFED, this assessment does not account for a number of safety factors built into the normal EFED Risk Quotient approach.

USE PROFILE

Chemical Identification

The chemical name for the pesticide compound AC 303,630 Technical is (4-bromo-2-(4-chlorophenyl)-1-(ethoxymethyl)-5-(trifluoromethyl)-1H-pyrrole-3-carbonitrile). The common name for the compound, as it is referred to in this risk assessment, is chlorfenapyr.

Type of Use

Chlorfenapyr is proposed for use as an insecticide and miticide.

Use Site

The proposed use site is cotton.

Target Pests

Mites, beet armyworm, tobacco budworm, and cotton bollworm are the target pests on cotton.

Formulation Type

Chlorfenapyr will be marketed as two formulas:

PIRATE™ (eastern United States market)
One gallon contains 3.0 lbs of active ingredient.
Active ingredient = 30.83%, Inert ingredients 69.17%.

ALERT™ (western United States market)
One gallon contains 2.0 lbs of active ingredient.
Active ingredient = 21.44%, Inert ingredients = 78.56%.

Method, Rate, and Timing of Application

The recommended application methods are ground spray and aerial spray. The maximum application rate for PIRATE use on cotton for a single cropping season is 0.5 lbs ai/acre. Table 1 is from the proposed label and outlines the target pests, application timing and range of application rates.

The registrant's avian risk assessment (MRID 444779-01) has identified the expected timing of chlorfenapyr applications:

Pirate Applications: All target pests on mid- to late-season cotton - potential application window extending from July through September

Alert Applications: Mite control on seedling cotton - potential application window extending from May to early June

All target pests on mid- to late-season cotton - potential application window extending from July through September

The proposed label for the Alert product contains language prohibiting more than two applications in a given year. However, the Pirate label contains no such language. (Note: for the purposes of this risk assessment, the number of applications modeled for exposure purposes reflects the maximum number at a given application rate that will not exceed the maximum application rate of 0.5 lb ai/A, these maximum numbers of applications are also presented in Table 1.)

ENVIRONMENTAL FATE CHARACTERIZATION

Preface

EFED previously completed full review and assessment of environmental fate studies for chlorfenapyr on 21 Oct 96. We concluded then that the fate data requirements to support the registration of chlorfenapyr on cotton, except for spray drift data and analytical methods validations, were satisfied.

The registrant, however, felt that the submitted studies reflected a persistence and an associated exposure that would not be realized under actual field conditions or, even if realized, would be inconsequential ecologically. They especially felt that the 3.8 year aerobic soil metabolism half-life which they had submitted (MRID 42770242) was anomalous, and that five field dissipation half-lives with individual statistical confidence intervals ranging from approximately one-half to two years more accurately represented the rate of degradation, even though there were major field study deficiencies, including no analysis for degradates. Chemicals with half-lives in this range are, however, still persistent. Testing the possibility of a lesser persistence, EFED accordingly presented terrestrial risk assessments covering a range of half-lives from one to 3.8 years. As was predictable from elementary principles, the results of the terrestrial assessments were largely insensitive to such long half-lives since so little degradation occurs within established ecological endpoint time frames. Of course, overall environmental contamination or build-up in environmental compartments (soil, water, sediment, etc.) is very sensitive to rate of degradation or half-life, and compounds with half-lives as long as chlorfenapyr's will build-up, as is discussed later in this assessment.

In view of the conclusions from EFED's previous risk characterization which strongly indicated potential adverse effects, especially to avian species, the registrant chose to conduct additional lab and field studies, most of them innovative and non-guideline, to provide measured or "real" residues on wildlife food items, to provide better estimates of persistence in soil, and to provide other data which have elements of a probabilistic nature to "better define chlorfenapyr's environmental fate and effects" (quotation from registrant MRID 44452603). With the submission of these new studies, the registrant has now clearly established:

1) a statistical range of aerobic soil half-lives for chlorfenapyr in five different soils varying from 0.7 to 1.1 years with an average value of 0.96 $\pm$ 0.18 year and a standard upper 90% confidence limit of 1.4 years. This was accomplished by repeating the initial laboratory aerobic soil metabolism study with the same soil, by testing four additional soils, by better control of experimental conditions, and through use of a reference (benchmark) compound. On this basis, the initial aerobic soil regression half-life of 3.8 years is anomalously long, and will not be used in any way for exposure assessment.

2) that much or most of the dissipation observed in the field is due to degradation.

In the process, they have also demonstrated that

1) because of chlorfenapyr's persistence, significant environmental build-up does occur; and

2) that concentrations on wildlife food items are similar to those used in EFED's previous risk assessments, and, consequently, do not significantly alter previous avian risk conclusions.

Fate Summary and Conclusions

Agricultural Use Pattern

Chlorfenapyr is an insecticide-miticide intended for use on cotton (this action) and other crops such as citrus and vegetables (pending actions). The maximum annual use rate on cotton is 0.5 lb ai/acre. Additional use information is attached or incorporated in other sections of this document.

Persistence/Rate of Degradation

Chlorfenapyr's persistence is typified by a range of laboratory aerobic soil metabolism half-lives based on five soils of 0.7 to 1.1 years with an average value of 0.96 $\pm$ 0.18 year and a standard upper 90% confidence limit of 1.4 years (MRID 44452621). These results are exclusive of a previous, anomalous 3.8 year value (MRID 42770243). Its observed dissipation "half-lives" in five small-plot cotton field studies in four states ranged comparably from 0.48 to 1.1 years with an average value of 0.75 year $\pm$ 0.25 year with a standard upper 90% confidence limit of 1.3 years (MRID 43492850). Since there was no analysis for degradates in the five cited field studies, some of the observed field dissipation/dispersal may have resulted from off-plot transport, not degradation, effectively indicating a somewhat longer degradative half-life and prolonged concentrations in environmental compartments. Recent re-analysis of chromatograms (MRID 44452622) of soil samples recorded in these cotton field dissipation studies identified a small amount of AC 312094 as a metabolite, indicating qualitatively that at least some degradation had occurred. A recently submitted, radiolabeled, small-plot field study in cotton in North Carolina (MRID 44452623) systematically identified small amounts of several degradates (see Degradates below), consistent with those found in soil in lab studies, and detected the presence of other minor unknowns. Although there was unexplained loss of roughly 65% of radioactivity and irregular oscillations in the data during the North Carolina study (perhaps because of untested surface transport by rainfall away from designated subplot areas into plot fringes which were framed by wooden barriers), the ratio of recovered parent radioactivity to total radioactivity (parent plus transformation products) as a function of time provides a normalizing measure of degradation rate (half-life). However, this relationship is valid if, and only if, it is assumed that all recovered materials and all missing materials (after separation from the original deposition) experience proportionately the same physical dissipation processes and are proportionately exposed to the same microscopic soil phases and surfaces for chemical or biochemical reactions. Under these assumptions, the resultant field dissipation half-life (first-order regression of time versus the natural logarithm of the percentage of parent in total radioactive residues) in the North Carolina study is approximately 0.9 year, with an upper 90% statistical confidence bound of approximately 1.3 years. These values fall in virtually the same range as found in the other field studies and in the lab aerobic soil metabolism studies.

Chlorfenapyr was essentially stable to laboratory hydrolysis and anaerobic soil metabolism. Under aerobic aquatic conditions, the average value for half-life in two German sediment compartments was 0.6 ± 0.2 year with an upper 90% confidence limit of 1.1 years; in the aqueous compartment, concentrations were essentially too low for precise analysis. Based on limited data in one aqueous compartment, EFED selected an upper bound modeling half-life for the aqueous compartment of approximately 0.8 year.

<u>Degradates</u>

Because of the persistence of chlorfenapyr and the consequent low yields of soil degradates during relatively short periods of study, EFED has not focused much attention on the role of transformation products in the risk assessment and risk characterization. Identified products are structurally similar to parent. Found in soil in field or lab studies were AC 303267, AC 303268 (the proposed toxic transformation product attributed for chlorfenapyr biological activity), AC 312094, AC 322118, AC 322250, and AC 325195 (see attached figure 1 for chemical structures). (Some of these transformation products exhibit ecotoxicity, some do not, while others have not been tested. None have been systematically subjected to the full complement of guideline tests for ecotoxicity. Results of available toxicity tests are presented elsewhere in this document. Of course, any associated ecotoxicity effectively serves to extend the persistence of parent.) Concentrations of these transformation products, when detected, were typically a few percent each or less of the applied chlorfenapyr. Only AC 312094, the desbromo derivative, sometimes approached or slightly exceeded 10% of total applied. *Relative* concentrations of AC 312094 in the radiolabeled North Carolina study were in the maximum range of 10-16%; *relative* maximum AC 325195 concentrations in the same study averaged less than 10%. Soil photolysis, with AC 325195 as a characteristic degradate, therefore plays a small role in chlorfenapyr's degradation (laboratory soil photolysis half-life of approximately 0.4 year). In general, transformation products appear to approximate or exceed the persistence of parent. Laboratory photolysis in water produced a major photoisomer AC 357806 (50-70% of total residues); this isomer was never reported as a product in any other lab or field study. Neither mineralization (carbon dioxide evolution) nor volatilization were significant in laboratory studies, and were not monitored in the field. The proposed cotton field degradation pathways for chlorfenapyr are attached (figure 1).

Build-up in the Physical Environment

Because of its persistence, the uniform, annual use of chlorfenapyr in a given area would result in significant build-up in environmental compartments. Commensurate with their half-lives, all chemicals undergoing first-order degradation come within 3% of their maximum value after a period of time corresponding to five half-lives; after ten half-lives the approach is within 0.1% of the maximum value. The exact general relationship of build-up in the soil compartment after years of uniform use with no off-site transport is best illustrated by the attached graph of concentration vs. time for selected half-lives (figure 2).

More specifically, if we select chlorfenapyr's previously cited 1.4 years aerobic soil metabolism half-life (approximately the same as the 1.3 years for field dissipation), then, after years of uniform use, the calculated asymptotic first-order value approaches 2.5 times the annual application amount (1.5 leftover from previous applications plus 1.0 from the current year application). Using the average aerobic soil half-life of 0.96 year, rather than the upper 90% limit of 1.4 years, the asymptotic value becomes 2.0 times the annual amount (1.0 residual plus 1.0 current). [Although not defensible scientifically or in a regulatory sense, if the even less conservative average field dissipation half-life of 0.75 year is naively selected, the asymptotic value is 1.7 times the amount applied annually (0.7 residual plus 1.0 current).]

Two supplemental multiyear soil accumulation-dissipation studies lasting approximately 4 1/4 years (five seasons, each with three uniform applications) in small bare soil plots in Italy and the United Kingdom demonstrate the trend towards increasing concentrations over time (MRID 44453624 plus updated summary data and analysis, barcode D246661, no MRID assigned). The attached figure 3 from the registrant (barcode D246661) summarizes the observations. In both countries, measured first year soil concentrations were approximately 0.1 ppm. Near the end of the studies the maximum concentration in Italy was approximately 0.3 ppm; in England, 0.4 ppm. However, because of severe limitations in study protocol and the pronounced oscillations in the data, these numbers are of marginal value and should not be conveyed in an absolute sense. Nevertheless, the data clearly show significant residual concentrations and the relative trend towards asymptotic increases in annual peak concentrations. Within experimental limits based on *actual* recovery from field soil (approximately 55% when corrected for 84-88% lab procedural recovery), and inclusive of at least some off-plot transport, build-up is realized. Commensurate with half-life, the results approximate theoretical expectations.

Mobility

Chlorfenapyr has a relatively high soil to water partitioning ratio which correlates well with soil organic carbon content. The average laboratory batch equilibrium K_{oc} (adsorption coefficient normalized for organic carbon) for four soils was about 12,000 mL/g. On this basis little vertical movement in soil would be expected. Confirming this expectation, leaching was not significant in field dissipation studies.

Ground Water Assessment

Even though persistent, chlorfenapyr's relatively high sorption coefficients and the low potential for leaching exhibited in field dissipation studies preclude it from significantly affecting groundwater. Any projected, hypothetical concentrations in ground water would be below the threshold of EFED's current SCI-GROW groundwater screening model.

Surface Water Assessment

Chlorfenapyr is, however, subject to enter surface water via runoff water and eroding sediment. As is discussed in the aquatic risks section of this document, chlorfenapyr's projected aquatic concentrations in water and sediment, in relation to its established ecotoxicity, clearly indicate potential surface water and sediment effects. In addition to the currently projected effects, potential chronic toxicity in sediment is an issue still to be resolved. Other indirect, general indicators of potential bioavailability are: parent and identified degradates are easily extracted in high yield from soil or sediment with simple organic solvents, and chlorfenapyr is dislodgeable from cotton foliage.

Based on the current Pesticide Root Zone Model (PRZM 3.1.1) for cotton culture and the Exposure Analysis Modeling System (EXAMS 2.97.5), with added statistical weight through use of the *provisional* Multiple Scenario Risk Assessment Tool (MUSCRAT) option (see attached ecological risk documentation), tier 2 estimates of peak drinking water concentrations in surface water sources in four representative census of agriculture regions ranged narrowly from approximately 2 to 5 parts per billion (ppb). The 90-day surface water concentrations ranged from approximately 1 to 2 ppb. Post-processing of MUSCRAT outputs beyond 90-days is not a current option.

Bioconcentration

Chlorfenapyr did not concentrate in bluegill sunfish. Instead, it was metabolized to AC 312094 which concentrated up to 2300 times in whole fish, but was depurated with a half-life of roughly 4 days (97% depuration after 21 days). It should be noted that the environmental persistence of chlorfenapyr may reduce the potential for biologically significant levels of depuration. In addition, because of its lipophilicity (octanol/water partitioning ratio of 68,000); the presence of chlorine, fluorine, and bromine atoms; and the previously mentioned potential bioavailability of parent and degradates in high yield from sediment, chlorfenapyr may concentrate in invertebrates such as mollusks which generally have lower capacity to detoxify and which could receive prolonged exposure in sediment. The former Assistant Administrator of the EPA ORD (Robert Huggett) offered an emphatic professional opinion that bioconcentration in invertebrates was an important concern. The potential for chlorfenapyr accumulation in the invertebrates, and the risks of accumulation of AC 312094 in fish with respect to aquatic organism-consuming wildlife have not been addressed in this risk assessment.

Analytic Limitations

Because of chlorfenapyr's very high ecotoxicity, currently reported analytical precision limits for its measurement in water (1 ppb for quantitation, 0.1 ppb for detection) need to be improved by a factor of five or ten in order to meet a criterion of detecting about one-tenth of the trace concentrations with observed ecological effects. In addition, depending on the outcome of a recommended chronic toxicity study, a more sensitive analytical method for sediment concentrations may be necessary. It is a concern that adequate analytical methods be available for all pesticidal chemicals. Otherwise, in the event of an adverse incident there can neither be freedom from implication nor attribution of cause.

Field Residue Studies

Foliar, Insect, and Soil Residue Study

A single application of the chlorfenapyr was made to cotton fields (one plot at 0.2, one plot at 0.4 lbs ai/acre, and two untreated plots, MRID 434928-14). Residues reported on cotton leaf tissues five hours after the 0.4 lbs ai/acre application were 183% of residues predicted by Fletcher et al. (1994)[2]. By day 28 residues on cotton foliage were approximately 3 mg/kg. Residues were determined on live insects collected both within the treated field and in the adjacent field border. It should be noted that there is uncertainty over the collection of only live insects as it is possible that such collection methods may produce an underestimation of residues in insects, if those still alive after treatment have not have received a maximal dose of insecticide. No chlorfenapyr was detected in insects collected from the adjacent habitat. Residues in insects collected within the field averaged 5.7 mg/kg through day 2 and dropped to levels below the method detection limit between days 7 and 14. Seeds collected from weeds within the adjacent habitat had no detectable residues. Soil residues were 158 μg/kg immediately following application and peaked at 170 μg/kg on day 14. By day 28 residues in soil averaged 100 μg/kg. It was determined through foliar leaf testing that nearly all chlorfenapyr on foliage was easily removed with a mild surfactant and water solution, regardless of the sampling time.

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[2]Fletcher, J.S., J.E. Nellesen, T.G. Pfleeger. 1994. Literature review and evaluation of the EPA food-chain (Kenaga) nomogram, an instrument for estimating pesticide residues on plants. Env. Toxicol. Chem. 13:1381-1391.

Weed Seed/Seed Head Residue Study

MRID 444526-08 presents the results of a study of the dissipation of chlorfenapyr in the seeds and seed heads of weedy plant species. Performed on a sandy loam soil field site in Stoneville, Mississippi, the study involved the treatment of plots planted in mixed weed seeds with three treatments of 0, 0.35, 0.18, 0.035, or 0.0075 lb ai/A for total applications of 0, 1.0, 0.5, 0.1, and 0.03 lb ai/A, respectively. From control and treated plots (one per treatment and control), weed seed heads, and composite and individual weed seed samples were collected an analyzed for chlorfenapyr. The results for weed seed heads and weed seeds are summarized in Table 2. Day 0 application residues for weed seeds and seed heads from this study are actually higher than residues predicted by Fletcher et al. (1994) for pods and seeds (e.g., Fletcher et al.: 24.6 mg/kg for 1 lb ai/A X 0.35 lb ai/A= 8.61 mg/kg versus Day 0.1 weed seed head field data for 0.35 lb ai/A = 27.2 mg/kg) or fruits (15 mg/kg 1 lb ai/A X 0.35 lb ai/A= 5.25 mg/kg versus Day 0.1 weed seed head field data for 0.35 lb ai/A = 27.2 mg/kg). It should be noted that the majority of data points are for a single analysis of a single composite sample collected from the corresponding treatment plot for each time interval. In a few cases, multiple chemical analyses (usually a duplicate analysis) were conducted on a single composite sample. While duplicate chemical analyses may test for analytical procedure variability and homogeneity of sub-sampling, the use of a single composite sample does not allow for an assessment of field variability. Therefore confidence intervals for these data points cannot be determined.

Insect and Cotton Plant Residue Study

MRID 444642-01 presents the results of a study of residues in insects as a result of single applications of chlorfenapyr to a single cotton field site under field conditions. The objective of the study was to determine the level of residues of chlorfenapyr in or on insects immediately after application and up to 28 days later. The test system consisted of larvae and adults of beet armyworms from laboratory reared colonies free from insecticides. Two broadcast applications of chlorfenapyr (0.2 and 0.35 lb/ai/A) were made to plots of cotton containing larvae and caged adults. The plots were located in Pulaski County Georgia. The test site consisted of two untreated control plots and four plots treated with chlorfenapyr. Two of the treatment plots were used for larval sampling, and two were used for adult moth sampling. Each of the larval treatment plots were divided into 22 subplots (2.9 m X 3.0 m). Three subplots were sampled per sampling period, with the insect samples composited within each subplot. The larvae and adults were collected for residue analysis. Adult insects were collected from cage enclosures at 0.1, 6, 15, 21, and 28 days after application. Larvae were sampled from the field on the day of and day after application. However, because field introduced larvae dispersed or pupated shortly after application, subsequent analyses of larvae were performed on laboratory reared larvae not directly treated with chlorfenapyr, but introduced in the laboratory to cotton samples taken from the treated fields at 3, 4, 8, 15, 22, and 29 days after application. Cotton residues were also collected and analyzed for chlorfenapyr.

Table 3 presents the measured chlorfenapyr residue data for adult and larval beet armyworms exposed either in-field or fed cotton plants collected from treated fields. The data are highly variable with respect to time period and are not consistent with respect to residues versus application rate. The registrant presented regressions (third order) of larval residue versus day after treatment. At both treatment levels (0.20 and 0.35 lb ai/A) the significance levels for these regressions (P= 0.0045 and p= 0.0004) suggested that the time after treatment slope of the data trends were significantly different from 0. However, the high variability of the data resulted in very poor predictive utility for the regressions (r^2 = 0.414 and 0.526 for 0.20 and 0.35 lb ai/A, respectively). It should be remembered that larval army worms were first exposed in the treated fields, but did not remain feeding on treated cotton plants. After initial exposure, larval army worms, raised on a dietary mixture containing no cotton, were exposed for only 3 to 10 hours in the laboratory to cotton plants collected from treated fields. These larvae were not in continual contact with treated fields, nor were data collected to demonstrate that the cotton plants introduced to laboratory armyworms (raised on a non-cotton food source), were actually consumed at a rate similar to those encountered in the field. There exists a potential that the measured residues from this study may underestimate actual in-field chlorfenapyr residues because of the short exposure period and the potential that dietary exposure was reduced due to the laboratory larvae unfamiliarity with cotton as a food source. Because of the potential for underestimation of insect residues inherent in MRID 444642-01, EFED elected to use the maximum values for each time interval as reflected in Table 3.

The registrant (Ahmed 1998a)[3] has supplied supplemental information regarding the frequency

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[3]Ahmed, Z. 1998a. Memorandum (with attachments) from Zareen Ahmed, Product Registrations Manager, American Cyanamid to Ann Sibold, Registration Division, USEPA/OPP, May 5, 1998.

distribution of invertebrate residue levels collected with 24 hours of a foliar spray application of pesticides (an organophosphate and an aryl heterocyclic compound). These supplemental data can serve as a check on how conservative the use of maximum armyworm residues is for the risk assessment. The 95th percentile value presented in this distribution is approximately 20 mg/kg per 1 lb/A application. This 20 mg/kg value, adjusted downward to a 0.35 lb/A application rate (20 mg/kg X 0.35 = 7 mg/kg), is greater than the maximum measured Day 1 value of 4.34 mg/kg for armyworms feeding on plants from a chlorfenapyr-treated field at 0.35 lb ai/A. Therefore, the use of the maximum armyworm residues from MRID 444642-01 for the purposes of this risk assessment does not represent a conservative assumption.

Table 4 summarizes the results of the cotton plant analyses. For the purposes of this risk assessment, these cotton plant values were incorporated into oral exposures to forage for small mammals. It should be noted that these values are in close agreement with values predicted by Fletcher et al. (1994). For example, the Fletcher value predicted for short grass at 0.2 lb ai/A would be 48 mg/kg for (240 mg/kg X 0.2 = 48 mg/kg) and the average value from the measured residues at Day 0.1 for 0.2 lb ai/A is 45.9 mg/kg). Therefore, use of cotton plant residues as a surrogate for other plants potentially consumed by small mammalian herbivores is reasonable.

TOXICOLOGICAL CHARACTERIZATION

Biological Mechanism of Action

Chlorfenapyr (AC 303630) is a pyrrole insecticide-miticide. The compound is a pro-insecticide, such that the biological activity is incumbent on activation to another chemical moiety. Oxidative removal of the N-ethoxymethyl group of chlorfenapyr by mixed function oxidases forms the compound identified as CL 303268. CL 303268 functions to uncouple oxidative phosphorylation at the mitochondria, resulting in disruption of production of ATP, cellular death, and ultimately organism mortality.

It should be noted that CL 303268 has been detected in tobacco budworm larvae exposed to chlorfenapyr (MRID 444779-01). However, all monitoring data for insect larvae supplied by the registrant, and used in exposure estimations for this risk assessment, reports only chlorfenapyr residues. Consequently, the potential contribution of toxic CL 303268 residues in biological media that make up wildlife diets is not included in this risk assessment.

Toxicity to Terrestrial Animals

Acute and Subacute Avian Toxicity

An acute oral toxicity study using the technical grade of the active ingredient is required to establish the toxicity of a pesticide to birds. The preferred test species is either mallard (a waterfowl species) or northern bobwhite (an upland gamebird). Results of these tests are listed in Table 5. The most sensitive single oral dose LD_{50} is for the red-winged blackbird (2.21 mg/kg, LD_{50} values expressed on a bodyweight-based dose), which will serve as the toxicological endpoint in avian single oral dose exposure risk calculations.

All deaths reported for the mallard and northern bobwhite occurred within the first 3 and 7 days, respectively. All red-winged blackbird mortality occurred within the first two days following treatment. The LD_{50} values for red-winged blackbird, mallard and quail were 2.21, 8.3 and 34 mg/kg, respectively.

Clinical signs of intoxication common to all three species included whole body and wing beat convulsions, lethargy and loose green or chalky excreta. In addition, dyspnea (labored breathing) and opisthotonos (head stretched over back) were reported for the mallard. Lethargy was reported in the highest red-winged blackbird dose group. Post-mortem exam showed no treatment related abnormalities other than firm pectoral muscles.

A reduction in body weight, as compared to the control animals, occurred in the northern bobwhite at dose levels above 32 mg/kg during the first 3 days of the study. No body weight reduction was noted in the mallards or red-winged blackbirds.

A reduction in food consumption, as compared to the control animals, occurred in the northern bobwhite at dose levels above 16 mg/kg during the first 3 days of the study. A similar response was observed in the mallard at treatments higher than 4 mg/kg.

These results indicate that chlorfenapyr is very highly toxic to waterfowl and passerine species and highly toxic to upland gamebirds on an acute oral basis. The guideline requirement (71-1) is fulfilled (MRID 427702-27 and 427702-28).

In addition to acute toxicity testing performed with the technical grade of the parent compound, acute testing was conducted with metabolites which are produced under normal environmental conditions. Table 6 lists the results of those tests.

AC 303,268, a soil photolytic degradate, was shown to kill nearly as quickly as the parent compound and was more toxic to northern bobwhite. Deaths prior to day 4 accounted for 88% of the total mortality observed in mallards and northern bobwhite. Weight loss coincided with decreased food consumption at day 3 at treatment groups 40 mg/kg and higher in the mallard and at 25 mg/kg and higher in the northern bobwhite. Signs of intoxication common to both species included shallow rapid breathing, reduced reaction time, and loss of coordination. Necropsy showed small pale yellow spleens and stained vents.

AC 312,094, a soil degradate and biological metabolite, was shown to kill slower than the parent compound and exhibit fewer negative impacts on the survivors. It is practically non-toxic to the mallard. No mallards died from the treatment nor were changes in behavior, weight or food consumption reported. However, it is considered slightly toxic to northern bobwhite. It killed northern bobwhite slower than the parent (33% of total mortality occurred by day 6). Weight loss and decreased food consumption occurred in the highest treatment group (1200 mg/kg) on days 3 and 7. After 7 days the food consumption in the high treatment group increased to quantities higher than the controls, but weight remained lower until the end of the study. Immediate symptoms of intoxication included rapid ventilation, esophageal fibrillation and ataxia. Longer lasting effects included unsteadiness, piloerection, inactivity and yellow-green feces.

CL 303,267, a soil metabolite, was shown to be practically non-toxic to both the northern bobwhite and the mallard duck. In the bobwhite, no test substance related mortality, moribundity, or signs of intoxication were observed in any of the definitive test birds. However, there were decreases in the 2250 mg/kg test group, as compared to vehicle controls, for bodyweight (day 0 to day 7). Mean feed consumption was lower at all doses when compared to controls. Two birds in the 2250 mg/kg treatment showed signs of emaciation, breast muscle atrophy, and bile duct pathology. In mallards CL 303,267 produced no test related mortality, moribundity, signs of intoxication, body weight abnormality, feed consumption changes, or pathological abnormalities.

CL 325,195, a soil metabolite, was shown to be slightly toxic to the northern bobwhite, and practically non-toxic to the mallard duck. In the northern bobwhite, effects observed in addition to mortality included bodyweight reductions, compared with controls, were observed for both the 455 and 700 mg/kg dose groups. Mean feed consumption was lower than controls for treatment groups 192, 296, 455, and 700 mg/kg. Pathological abnormalities with dose-related frequency, were observed in the 455 and 700 mg/kg treatment groups, consisting of emaciation and changes in breast muscle tone. Exposure of CL 325,195 to mallards produced no test-related mortality, moribundity, or signs of intoxication. Mean feed consumption was reduced from controls in the 292 and 1350 mg/kg dose groups. There were no bodyweight abnormalities nor pathological observations for any dose group.

These results indicate the metabolite AC 312,094 is practically non-toxic to waterfowl and slightly toxic to upland gamebirds. The metabolite AC 303,268 is moderately toxic to waterfowl and highly toxic to upland gamebirds. CL 325,195, is slightly toxic to upland gamebirds and practically non-toxic to waterfowl. CL 303,267 is practically non-toxic to upland gamebirds and waterfowl.

Two subacute dietary studies using the technical grade of the active ingredient are required to establish the toxicity of a pesticide to birds. The preferred test species are mallard (a waterfowl species) and northern bobwhite (an upland gamebird). Results of these tests as well as a test using the passerine red-winged blackbird are listed in Table 7. The red-winged blackbird LC_{50} of 10.75 mg/kg-diet will serve as the basis of the toxicological endpoint for subacute dietary exposure risk calculations (note: a conversion to daily oral dose units is described later in this section).

All deaths reported for the northern bobwhite and mallard occurred within the first 4 and 5 days, respectively, with LC_{50} values of 132 and 8.6 mg/kg-diet, respectively. Clinical signs of intoxication observed in the mallard included lethargy, dyspnea, loss of coordination, loss of righting reflex, circling backwards and unusual head posture. Northern bobwhites exhibited no symptoms other than irregular excreta. Complete remission of all symptoms was achieved in survivors of both species by the beginning of the third day. Post-mortem exam showed no treatment related abnormalities in either species, other than green gizzards and enlarged gallbladders in mallards. Body weight reduction, as compared to the control animals, was noted throughout the entire study in the mallard at dose levels above 4 mg/kg-diet and northern bobwhite at dose levels above 80 mg/kg-diet. Food consumption measurements showed only slight decreases at the two highest dose levels, as compared to the controls, for both species.

Measurements taken after day 2 showed no difference.

All birds found dead in aviaries for the red-winged blackbird test (LC_{50} 10.75 mg/kg-diet) exhibited tetanus-like full-body rigidity. No bodyweight changes nor food consumption alterations, with respect to controls, were observed for any treatment group. The red-winged blackbird study incorporated two treatment groups at 14 mg/kg-diet to evaluate the effects of exposure timing on mortality. The standard treatment group were exposure through the diet for a total of five days. The satellite treatment group received treated diet for only the first 3 of 5 days. The satellite treatment birds exhibited no mortality, whereas the standard treatment birds exhibited all mortality on or before 3 days of exposure. No explanation for the differences between the onset of mortality for the standard and satellite treatment groups has been developed.

These results indicate that chlorfenapyr is very highly toxic to waterfowl and passerine species and highly toxic to upland gamebirds on an acute dietary basis. The guideline requirement (71-2) is fulfilled (MRID 427702-29 and 427702-30).

For the purpose of this risk assessment, the red-winged blackbird LC_{50} was selected as the subacute dietary toxicity threshold. This selection is based on the selection of six passerine bird species as surrogate species representative of the birds observed to use cotton fields (as summarized in the avian risk assessment prepared by the registrant, MRID 444779-01). According to the tabular presentation in the avian risk assessment prepared by the registrant, the LC_{50} for red-winged blackbird (expressed in terms of mg/kg-diet) was compared directly to avian dietary concentrations (a weighted average concentration expressed in term of mg/kg-diet). This approach does not account for the potential for varying food ingestion rates as a function of bodyweight. From the allometric equations incorporated in the registrant's avian risk assessment, it is evident that the proportion of bodyweight consumed as diet is not linear with respect to the bodyweight of the bird. Smaller birds consume more food per unit bodyweight than larger birds. Therefore, for a species-specific risk assessment, dietary exposures and dietary toxicological study endpoints should be expressed in terms of a daily dose in terms of mg/kg-body weight (mg/kg-bw/d). Expressing endpoints and dietary exposures in such terms accounts for the effect of ingestion rate on daily exposure. Note: this approach does not account for differing sensitivity to toxicants resulting from potentially different metabolic activation rates. The interspecies sensitivity may vary by as much as a factor of 10.

Expressing the red-winged blackbird LC_{50} in terms of a subacute oral dose is accomplished by multiplying the endpoint by the average daily food intake for the closest treatment rate (in this case the 10 mg/kg-diet treatment group for the study consumed an average of 0.00993 kg per bird per day) and dividing the product by the average bodyweight (the 10 mg/kg-diet for treatment group's average bodyweight was 0.0653 kg). The result of this conversion is a subacute lethal dose (50% of the population) of 1.63 mg/kg-bw/d. It should be noted that the measurement of daily dietary consumption during many laboratory dietary studies is a crude estimate and may not fully account for a number of study-specific events that may contribute to uncertainty in the measurement.

The red-winged blackbird endpoint is not the most sensitive when expressed as a dietary concentration (the mallard LC50 is 8.6 mg/kg-diet versus the red-winged blackbird of 10.75 mg/kg- diet). However, when expressed in terms of a daily oral dose, the red-winged blackbird endpoint is more sensitive (1.63 mg/kg-bw/d for the red-winged blackbird versus 2.38 mg/kg-bw/d for the mallard).

Chronic Avian Toxicity

Avian reproduction studies using the technical grade of the active ingredient are required when any **one** of the following conditions are met: (1) birds may be subject to repeated or continuous exposure to the pesticide, especially preceding or during the breeding season; (2) the pesticide is stable in the environment to the extent that potentially toxic amounts may persist in animal feed; (3) the pesticide is stored or accumulated in plant or animal tissues; and/or (4) information derived from mammalian reproduction studies indicates reproduction in terrestrial vertebrates may be adversely affected by the anticipated use of the product. The preferred test species are mallard and northern bobwhite. Avian reproduction studies were required for technical chlorfenapyr for the following reasons.

1) The proposed labeling and usage of both PIRATE™ and ALERT™ allow multiple applications during a growing season, totaling no more than 0.5 pound active ingredient per acre per year. Some products can be applied to control early season pests, which coincide with breeding season.

2) Chlorfenapyr is slowly degraded under both aerobic and anaerobic laboratory

conditions with a first-order half-life on the order of one or more years.

3) There exist data demonstrating chlorfenapyr residues in avian food items, including weed seeds, insects, and by analogy to cotton plant residues, forage.

The results of avian chronic tests are listed in Table 8. The mallard duck reproduction NOEL of 0.5 mg/kg-diet serves as the reproduction toxicity endpoint for avian long-term exposure risk calculations (note: a conversion to daily oral dose units is described later in this section).

Treatment-related differences were observed during the mallard experiment between the controls and treatment groups. In the 2.5 mg/kg-diet treatment group, reductions were observed for the total number of eggs laid, the number of viable embryos (immediately after laying), the number of viable embryos at 21 days of age (just prior to hatch), the number of normal hatchlings, the number hatchlings surviving 14 days, as well as a decrease in body weight of adult males. At a treatment level of 1.5 mg/kg a decline was noted in the body weight of the adult females. Food consumption declined with increasing active ingredient concentrations and was found significant in the 2.5 mg/kg-diet treatment group.

Reductions were observed in the number of northern bobwhite hatchlings surviving 14 days at a treatment level of 4.5 mg/kg-diet. Additionally, hatchling weight was lower at the 1.5 mg/kg treatment level.

The northern bobwhite study is determined to be supplemental and cannot be upgraded. However, the need for the new study is waived as the reported study has a very low NOEL, and a new study would not likely provide appreciably different results. Therefore guideline requirement (71-4) is fulfilled for the mallard (MRID 434928-13) but not the northern bobwhite (MRID 434928-11).

For the purposes of this risk assessment, the mallard chronic NOEL for reproduction was selected as the chronic avian endpoint. The avian risk assessment prepared by the registrant compared the NOEL for mallard (expressed in terms of mg/kg-diet) directly to avian dietary concentrations (a weighted average concentration expressed in term of mg/kg-diet). This approach does not account for the potential for varying food ingestion rates as a function of bodyweight. From the allometric equations incorporated in the registrant's avian risk assessment, it is evident that the proportion of bodyweight consumed as diet is inversely proportional to the bodyweight of the bird. Smaller birds consume more food per unit bodyweight than larger birds. Therefore, for a species-specific risk assessment, dietary concentrations and dietary toxicological study endpoints should be expressed in common units of a daily dose per unit bodyweight (mg/kg-bw/d). Expressing endpoints and dietary exposures in such terms accounts for the effect of ingestion rate on daily exposure.

Expressing the mallard NOEL in terms of a chronic oral dose is accomplished by multiplying the endpoint by the average daily food intake for the closest treatment rate (in this case the 0.5 mg/kg-diet treatment group for the study consumed an average of 0.1307 kg per day per bird) and dividing the product by the average bodyweight (the 0.5 mg/kg-diet for treatment group's average bodyweight was 1.106 kg). The result of this conversion is a chronic avian no observed effect dose of 0.059 mg/kg-bw/d.

Acute and Chronic Mammalian Toxicity

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, rat or mouse toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. These toxicity values are reported in Table 9.

Acute exposure to technical chlorfenapyr in mice resulted in 95% of the deaths occurring within 24 hours at a dose level of 140 mg/kg with a combined (both sexes) LD_{50} of 55 mg/kg. No important clinical or gross necropsy observations were reported.

On a unit of active ingredient basis, chlorfenapyr is more toxic as a formulated product. The combined species rat LD_{50} for technical chlorfenapyr is 626 mg/kg. In contrast, the rat LD50 for the 2SC formulation (MRID 432682-04) is approximately 560 mg/kg and contains only 120 mg active ingredient. It is unknown if the increased toxicity is due to a additional substance in the formulation, a synergistic effect between the active ingredient and formulation ingredients, or variation between studies. Ultimately, the quantity of either formulation or the active ingredient to result in mortality is approximately the same.

Symptoms of exposure to AC 303,630 2SC include decreased activity, salivation, writhing and abnormal posture. Necropsy was unremarkable in surviving animals. In dead animals, grossly dark and mottled livers, pronounced striations of abdominal wall, tetany, salivation, pale intestinal tracts, dark lungs and diarrhea were observed.

Symptoms of exposure to AC 303,630 3SC in rats include decreased activity, salivation, ataxia, hyperthermia, protruding testes, prostration and death. Grossly congested and mottled livers and pronounced striations of abdominal muscles were observed at necropsy. Weight gains of the survivors were not affected.

The acute toxicity of four metabolites to rats was determined. Of those tested only AC 303,268 resulted in higher toxicity than the parent compound (e.g., combined sex LD_{50}s of 28.7 and 626 mg/kg for metabolite and parent, respectively). Of the 40 rats exposed to AC 303,268 at concentrations higher than 31.25 mg/kg, 39 died within 8 hours of dosing. Mortality occurred at a slower rate in tests with the other 3 metabolites but still most was observed within 3 days. Survivors of exposure to the metabolites exhibited no lasting clinical effects or notable findings during gross necropsy. No weight changes were reported for survivors. Clinical signs reported for exposure to the metabolites included decreased activity, prostration, ptosis, increased salivation and diuresis. Abnormalities found at necropsy included discolored livers and spleens, discolored and distended stomachs, and gas filled GI tracts. Striated muscle tissue was reported in animals killed by AC 303,268.

The sub-chronic LOEL (600 mg/kg-diet) and NOEL (300 mg/kg-diet) observed in rats (MRID No. 427702-19) are based on reduced body weight gain and increased relative liver weights in males, decreased percent hemoglobin and increased absolute/relative liver weights in females.

The sub-chronic LOEL (80 mg/kg-diet) and NOEL (40 mg/kg-diet) observed in mice (MRID 434928-30) is based on hepatic cell hypertrophy in ≤20% of test animal.

In a two generation reproduction study with rats (MRID 434928-36) the LOEL for systemic toxicity was 300 mg/kg-diet (22 mg/kg-bw/day) and based on pre-mating effects on parental weight gain. The LOEL for reproductive toxicity was 300 mg/kg-diet (22 mg/kg-bw/day) and based upon decreased lactational weight gains. The NOEL for these systemic and lactational weight endpoints was 60 mg/kg-diet. No effects were seen in reproductive performance parameters, other than those listed above, at any dose up to 600 mg/kg-diet (44 mg/kg-bw/day).

The results indicate that based on the most sensitive species, technical chlorfenapyr is highly toxic to small mammals (mouse LD_{50} 55 mg/kg), AC 303,630 3SC is moderately toxic (male rat LD_{50} 283 mg/kg), and AC 303,630 2SC is slightly toxic to small mammals (male rat LD_{50} 560 mg/kg) on an acute oral basis. Male rats are 2.6X and 3.5X more sensitive than females when exposed to AC 303,630 Technical and AC 303,630 3SC, respectively. When exposed to AC 303,630 2SC and the metabolites AC 303,268 and AC 312,094, no differences were noted between sexes. Male mice are 1.7X more sensitive than females when exposed to technical chlorfenapyr. Males were roughly 2X more sensitive to the metabolite AC 325,195 than females, while the reverse was seen with AC 312,250.

Insect and Soil Organism Toxicity

A honey bee acute contact study using the technical grade of the active ingredient is required if the proposed use will result in honey bee exposure. A honey bee acute contact study is required for technical chlorfenapyr because multiple applications will be made throughout the growing season, including the period of flowering. Results of these tests are listed in Table 10.

The results indicate that technical chlorfenapyr is highly toxic to bees on an acute contact basis. However, no mortality occurred after the formulation is allowed to dry on vegetation, at application rates up to 0.43 lbs ai/acre. The guideline requirements (141-1) are fulfilled (MRID 427702-33 and 434928-45).

Two studies were submitted evaluating the toxicity of technical chlorfenapyr and AC 303,630 3SC on the earthworm *Eisenia fetida*. The results of these studies are listed in Table 11.

Earthworms in all treatment groups, including the control, lost weight in the acute toxicity study. Mortality was observed at treatment levels $\geq$17 mg/kg-soil. The 14-day LC_{50} for survival was 22 mg/kg-soil. The NOEC for both survival and weight was 8.4 mg/kg-soil. No effect was observed on earthworm burrowing ability. Residue analysis was not conducted on earthworm tissue. A reference toxicant, 2-chloroacetamide, was used to validate the test methods. However, only 5% mortality was observed in the reference group instead of the expected 50%. The results of the reference treatment test indicate the experiment did not function properly and indicate that the actual toxicity of chlorfenapyr is higher than predicted.

No mortality was reported in the adults from sublethal exposure to AC 303,630 3SC at application rates up to 1.34 lbs ai/acre. Additionally, no differences were observed in either adult weight or the number of juveniles present at the end of the test. The positive control, benomyl produced significant ($p<0.05$) effects on earthworm weight, number of juveniles produced, and food consumption in accordance with a provision for clear sublethal effects as outlined in the testing protocol.

Terrestrial Field Testing

A terrestrial field test using the chlorfenapyr was requested by EEB on November 4, 1994, because the active ingredient is in a new class of pesticides (pyrroles) and has an entirely new mode of action (uncouples oxidative phosphorylation in the mitochondria). The field study request specifically stated methods in the Guidance Document for Conducting Terrestrial Field Studies (1988)[4], and recommendations of the Avian Effects Dialogue Group[5] be used in designing the field test.

The registrant has submitted the following five studies towards fulfilling this requirement (Table 12): a simulated field (pen) test and a dermal toxicity test with the northern bobwhite; an avian census of southern cotton fields and a field dissipation study of a single dose (0.2 lbs ai/acre) on cotton. In addition, the registrant has submitted two proposed study protocols. One protocol outlined methods to be used in an avian census study and another protocol detailed methods to be used in a habitat utilization study of red-winged blackbirds. Much of the information gained from the studies mentioned above can be used in this risk assessment. However, portions of some studies were rejected by EEB scientists due to unacceptable methods. None of the submitted studies meet the requirement of a field study.

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[4] Fite, E.C., L.W. Turner, N.J. Cook, and C. Stunkard. 1988. Guidance document for conducting terrestrial field studies. USEPA. EPA 540/09-88-109.

[5] Avian Effects Dialogue Group. 1989. Pesticides and Birds: Improving impact assessment. The Conservation Foundation.

Simulated Field Pen Study. Results from the simulated field (pen) study (MRID 438870-07 and 434928-14) indicate the active ingredient was not available to northern bobwhite. However, most of this study was invalid. One application was made to a cotton field at 0.35 lbs ai/acre. The high dose pen contained half treated cotton and half untreated field edge plants. The low dose pen was located in the plant zone bordering the treated field. The control pen was located in untreated cotton. Test birds were de-beaked and provided clean feed *ad libitum*. One mortality occurred in the low dose pen and two in the high dose pen. Despite the observed mortality, most of this study was invalid for the following reasons: 1) birds were not placed in the pens until after the chemical had dried; 2) birds were provided clean feed during the entire study; 3) birds were debeaked prior to the experiment; 4) one-half of the high dose pen was located in habitat which received no direct pesticide application. An average of 83.7 mg/kg was reported on cotton foliage in the high dose treatment pens after one application. This value is 1.8X the concentration predicted by Fletcher (1995)[6]. Chlorfenapyr residues were not detected on the sorghum in the high dose pen after the first application, indicating little deposition on adjacent vegetation from drift. Sorghum in the low dose pens, 25 feet from the treated field, received little detectable active ingredient.

Dermal Toxicity Study. A primarily dermal toxicity study (MRID 438807-07 and 434928-14) with northern bobwhite was conducted to assess the risk of exposure through contact via exposed skin, such as the feet, through the feather layers and limited oral ingestion via preening. The 16 birds per treatment level were placed in 1.7 x 1.4 meter pens containing cotton treated at rates up to 4X the recommended application rate. The exposure period started after the chemical had dried. Following a 24 hour exposure period the birds were held for 27 days. Clean feed and water was provided *ad libitum*. No mortality or differences in body weight occurred in any treatment group. Residues on cotton leaf samples collected in the 1X treatment group were 0.8X the concentration predicted by Fletcher (1995). Maximum residues found on cotton leaf samples were about 320 mg/kg for after four applications at 0.35 lbs ai/acre. This study was not designed to assess the affects of exposure to the wet chemical.

Avian Dietary Discrimination Study. An avian dietary discrimination test (MRID 438870-07) was conducted with the northern bobwhite to determine the aversion qualities of chlorfenapyr.

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[5] Fletcher, J.S. , J.E. Nellessen 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. Toxicol. Chem. 13(9):1383-1391.

Technical material was mixed into a commercial diet at concentrations up to 250 mg/kg-diet and each bird (male, female, adult and juvenile) was presented with both treated and clean feed. Changes in body weight, consumption of treated feed and mortality were the measured endpoints. No mortality, weight change, or food consumption changes were noted in the adults in any treatment group. However, five juveniles died at the 250 mg/kg-diet treatment level. Weight loss was reported in the juvenile treatment groups 250 mg/kg-diet by day 6; and in the 140 mg/kg for and 250 mg/kg-diet treatments by day 10. At the 250 mg/kg-diet treatment level, consumption of treated feed by juveniles was lower than the controls during the first 5 days of the test. It was reported that the northern bobwhite could not reliably discriminate feed treated with methiocarb, a known avian repellent, at concentrations less than or equal to 600 mg/kg-diet. The adult quail tested for aversion to chlorfenapyr did not alter their food consumption at concentrations up to 250 mg/kg-diet. Since 250 mg/kg-diet was the highest concentration tested it is not possible to determine if chlorfenapyr has similar repellency properties to adult quail as methiocarb. However, no deleterious effects were observed in the adults at the highest concentration. Juveniles on the other hand were notably impacted at concentration above 70 mg/kg.

Avian Census (1993). A detailed census of the avian community in and around cotton fields was conducted in Arizona, Texas and Mississippi/Alabama, in 1993 (MRID 434928-14). EFED considers this study as a preliminary attempt to classify potential study locations in terms of vegetative type and structure, avian community structure, and avian use patterns to better design a future field study during which PIRATE will be applied. Approximately 175 surveys were conducted in each state. These were subdivided into plots representing riparian, agricultural and scrub/forest communities. Results of the surveys included the total number of individuals and species observed, most abundant species, avian community diversity, avian use of cotton fields and incidental wildlife observations. The five most common species observed during censuses are listed in Table 13.

Generalizing over all three regions, avian abundance was greatest in Arizona, nearly twice that of Mississippi/Alabama and more than twice that of Texas. Avian abundance and use of cotton fields increased as the growing season progressed. Time periods immediately prior to harvest had the greatest avian use. Forest and riparian habitats had the greatest avian abundance and diversity with the exception of Arizona study sites. Among all habitat types, upland forest sites in the southeast were the most diverse. Sites in Arizona adjacent to agricultural habitats had low avian diversity but high abundance due to high numbers of red-winged blackbirds. Species richness was highest in Arizona and Mississippi/Alabama

Avian Census (1995) In 1995, another detailed non-guideline avian census of cotton fields in Arizona, Texas, Mississippi, and Alabama was conducted (MRID 444642-02). Submitted to EFED in January 1998, the study has been subjected to a preliminary review. The data from this study were incorporated only into the risk characterization portion of this risk assessment. Twelve cotton fields from Texas, twelve fields from Arizona, and twelve fields from Alabama and Mississippi were subjected to systematic field observation from June 8 to August 27, 1995. Avian censuses were taken during three separate periods between June and August and involved 8-minute visual observations taken three times per period for a total of nine 8-minute observation periods per cotton field. In addition, six 1-hour observation periods were conducted on each field for the purposes of surveying avian activity within the cotton fields.

A total of 54 bird species were identified as occurring in and around Arizona Fields; 47 species in Texas fields; and 54 species in Alabama and Mississippi fields. Of the total observations of birds in and around Arizona fields, 60% to 69% of the observations were for birds actually observed in cotton fields. In Texas, 21% to 27% of observations were for birds in fields. Approximately 11% to 24% of all observations for birds in and around Alabama and Mississippi fields were for birds actually within field borders.

Study for Acute Effects (Carcass Searches and Radiotelemetry). MRID 444526-16 presents the results of an avian telemetry/census and wildlife carcass search study of cotton fields treated with a single chlorfenapyr application 0.35 lb ai/A. This study was submitted to EFED in December 1997. This study was designed to evaluate acute effects in avian species from treatment of cotton fields with chlorfenapyr. This field study has not undergone a formal data evaluation at this time. It should be noted that past EFED recommendations for avian field testing have stressed the need to evaluate reproduction effects. The above study was not designed to measure such effects in the field.

Field Monitoring

MRID 438870-01 presents three reports summarizing wildlife mortality associated with single field applications of up to 0.2 lbs ai/acre. These monitoring efforts are of varying intensity and quality. However none were extensive enough to refute the risk to terrestrial wildlife. No dead or debilitated animals were found in any monitoring effort.

Mississippi State wildlife personnel conducted surveys in a total of 33 treated fields. The surveys included 70.3 acres of habitat adjacent to treated fields. No surveys were conducted within the treated fields. Thirty-six percent of the surveys were conducted within the first 24 hours after application, 33% between 24 and 48 hours post-application, the remaining surveys were conducted 2,3, and 4 days post-application. Twenty-six species were observed, of which 72% of all individuals were mourning dove, sparrows, cowbirds or red-winged blackbirds.

Alabama surveys were conducted by one individual and included 16 treated fields. The surveys encompass 20.4 miles of treated field (30%) and adjacent habitat (70%) transects. One, two, and five surveys were conducted within 24 hours, 48 and 72 hours of treatment, respectively. Twenty six species were observed within the treated field. The four most common species within the fields were the indigo bunting, cardinal, red-winged blackbird and mourning dove.

Georgia State wildlife personnel conducted four surveys. Elapsed time between treatment and surveys ranged from 3 to 15 days. The author of the report stated no general conclusions should be drawn from the surveys regarding the effect of chlorfenapyr due to the excessive time between the application and survey.

Toxicity to Aquatic Animals

Freshwater Fish Acute Toxicity

Two freshwater fish toxicity studies using the technical grade of the active ingredient are required to establish the toxicity of a pesticide to freshwater fish. One study should use a coldwater species (preferably the rainbow trout), and the other should use a warmwater species (preferably the bluegill sunfish). In addition to these required tests, the registrant has also submitted a channel catfish (*Ictalurus punctatus)* study. The results of these tests are listed in Table 14.

The results indicate that chlorfenapyr is very highly toxic to fish on an acute basis. The guideline requirement (72-1) is fulfilled.

In addition, two freshwater fish toxicity tests were conducted on the major degradates. The results of the major degrade, CL 312,094 (the desbromo derivative of the parent compound) is in Table 15.

The results indicate that the metabolite CL 312,094 LC_{50} is greater than the highest test concentration. Consequently, the toxicity cannot be characterized for freshwater fish. However, since this degradate is less toxic than the parent compound, additional data will not be required at this time. The guideline requirement (72-1) is fulfilled for this degradate.

A rainbow trout acute toxicity test for CL 357,806, the degradate produced by photolysis in water, (MRID No. 438870-08) was classified invalid. A quantitative toxicity endpoint suitable for use by EFED in risk assessments could not be established for this study because of failure to measure the test concentrations as required. The data, if accurate, would suggest that this compound is more toxic than the parent and perhaps classify it as very highly toxic. Therefore, the guideline (72-1) is not fulfilled for this degradate. However, since photolysis in water is not expected to be a major fate pathway, the EEB is not requiring this study be repeated at this time.

Additionally, bluegill sunfish were tested with the soil metabolites CL 303,267 and CL 325,195. These tests were considered supplemental since chemical analyses were not performed and test concentrations were only measured at the initiation of the tests. The tests may be up-graded to core status if chemical characteristics such as solubility and adsorbing tendencies could be demonstrated. **However, until tests are upgraded to core status, the test results cannot be utilized in a risk assessment.** The purported LC_{50}s of the bluegill studies are less toxic than the parent. The results of the studies are presented in Tables 16 and 17.

Freshwater Fish Chronic Toxicity

Data from a fish early life-stage test using the technical grade of the active ingredient are required if the product is applied directly to water or expected to be transported to water from the intended use site, and when any **one** of the following conditions exist: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity; (2) any acute LC_{50} or EC_{50} is less than 1 mg/L; (3) the EEC in water is equal to or greater than 0.01 of any acute EC_{50} or LC_{50} value; or (4) the actual or estimated environmental concentration in water resulting from use is less than 0.01 of any acute EC_{50} or LC_{50} value and any one of the following conditions exist: studies of other organisms indicate the reproductive physiology of fish may be affected, physicochemical properties indicate cumulative effects, or the pesticide is persistent in water (e.g. half-life greater than 4 days). The preferred test species is rainbow trout. All the conditions stated above apply for chlorfenapyr except for condition (4). Results of this test are listed in Table 18. The results indicate that toxicological effects based on mortality first appeared at the 7.64 $\mu g/L$ level. The guideline requirement (72-4) is fulfilled.

A fish life-cycle test using the technical grade of the active ingredient is required when an end-use product is intended to be applied directly to water or is expected to transport to water from the intended use site, and when any of the following conditions exist: (1) the EEC is equal to or greater than one-tenth of the NOEL in the fish early life-stage or invertebrate life-cycle test or; (2) studies of other organisms indicate the reproductive physiology of fish may be affected. The preferred test species is the fathead minnow. A fathead minnow study (MRID 443648-03) was reviewed and classified as Invalid because both control and solvent control appear to have been contaminated. Additionally, measured concentrations at all treatment levels were highly variable. This test must be repeated.

Freshwater Invertebrate Acute Toxicity

A freshwater aquatic invertebrate toxicity test using the technical grade of the active ingredient is required to assess the toxicity of a pesticide to freshwater invertebrates. The preferred test organism is *Daphnia magna*, but early instar amphipods, stoneflies, mayflies, or midges may also be used. Results of this test is listed in Table 19. The results indicate that chlorfenapyr is very highly toxic to aquatic invertebrates on an acute basis. The guideline requirement (72-2) is fulfilled.

In addition, a freshwater aquatic invertebrate test toxicity test was conducted on the major photolytic degradate in water, CL 357,806. The results of this study are listed in Table 20.

The results indicate that CL 357,806 is highly toxic to freshwater aquatic invertebrates. Since the LC_{50} of 18 $\mu g/L$ is less toxic than the parent compound additional testing will not be required for this degradate at this time. However, no data was submitted for the major degrade, CL 312,094 (the desbromo derivative of the parent compound), and the registrant does not explain the reason for the non-submission of data. Further acute testing for the desbromo compound will be considered after an explanation is submitted.

Acute tests for the soil metabolites CL 312,094, CL 325,195, and CL 303,267 were also submitted for the freshwater invertebrate *Daphnia magna*. These tests were considered supplemental since chemical analyses were not performed and test concentrations were only measured at the initiation of the tests. The tests may be up-graded to core status if chemical characteristics such as solubility and adsorbing tendencies could be demonstrated. **However, until tests are upgraded to core status, the test results cannot be utilized in a risk assessment.** The purported LC_{50}s for the bluegill are less toxic than the parent. The results are presented in the Tables 21 through 23.

Freshwater Invertebrate Chronic Toxicity

Data from an aquatic invertebrate life-cycle test using *Daphnia magna* are required if the product is applied directly to water or expected to be transported to water from the intended use site, and when any **one** of the following conditions exist: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity; (2) any acute LC_{50} or EC_{50} is less than 1 mg/L; or (3) the EEC in water is equal to or greater than 0.01 of any acute EC_{50} or LC_{50} value; or (4) the actual or estimated environmental concentration in water resulting from use is less than 0.01 of any acute EC_{50} or LC_{50} value and any of the following conditions exist: studies of other organisms indicate the reproductive physiology of invertebrates may be affected, physicochemical properties indicate cumulative effects, or the pesticide is persistent in water (e.g. half-life greater than 4 days). *Daphnia magna* is the preferred test species. All the conditions stated above apply for chlorfenapyr except for condition (4). Results of this test are listed in Table 24.

The results indicate that toxicological effects based on mortality first appeared at the 7.7 μg/L level. The guideline requirement (72-4) is fulfilled.

Estuarine and Marine Animal Acute Toxicity

Acute toxicity testing with estuarine and marine organisms (fish, shrimp and oyster embryo-larvae or shell deposition) using the technical grade of the active ingredient is required when an end-use product is intended for direct application to the marine/estuarine environment or is expected to reach this environment in significant concentrations. The preferred test organisms are the sheepshead minnow, mysid, and eastern oyster. Estuarine/marine acute toxicity testing is required for chlorfenapyr because the end-use product is expected to reach the marine/estuarine environment in significant concentrations. Results of these tests are listed in Table 25.

The results indicate that chlorfenapyr is very highly toxic to marine/estuarine organisms on an acute basis. The oyster shell deposition study (MRID 434928-17) was invalid due to inadequate growth in controls (< 2mm). Since an embryo-larvae study was not conducted, this study must be repeated. During the last submission of data (January 1998) neither a new shell deposition study nor an embryo-larvae study were submitted. The guideline requirement (72-3) still remains unfulfilled.

Estuarine and Marine Animal Chronic Toxicity

Data from estuarine/marine fish early life-stage and aquatic invertebrate life-cycle toxicity tests are required if the product is applied directly to the estuarine/marine environment or expected to be transported to this environment from the intended use site, and when any **one** of the following conditions exist: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity; (2) any acute LC_{50} or EC_{50} is less than 1 mg/L; (3) the EEC in water is equal to or greater than 0.01 of any acute EC_{50} or LC_{50} value; or (4) the actual or estimated environmental concentration in water resulting from use is less than 0.01 of any acute EC_{50} or LC_{50} value and any of the following conditions exist: studies of other organisms indicate the reproductive physiology of fish and/or invertebrates may be affected, physicochemical properties indicate cumulative effects, or the pesticide is persistent in water (e.g. half-life greater than 4 days). The preferred test organisms are the sheepshead minnow and mysid. All the conditions stated above apply for AC 303,630 except for condition (4). Results of this test are listed in Table 26.

The results indicate that toxicological effects based on mysid shrimp mortality first appeared at the 0.385 $\mu g/L$ level. The chronic sheepshead minnow study (MRID 434928-20) was invalid due to low dissolved oxygen levels throughout the experiment. This study must be repeated. Therefore the guideline requirement (72-4) is not fulfilled.

An estuarine/marine fish life-cycle test using the technical grade of the active ingredient is required when an end-use product is intended to be applied directly to water or is expected to transport to water from the intended use site, and when any of the following conditions exist: (1)

the EEC is equal to or greater than one-tenth of the NOEC in the fish early life-stage or invertebrate life-cycle test or; (2) studies of other organisms indicate the reproductive physiology of fish may be affected. The preferred test species is the sheepshead minnow.

An estuarine/marine study (MRID 443648-02) was reviewed and classified as Invalid because the control appears to have been contaminated. Additionally, mean measured concentrations were approximately 50% of nominal. Because the sensitivity of the analytical procedures ranged from 0.05 to 0.3μg/, it is possible that the solvent control contained as much as 2.7 μg/L chlorfenapyr. Therefore, this test must be repeated.

Aquatic Field Testing

Due to the aquatic concerns resulting from the use of chlorfenapyr the registrant submitted a microcosm study "to develop an understanding of the potential impact of the chemical on aquatic organisms under conditions more representative of an actual environmental application".

As explained in the abbreviated review, since EPA has no protocol or guidance documents for the review of microcosm studies, the results from this microcosm review can only be used as supplemental information. It was noted in the review that 90% and 100% mortalities for fish (bluegill sunfish) were observed at nominal concentration of 30 and 300 μg ai/L (11.33 and 221.32 μg ai/L measured concentrations), respectively.

Sediment Toxicity

To address the question of bioavailability of chlorfenapyr to benthic organisms sediment toxicity testing is required. At the time EPA requested this testing, the only protocol which had been fully developed was a 10-day acute sediment toxicity test. However, at this time EPA has developed a guideline protocol for a 28-day chronic sediment test. An acute sediment toxicity test for the freshwater amphipod *Hyallella azteca* was reviewed (MRID 444526-19). The results are presented in Table 27. The results indicate that mortality occurs to sediment dwelling organisms such as *Hyallela azteca* at a level of 19.6 mg/kg.

The marine amphipod has only just recently been submitted, and has not yet been subjected to a formal data evaluation by EFED. However, according to the results submitted by the registrant the measured 10-day acute LC_{50} was 0.18 mg/Kg for the marine amphipod *Leptocheirus plumulosus*.

Toxicity to Plants

Terrestrial Plant Toxicity

Currently, terrestrial plant testing is not required for pesticides other than herbicides, except on a case-by-case basis (e.g. labeling bears phytotoxicity warnings; incident data or literature which demonstrate phytotoxicity).

Aquatic Plant Toxicity

As with terrestrial plants, currently, aquatic plant testing is not required for insecticides or other classes of pesticides, except on a case-by-case basis (e.g. labeling bears phytotoxicity warnings; incident data or literature which demonstrate phytotoxicity).

EXPOSURE ASSESSMENT

Terrestrial Avian and Mammalian Exposure Assessment

Exposure estimates for avian and mammalian organisms in previous risk assessments for chlorfenapyr on cotton have been based either on the EFED approach using the Kenega nomograph (as modified by Fletcher et al., 1994)[7], or on an exposure estimation method founded on the assumptions of ubiquity and stability of chlorfenapyr and the use of predicted soil residues as a surrogate for other exposure media[8].

The subsequent availability of measured chlorfenapyr residues in avian and mammalian food items prompted the registrant to prepare an avian risk assessment incorporating such data for exposure estimating purposes. For this risk assessment EFED has elected to include these same residue

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[7] Section 3 EFED Assessment (DP Barcode: 210808)

[8] Ecological Risk Assessment Briefing Packet for Chlorfenapyr, May 1, 1997

data into the exposure assessment. This risk assessment incorporates such data in estimating avian and mammalian dietary exposures. Because the time periods for collection of samples for different avian food item residue studies were not completely consistent across all studies (e.g., weed seed head samples were collected on days 1,3, 15 after initial application whereas insect larval samples were not collected on these days) it became necessary, for exposure modeling purposes, to include a subset of residue data points in common to all studies.

The assessment does not quantify exposures associated with oral ingestion during preening, ingestion of pesticide via drinking water, dermal exposures due to contact with treated surfaces, inhalation of pesticide volatilized to air or associated with suspended particulate. Because the available residue data are limited to studies of a few cotton fields, the avian and mammalian risk assessments do not factor in the impacts of local environmental conditions as they relate to the spacial and temporal distribution of pesticide residues in the field.

Residues in Dietary Items Adjusted to Label Conditions

The registrant has submitted a variety of studies that present post application concentrations of chlorfenapyr in cotton plants, weed seeds, weed seed heads, and insects. Brief synopses of the studies used in this EEC estimation approach are described in the environmental fate section of this document. The residue data selected as the basis for estimating avian and mammalian exposures are from MRID 444526-08 and MRID 444642-01.

<u>Weed Seed Head Residues</u>

Table 2 presents the data for weed seed heads and weed seeds from MRID 444526-08. The weed seed head data for each combination of treatment and sampling interval represents the results of a single composite sample. The measured values for weed seeds represent primarily the results of single sample analyses, but at times are the results of averages of multiple analyses of the same sample. A brief comparison of the composite weed seed head samples and the average concentrations of chlorfenapyr on weed seeds suggests that the two sets of data are roughly equivalent. Therefore, the more extensive data set on weed seed heads was selected as the basis for estimating concentrations of chlorfenapyr residues for in-field seeds in the avian and mammalian diet. EFED has used these data in this current risk assessment with reservation. The assessment results based on these data likely do not represent maximal potential residues in weed

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seeds or heads and, by extension maximal exposure levels for organisms feeding of weed seeds. By collecting composite samples across the plots, any variability associated with the spacial distribution of chlorfenapyr residues across the fields is lost. It is not known how high maximal residues levels were in the treated plots. Furthermore, data from a single field are not representative of environmental conditions for cotton fields across the cotton-growing portions of the United States.

Because the field study generating these data was conducted prior to the revised label rates, the application rates used in the study do not exactly match the new proposed label rate. To address the problem of non-matching application rates, weed seed head residues for tested application rates similar to the label rates were assigned to label rates as surrogate residues. It should be noted that the measured residues are likely underestimates of maximum possible residues because the treatment interval employed in the field was 7 days while a 5-day treatment interval is allowable under the proposed label. In addition, the use of composite samples in the available data does not address the potential for avian exposures as a result of feeding in localized areas of high residues as a result of non-uniform application. Table 28 presents estimated weed seed head residues for each application strategy allowed for on the proposed label. To estimate weed seed head residues at label rates, residue values for the closest tested application rate were multiplied by the ratio of label application rate to tested application rate (e.g., residues for a 0.2 lb ai/A application rate were estimated by multiplying the 0.18 lb ai/A application rate measured residues by the ratio of 0.2/0.18). Residue data from MRID 444526-08 were limited for each pest control application scenario to the actual number of applications allowed per year under the proposed label.

With respect to the output in Table 2, the rationale for estimating residues for shorter time periods for the 0.2, 0.25, and 0.35 lb ai/A application scenarios is as follows. Because the data from MRID 444526-08 involved three consecutive applications of chlorfenapyr, the full set of residue data cannot be directly applied to label application scenarios with less than three applications. If one used data following the last one or two applications, there would be overestimations of the residues in weed seeds that would not be consistent with label limitations. Therefore, although the MRID 444526-08 data set extends for all application rates to 56 days after first application, the residues for applications at 0.2, 0.25, and 0.35 lb ai/A were limited to only the sampling periods encompassed by either the first or second applications.

Because no residue studies for the fruits of wildlife-used plants have been submitted to the Agency, weed seed head residue data were used as a surrogate for fruits. The avian risk assessment prepared by the registrant (MRID 444779-01) used European study residue data for commercial fruit crops as a surrogate for fruits in wildlife fruits. EFED elected not to use this approach because these studies have not been submitted to the Agency, and the types of fruits used in the registrant's risk assessment included such items as tomatoes, which are not likely to be representative of the very small wild plant fruits likely to be encountered by wildlife.

Insect Residues

For the purposes of this risk assessment, data on the residues of chlorfenapyr in armyworm larvae (MRID 444642-01) were used to represent in-field insect residues potentially available to terrestrial birds and mammals feeding in cotton fields. The larvae were selected over the adult moths, as it is the occurrence of egg masses and hatching larvae that would trigger the application of chlorfenapyr and therefore offer the most probable route of exposure to avian species feeding on insects from the cotton fields.

Because the chlorfenapyr application rates employed in the beet armyworm residue study do not reflect the application rates allowed for by the proposed label, EFED adjusted the insect residues to account for these differences by multiplying the residue levels by the ratio of label application rate to test application rate. This adjustment conservatively assumes a linear relationship between application rate and insect residue level. The conservatism associated with this assumption comes from the observation in MRID 444642-01 that higher application levels do not necessarily result in higher insect residues. The registrant has postulated that once an insect lethal oral dose is achieved, the insects reduce or stop feeding. Because the armyworm larva study only presents data for a single application, a method for accounting for the effect of multiple application scenarios on insect residues was developed. The method essentially added residues from each subsequent application at a discrete time period. For example, with a seven day application interval, insect residues at 7.1 days after the first application were calculated as the residue value for a single application at 7 days post-treatment plus the residue for a second application as estimated from the 0.1 day residue for a single application. For the purposes of this risk assessment, a 7-day application interval was selected to remain consistent with the weed seed head residue data. It should be noted that the label allows for a 5-day application interval, so the residue estimates used in this risk assessment do not reflect a worst-case estimate. For the purpose of simplifying presentation and analysis, residue data estimates were limited to a time period of 0.1 to 28.1 days after the first application. Table 29 summarizes these results.

Cotton Residues as Surrogate for Forage

While residues have been measured in weed seeds, there are no data for residues in other portions of weed and grasses that could potentially be used as dietary items for small herbivorous mammals. Data from MRID 444642-01 presents the most complete data set for residues of chlorfenapyr on cotton plants. While cotton plants themselves may not be a principal source of vegetative forage for small mammals, the residue data for cotton is very close to concentrations of chlorfenapyr predicted by the standard EFED approach on short-grass forage, that would otherwise serve as the basis for residue-based exposure estimates. Therefore, these cotton data were used as a surrogate for forage plants. Table 30 presents chlorfenapyr forage residues, corrected for label application rates and number of applications. The data have been limited to a 28-day window to be consistent with other time-limited dietary item predictions.

Soil Residues

Soil residues were estimated on the basis of application rate for a 0-3 cm depth interval. A 3 cm depth was assumed to be the likely maximum depth of soil available for incidental ingestion by avian species using cotton fields. Chlorfenapyr concentrations in soil were calculated for each application scenario, using a multiple application interval of 7 days to be consistent with the interval employed in field/laboratory residue studies for avian food items. Because of the temporal limitation of the avian food item residue data (discussed below), soil residues were estimated to a maximum of 28 days following first application, and incorporated a 90 percent upper confidence limit half-life of 496 days. It should be noted that the proposed label allows for 5-day application intervals. The use of a 7-day interval in this risk assessment represents a less than worst-case scenario, although the long half-life employed in calculating soil residues suggests that the application interval difference would not greatly affect soil residue estimates. Table 31 presents the results of soil residue estimates.

Calculating Avian and Mammalian Dietary Exposure Levels

In preparation of their own risk assessment (MRID 444779-01), the registrant presented field and literature data on the species of birds that occur in cotton fields. The species selected for the risk assessment include Carolina wren, white-eyed vireo, northern cardinal, blue grosbeak, mourning dove, red-winged blackbird, and mallard duck. The first six species listed were selected from an exhaustive list of species known from the literature and empirical observation data of bird species in cotton fields and for which there existed published data on dietary characteristics. The mallard duck was considered a migratory transient, stopping to rest but not necessarily feeding in cotton fields. For the purposes of this risk assessment, EFED used the same species (with the exception of the mallard duck) as surrogates for birds using cotton fields. The mallard duck was excluded from the surrogate species list as it is expected that exposure for non-feeding birds in cotton fields would be minimal.

With respect to mammalian receptors, no intensive census of species use of cotton fields has been submitted by the registrant. However, trapping and carcass data from MRID 444526-16 indicate that a number of rodent species occur in cotton fields. Trapping data from MRID 444526-16 revealed that *Peromyscus* species accounted for 7 of 11 small mammals recovered. From the data in MRID 444525-16, and the availability of biological data on the closely-related deer mouse (*Peromyscus maniculatus*), EFED selected the white-footed mouse (*Peromyscus leucopus*) as a surrogate for small mammals known to occur in cotton fields.

Pastorok et al. (1996)[9] has summarized a basic chemical intake model for wildlife species to calculate a dietary exposure dose for a given chemical of concern and a given receptor species. The general formula for this basic chemical intake model is as follows:

$$IR_{chemical} = \sum (C_i)(M_i)(A_i)/W$$

where: $IR_{chemical}$ is the species-specific total rate of intake of chemical by ingestion (mg/kg-bw/day)

[9]Pastorok, R.A., M.K. Butcher, R.D. Nielsen. 1996. Modeling wildlife exposure to toxic chemical; trends and recent advances. Human and Ecological Risk Assessment 2:444-480.

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C_i is the chemical concentration in medium I (mg/kg) (soil and dietary components)

M_i is the rate of ingestion of medium I (kg/day)

A_i is the gastrointestinal absorption efficiency of the chemical in medium I relative to absorption in laboratory toxicity tests

W is the body weight of the receptor species (kg)

This basic model was used to estimate oral dose exposures for the six surrogate avian species and one mammalian species selected for risk assessment. Because of a lack of data regarding gastrointestinal absorption efficiencies both in the available toxicity studies and for free-living receptors, the absorption efficiency (A_i) for all species was conservatively assumed to be 100% or 1.0. The registrant has presented a kinetics-based argument that chlorfenapyr in soils is essentially non-bioavailable as compared to chlorfenapyr associated with dietary items (MRID 444779-01). In addition, supplemental information (Ahmed 1998b)[10] has been submitted by the registrant that suggests that aged chlorfenapyr residues are of low extraction efficiency under acidic conditions approximating the avian gut. However, the soil extractions for this supplemental study were performed on samples collected from the field 180 days post-treatment and stored for almost 4 years. The registrant has cited a number of studies in the above submissions that suggest that the sorption affinity of organic compounds to soils increases as residues age. Therefore, the 180-day sample extractions on samples collected almost 4 years earlier have little applicability to the question of the bioavailability of chlorfenapyr from soil within the comparatively short 4-week post-application exposure period modeled in this risk assessment. While there exists the possibility for differential bioavailability between diet and soils, there are insufficient data relative to chlorfenapyr absorption efficiency by avian and mammalian species in any medium to develop a quantitative relationship between media. For soil exposure, EFED has assumed 100% bioavailability but has chosen a very low incidental soil ingestion rate for each receptor species assessed.

The model used for estimating oral dose exposure for each species was based on a simple four-component model that considered incidental ingestion of soil and consumption of invertebrates

[10]Ahmed, Z. 1998b. Memorandum (with attachments) from Zareen Ahmed, Product Registrations Manager, American Cyanamid to Ann Sibold, Registration Division, USEPA/OPP, May 15, 1998.

(i.e., larval armyworms), seeds, and fruit or vegetative fodder. The equation describing this model is as follows:

$$\text{exposure mg/kg-bw/day} = \frac{(C_{insect}\ \text{mg/kg})(\text{kg insect/day}) + (C_{seed}\ \text{mg/kg})(\text{kg seed/day}) + (C_{fruit\ or\ plant}\ \text{mg/kg})(\text{kg fruit or plant/day}) + (C_{ss}\ \text{mg/kg})(\text{kg soil/day})}{\text{kg body weight}}$$

where: C_{insect}, C_{seed}, and C_{ss} are the estimated concentration in insects, seeds, and soils (0-3 cm) as reported in Tables 28, 29, 31. C_{fruit} is the concentration of chlorfenapyr residue in fruit of non-target plants of treated fields. No data have been submitted for concentrations in non-target fruits, therefore C_{fruit} is estimated by the corresponding C_{seed} value from Table 28. C_{plant} is the concentration of chlorfenapyr in other vegetative forage for small mammal receptors as estimated by the cotton plant vegetative residue data from Table 30.

kg insect, seed, fruit, or plant is the mass in daily diet attributable to the component for each species as a function of allometric relationships for field metabolic rate, food item gross energy, and assimilation efficiency from USEPA (1993)[11] (See Tables 32 and 33)

kg soil is the product of the total dietary intake of the organism (Tables 32 and 33) and an assumption of incidental soil ingestion at a rate of 2% of dietary intake. This function is based on the lowest fraction of diet recorded by Beyer et al. (1993)[12] for avian species and for the meadow vole and is <u>not</u> conservative.

kg body weight is the average body weight of adult birds from Dunning

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[11]USEPA. 1993. Wildlife Exposure Factors Handbook. Chapter 4. EPA/600/R-93/187b, Office of Research and Development, United States Environmental Protection Agency.

[12]Beyer, W.N., E.E. Connor, S. Gerould. 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manage. 58:375-382.

(1984)[13] or average adult bodyweights of mammals (EPA 1993)[6]

Table 32 presents the bodyweights, and feeding characteristics for each of the six surrogate avian species. Table 33 presents similar data for the white-footed mouse.

Tables 34 through 40 present the daily oral dose estimates for each avian and mammalian species for all potential application senarios.

Aquatic Organism Exposure Assessment

In an earlier EFGWB assessment, chlorfenapyr was characterized as extremely persistent with an aerobic soil metabolic half-life of 3.8 years and a strong tendency to adsorb to soil (Kd_{ads} = 32-155, Kd_{des} = 67-362) and pond. For these reasons, the EEB requested the Surface Water Section of the Environmental Fate and Ground Water Branch to use environmental fate and transport computer models to calculate more refined EECs. The Pesticide Root Zone Model (PRZM2, version 2.3) was used to simulate pesticides in field runoff. The Exposure Analysis Modeling System (EXAMS II) was used to simulate pesticide fate and transport in an aquatic environment (1-hectare body of water 2-meters deep receiving runoff from 10-hectare field).

[13]Dunning, J.B. 1984. Bodyweights of 686 Species of North American Birds. Western Bird Banding Association Monograph 1.

Some of the environmental fate parameters used in the model for this pesticide were:

Soil K_{oc}	11,500 L/Kg
Aerobic Soil metabolism half-life	3.8 years
Anaerobic Soil metabolism half-life	2.0 years
Solubility	0.13 mg/L
Photolysis half-life	15 days

The EECs generated from the EXAMSII/PRZM2 runoff model were presented in earlier risk assessments and are not presented here. Two scenarios were chosen for modeling. The Mississippi site was chosen because it presented a high potential for runoff, while the Texas site was chosen because of the high level of cotton production in the state.

Subsequent to this early EXAMS/PRZM2 assessment, additional environmental fate data have been made available to EFED and significant updates to the PRZM model have been completed. Review of these new data and the advent of concerns regarding potential effects on sediment organisms prompted EFED to re-evaluate the potential for chlorfenapyr to enter and persist in surface water and sediments. To further refine the chlorfenapyr exposure assessment, the Multiple Scenario Risk Assessment Tool (MUSCRAT) was used. MUSCRAT is designed to give a spatial and temporal distribution of EEC's for each of the predominant USDA Census of Agriculture regions (4, 6, 7, 11) in which cotton is grown and utilizes the updated version of the PRZM model. (Note: MUSCRAT more precisely quantifies the upper 90th percentile confidence bound previously assumed by the PRZM model, but does not change *individual* PRZM model outputs. However, MUSCRAT has not been adopted as standard practice for EFED risk assessment. MUSCRAT was used in this case to compare results with the modeling submitted by the registrant in MRID 444526-02). The EEC's presented graphically by the MUSCRAT program are the one-in-ten year return period concentration values for all of the cotton capable acreage in the four main growing regions.

The process used for using the MUSCRAT program was as follows:

1. Four USDA agricultural regions were selected for modeling, that represented more than 99 percent of cotton grown in the United States.

2. A series of cotton-growing sites were selected from each region to encompass the distribution of erosion and run-off vulnerabilities.

3. A PRZM/EXAMS modeling run (36-year) was performed on each selected site.

4. A 1-in-10 year exceedance probability set of concentrations (water column and sediment) was calculated from the PRZM/EXAMS run on each site.

5. These 1-in-10 year exceedance probability values were then combined for each site and region and the 90th percentile of that distribution of values was selected to represent the EECs for this assessment.

MUSCRAT inputs selected for this simulation by EFED are as follows:

Aerobic Soil Metabolic Half-life	496 Days
Aerobic Aquatic Metabolic Half-life	278 Days
Anaerobic Aquatic Metabolic Half-life	412 Days
K_{oc}	11,950
Solubility	0.12 mg/L
Molecular Weight	407.6
Vapor Pressure	4.0E-8
PRBEN	default (0.5)

Sediment input values were normalized for sediment Total Organic Carbon (TOC). Since the acute sediment toxicity study submitted did not report the TOC, a 6% value was used. This was derived under the assumption that the standard organic carbon in organic matter is about 58.8%. Since the organic matter content of the spagnum peat was 10%, the resulting TOC was calculated to be 6%.

The concentrations for the interstitial water (pore water) were not modeled because the moisture content of the sediment was not reported in the sediment toxicity study and therefore comparisons for the purposes of risk assessment were not possible.

The values for the MUSCRAT-predicted concentrations in the water column and sediment are summarized in Table 41. Also included in the table, for reference purposes, are water column concentrations calculated using EFED's standard cotton modeling scenario and PRZM3.2/EXAMS. As can be seen from this table, chlorfenapyr concentrations estimated for water and sediment are higher using the MUSCRAT program than those estimated with PRZM 3.1.2/EXAMS for USDA regions 4,6, and 7. Only in USDA Region 11 (California) are the MUSCRAT concentrations lower than the PRZM 3.1.2/EXAMS, though the difference is not great. Therefore, the MUSCRAT concentrations were selected as the generally more conservative concentrations for risk assessment purposes and represent a general methodology consistent with that used by the registrant in MRID 444526-02.

RISK ASSESSMENT and CHARACTERIZATION

Risk Quotient (RQ) and the Levels of Concern (LOC)

Risk characterization integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. The means of integrating the results of exposure and ecotoxicity data is called the quotient method. For this method, risk quotients are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic.

$$\text{risk quotient} = \frac{\text{exposure level}}{\text{toxicological endpoint}}$$

Risk quotients are then compared to OPP established levels of concern. These LOCs are criteria used by OPP to indicate potential risk to nontarget organisms and the need to consider regulatory action. More specifically, the criteria indicate that a pesticide, when used as directed, has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories:

o **acute high risk** - potential for acute risk is high; regulatory action may be warranted in addition to restricted use classification

o **acute restricted use** - the potential for acute risk is high, but this may be mitigated through restricted use classification

o **acute endangered species** - the potential for acute risk to endangered species is high; regulatory action may be warranted o **chronic risk** - the potential for chronic risk is high; regulatory action may be warranted

Currently, EFED has no procedures for assessing chronic risk to plants, acute or chronic risks to nontarget insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from the results of required studies. Examples of ecotoxicity values derived from the results of short-term laboratory studies which assess acute effects are:

- LC_{50} (fish and birds)
- LD_{50} (birds and mammals)
- EC_{50} (aquatic plants and invertebrates)
- EC_{25} (terrestrial plants)
- EC_{05} or NOEC (endangered plants)

Examples of toxicity test effect levels derived from the results of long-term laboratory studies which assess chronic effects are:

- LOEC (birds, fish, and aquatic invertebrates)
- NOEC (birds, fish and aquatic invertebrates)
- MATC (fish and aquatic invertebrates)

Generally, for birds and mammals, the NOEC value is used as the ecotoxicity test value in assessing chronic effects. Other values may be used when justified. For the purposes of this risk assessment the NOEC is used as the ecotoxicity test value in assessing chronic effects to fish and aquatic invertebrates.

Risk presumptions, along with the corresponding risk quotients and levels of concern, are listed in Table 42.

Risk Assessment for Nontarget Terrestrial Animals

Avian Acute and Chronic Risks

In this risk assessment, risk quotients were calculated on predicted daily oral exposures to parent chlorfenapyr, which were based on measured ("real") residue data for avian food items. In order to provide the reader with an idea of the relative risks for all application scenarios, risk quotients were calculated for each scenario.

Daily risk quotients reflect the ratio of daily oral dose to toxicological endpoint. For the purposes of this risk assesment all units (both oral dose and toxicological endpoint) have been normalized in terms of mass of chlorfenapyr per receptor organism body mass. This normalization process is important to note because it differs from the dietary concentration-based risk assesment practice employed in previous EFED risk assessments for chlorfenapyr and currently used in the registrant's avian risk assessment. The approach is intended to account for the effect of metabolic requirements on the ingestion of food per unit body mass. The proportion of body mass ingested as food increases as the mass of the bird species decreases. The net effect is that for any given dietary concentration of a pesticide, smaller birds will receive higher oral doses than larger birds per unit of bodyweight. It should be noted that this normalization process does not take into account the potential for higher metabolic rates to influence the sensitivity of a given avian species. In cases where metabolic activation is required for toxic action (i.e., the mixed function oxidase activation of chlorfenapyr to a toxic degradate), higher metabolism rates may result in increased sensitivity. Finally, this risk assessment does not consider potential interactions with other pesticidal chemicals used on cotton fields. Both the labels for Pirate and Alert products allow for tank mixes, and the Alert label indicates that repeated uses of the product should be interspersed with other pesticides of different modes of action. The lack of data concerning what other chemicals could be included in tank mixes or interspersed with chlorfenapyr applications and the paucity of toxicity data concerning the effects of mixtures precludes a quantitative assessment of increased risk associated with multiple-chemical exposures.

Because of the large number of risk quotients calculated for this risk asessment, Tables 43 through 45 present all risk quotients in tabular form by receptor species. To facilitate a more rapid evaluation of this information, Figures 4 through 9 present a comparison of toxicological endpoints with exposure for each of the six selected avian species known to occur in cotton fields and each basic chlorfenapyr application scenario. For the Figures 4 through 9, the single oral dose and the subacute dietary toxicity endpoints were multiplied by a factor of 0.5 to be consistent with the EFED high risk level of concern (RQ=0.5). From these figures it can be seen that all application scenarios result in daily oral dose level that exceed the chronic avian reproduction endpoint of 0.059 mg/kg/d (based on the NOEC 0.5 mg/kg diet for mallard ducks) for at least 14 days. If more than two applications of chlorfenapyr are made, the exposure models suggest that dietary exposure may exceed the chronic avian reproduction endpoint for a minimum of another 14 days (the duration of the exposure model was 28 days total, residue data permitting). In addition, the subacute lethal oral dose endpoint and/or the acute single oral dose lethal endpoint, adjusted for a high risk level of concern, are exceeded by the oral dose estimates for multiple days for all application rates for every modelled avian species.

In all modelled species for all application scenarios, for all time periods, exposures exceed chronic risk level of concern (1.0) by factors exceeding an order of magnitude. In addition, exposures exceeding acute endpoints result in RQs that exceed the high acute risk (0.5), restricted use (0.2), and endangered species (0.1) levels of concern. Tables 43 through 45 indicate that the high acute risk level of concern is exceeded for multiple days for every application scenario in all species but the mourning dove. For this species the lowest application scenario 0.075 lb ai/A does not trigger the acute high risk level of concern, but does trigger the restricted use level of concern at times of application.

These findings suggest that chlorfenapyr applications to cotton, consistent with labeled rates, number of applications, and non-conservative application intervals (7 days versus a minimum label of 5 days) pose acute and chronic risks to avian species known to utilize cotton fields. Based on the very high RQs encountered for reproductive effects throughout the modelled 28-day period, there appears to a be an extensive opportunity for avian species to be exposed to chlorfenapyr in the diet for sufficiently long periods of time and at more than sufficient dose levels to cause reproductive effects. In all application scenarios, exposures may be considered to represent high acute risks for most avian species modelled.

Mammalian Acute and Chronic Risks

In this risk assessment risk quotients for the mamalian receptor organism were calculated and are presented in a manner consistent with the avian receptors.

Table 46 presents the RQs for the selected mammalian receptor (white-footed mouse) for all treatment scenarios. Figure 10 presents a comparison of the estimated oral exposure levels with mammalian toxicity endpoints. For the purposes of Figure 9, the single oral dose and subchronic toxicity endpoints have been multiplied by a factor of 0.5 to be consistent with the EFED high risk level of concern (RQ=0.5).

Estimated oral exposures exceeded the chronic toxicity threshold at all application rates for multiple days. The acute single oral dose toxicity endpoint was not exceeded by the exposure estimates. The restricted use level of concern (0.2) is exceeded by exposures immediately following application for the 0.25 and 0.3 lb ai/A application rates. The endangered species acute level of concern (0.1) is exceeded by single oral doses for one or more days at all application rates. The subchronic oral dose toxicity endpoint is exceeded by oral dose estimates for all application scenarios for one or more days, and the restricted use (0.2) and endangered species (0.1) levels of concern are exceeded frequently over the 28-day modelling period for all application scenarios.

These results suggest that small mammals using cotton fields as sources of dietary materials are at risk for reproductive impairment and mortality.

Risks to Beneficial Insects

Currently, EFED has no procedure for assessing risk to nontarget insects. Results of acceptable studies are used for recommending appropriate label precautions. The high toxicity of chlorfenapyr to honeybees suggests a concern that chlorfenapyr will adversely impact beneficial insects. In particular, early applications of chlorfenapyr (i.e., mite control) at times of cotton inflorescence may adversely affect populations of pollinators.

Risk to Nontarget Aquatic Animals

The non-target aquatic risk assessment considers MUSCRAT-calculated EECs derived for the USDA Agricultural Regions 3,4,7, and 11.

Freshwater Fish

Acute and chronic risk quotients for freshwater fish are listed in Table 47. The results indicate that acute high risk, restricted use, and endangered species LOCs are exceeded for freshwater fish for aerial applications in regions 3, 4, and 7. The chronic risk LOC is not exceeded for freshwater fish when the 60-day EEC is employed. However, the finding that chronic risks are not anticipated is of low confidence because of the limited availability of chronic effects testing data in freshwater fish, and the persistence of the compound.

Freshwater Invertebrates

The acute and chronic risk quotients for freshwater invertebrates are listed in Table 48. The results indicate that acute high risk, restricted use, and endangered species LOCs are exceeded for freshwater invertebrates for aerial and ground applications in Regions 4, 6, and 7. Acute restricted use and endangered species LOCs are exceeded for Region 11. Chronic risk LOC are not exceeded for freshwater invertebrates.

Estuarine and Marine Animals

The acute and chronic risk quotients for two estuarine and marine organisms are listed in Table 49. The results indicate that acute high risk, restricted use, and endangered species LOCs are exceeded for marine/estuarine invertebrates for aerial and ground applications for all Regions. Only endangered species LOCs are exceeded for marine/estuarine fish. Chronic LOCs for marine/estuarine invertebrates are exceeded by factors ranging from 6.8X to 15.9X. Chronic LOCs for marine fish can not yet be determined since the fish life-cycle study (MRID 443648-02) has been determined to be Invalid and must be repeated.

Sediment-Dwelling Organisms

Acute risk quotients for the freshwater amphipod *Hyalellea azteca* are listed in Table 50. The results indicate that acute high risk, restricted use, and endangered species LOCs are not exceeded for freshwater amphipods for aerial and ground applications in Regions 4,6,7, and 11.

Although the marine amphipod study has yet to be reviewed and validated, the preliminary toxicity results (not fully reviewed by EFED) submitted by the registrant show a measured 10-day acute LC_{50} of 0.18 mg/kg for the marine amphipod *Leptocheirus plumulosus*.

Table 52 presents preliminary Risk Quotients for sediment-dwelling marine amphipods. The results submitted by the registrant suggest that acute high risk, restricted use, and endangered species LOCs are exceeded. The acute high risk level of concern is exceeded by factors ranging from 4.7 to 10.8 for aerial and ground applications in Regions 4, 6,7, and 11.

Risk to Nontarget Plants

Terrestrial and aquatic plant testing is not required for insecticides or other classes of pesticides, except on a case-by-case basis (e.g. labeling bears phytotoxicity warnings; incident data or literature which demonstrate phytotoxicity). Hence, terrestrial and aquatic plant risk assessments will not be accomplished at this time.

Endangered Species

Assessment of potential risks to avian and mammalian endangered species is limited by the receptor species selection process incorporated into this risk assessment. Direct application of the risk quotients calculated for avian receptors should be limited to endangered species of similar bodyweights and similar dietary habits. To this end, the calculated risk quotients suggest a potential for acute and chronic risks to endangered avian species that may (if any) utilize cotton fields. Similarly, aquatic EECs exceeding the endangered aquatic organisms levels of concern suggests the potential for run-off from cotton fields treated with chlorfenapyr to adversely affect endangered aquatic organisms. A listing of endangered animals potentially at risk from chlorfenapyr exposure in the cotton-growing areas is listed in Appendix A.

The Endangered Species Protection Program is expected to become final in the future. Limitations in the use of chlorfenapyr will be required to protect endangered and threatened species, but these limitations have not been defined and may be formulation specific. EPA anticipates that a consultation with the Fish and Wildlife Service will be conducted in accordance with the species-based priority approach described in the Program. After completion of consultation, registrants will be informed if any required label modifications are necessary. Such modifications would most likely consist of the generic label statement referring pesticide users to use limitations contained in county Bulletins.

Avian Risk Characterization

This risk assessment has expanded upon the estimates of dietary exposure for avian and mammalian receptor organisms through the incorporation of measured field residues not used in previous assessments of the risks of chlorfenapyr use on cotton. In addition, the risk assessment has moved from using generalized avian receptors to a consideration of avian census data and subsequent inclusion of avian species demonstrated to occur in and around cotton fields. Biological information for these identified representative avian species was considered in the construction of species-specific models of dietary exposure. Both dietary exposures and toxicological endpoints were expressed in terms of daily oral doses (mg/kg-bw/day) so that comparisons of exposure and toxicity could account for differences between food intake for receptor species and laboratory test species.

The results of the avian risk assessment strongly suggest that mortality of a number of bird species, with varying feeding strategies, can occur at numerous time periods over the course of cotton field treatment. In addition, the reproductive toxicity at very low exposure levels compared to measured residues in avian food items suggests that exposure opportunities within cotton fields are of sufficient magnitude and duration to pose important toxicological risks to the reproductive success of avian species.

Mortality and reproductive impairment of survivors pose important risk to the maintenance of viable populations of the avian species assessed in this risk assessment. Because these species are representative of the more than 50 avian species known to occur in and around cotton fields, the potential for adverse population impacts to many avian species from chlorfenapyr exposure is great. Table 51 presents the present trends in breeding bird populations of the avian species used in this risk assessment. These data originate from National Biological Service (Sauer et al. 1997)[14]. All the species included in this risk assessment exhibit downward trends in population in

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[14]Sauer, J.R., J.E. Hines, G. Gough, I. Thomas, B.G. Peterjohn. 1997. The North American Breeding Bird Survey results and Analyses. Version 96.4. Patuxent Wildlife Research center, Laurel, MD.

three or more cotton states since 1966. Four of the species (white-eyed vireo, mourning dove, northern cardinal, and red-winged blackbird) showed population declines that were highly statistically significant ($p<0.05$) in three or more states. While these data do not establish causality for population declines (a variety of factors are likely to contribute to population declines), they do suggest that populations of many bird species at a state-wide level of resolution could be sensitive to additional reproductive impairment and reduced survival rates from exposure to chlorfenapyr.

EFED risk concerns are further magnified by the potential to impact single representatives of threatened or endangered avian wildlife. In the case of these stressed populations, mortality and reproductive impairment of individuals could pose threats to the continued survival of a species.

However, EFED recognizes that there are a number of important issues, not addressed in the assessment above, that must be considered in order to further understand the terrestrial risk picture. These include information related to (1) the opportunity for avian species to use dietary resources from treated cotton fields; (2) the timing of application with respect to important life-history periods; (3) the geographical extent of treated cotton; (4) the importance of degradates to exposure and toxicity; (5) the stability of chlorfenapyr in treated fields; (6) application interval effects; (7) the importance of other routes of exposure; (8) species-specific toxicity; and (9) daily dose versus cumulative dose as a predictor of subacute lethal effects. These items are addressed below.

<u>The Impact of Data Concerning Avian Use of Cotton Fields Upon Risk Assessment Outcome</u>

Based on the information summarized in Figures 4 through 9 and Tables 43 through 45, chlorfenapyr poses serious risks for reproduction and acute toxic effects when avian receptors utilize cotton fields as a sole source of diet (i.e., an assumption of 100% diet from cotton fields). It is recognized that an assumption of total dietary resources originating from treated fields is likely to be conservative for long-term exposures associated with observed reproductive efects. However, for acute effects associated with a single oral dose or a few days of dietary exposure, an assumption of 100 percent of the short-term diet originating from a cotton field is not unreasonable.

In the registrant's avian risk assesment, dietary exposures are modified through consideration of the potential for avian species to use cotton fields as a dietary source. The registrant calculated RQ values for acute, subacute, and reproduction effects based on a high (100% treated field use), medium (50% treated field use), and low (0% treated field use) exposure scenarios. In this approach, exposures to dietary items from treated fields were diluted by corresponding exposures from dietary items foraged from untreated areas surrounding cotton fields. These exposure estimates considered drift-associated contamination. The registrant maintains that avian exposures are closest to the low (0% field use) exposure scenario.

The avian census data of cotton fields in MRID 444642-02 show a total of 54 bird species were identified in Arizona fields; 47 species in Texas fields; and 54 species in Alabama and Mississippi fields. Avian use of Arizona fields ranged from 60% to 69% of observations. In Texas, avian use ranged from 21% to 27% of observations. Use of Alabama and Mississippi fields ranged from 11% to 24% of observations. These avian census data primarily are concerned with presence or absence of species within fields and surrounding buffer. However, there are data for 72 hours of in-field observation of activities within cotton fields. In both Arizona and southeastern cotton field sites, perching and foraging accounted for over 50% of the observations. In Texas, foraging activities comprised 35% of the observations.

In a field study performed to investigate the acute effects of chlrofenapyr treatment of cotton on birds (MRID 444526-16), birds occurred in chlorfenapyr-treated and untreated cotton fields for a total of 13% of the observations made. Chlorfenapyr treatment had no impact on the degree to which cotton fields were used by birds. Observations from this study indicated that cardinals and morning doves were actively seeking patches of weeds within the cotton crop and the authors concluded that the birds were feeding on johnson grass seed dropped on the soil.

In addition to data submitted by the registrant, Gusey and Maturo (1972)[15] report avian foraging (listed as medium and high levels of feeding activity) in cotton fields in Arizona, Arkansas, Georgia, South Carolina, and Texas.

Clearly, a large variety of avian species use cotton fields with appreciable frequency and the uses include a substantial number of foraging behavior observations. However, the available avian

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[15] Gusey, W.F. and Z.D. Maturo. 1972. Wildlife Utilization of Croplands. Environmental Conservation department, Shell Oil Company, Houston, TX.

census data do not provide sufficient information on the actual proportions of avian diet that originate in cotton fields. It is possible that cotton fields may contribute to avian diets out of proportion to the time birds have been observed in the fields. It is also possible that pest outbreaks in cotton fields may result in higher foraging rates in cotton fields. However, for the purposes of evaluating the impact of data concerning avian use of fields on the outcome of the risk asessment, an assumed minimum proportion of the avian diet of 10% from treated cotton fields was used to test the impacts on calculations of avian chronic RQs. This assumption of 10% is lower than the minimum number of observations of birds in cotton fields (11% reported in MRID 444642-02 and 13% in MRID 44526-16). To simplify the evaluation of avian use effects on risk assessment, no contribution of chlorfenapyr residues from off-field food sources contaminated by drift were included in the re-calculation of avian RQs

Reducing intake of food from treated fields to 10% of the total diet and assuming all off-field dietary residues are zero, effectively reduces all avian reproduction RQ values to 10% of the values listed in this assessment. Even with such a reduction, reproduction effects-based RQs for all but one species (mourning dove) still exceed the chronic level of concern (1) over most, if not all exposure periods modelled, and for all application scenarios except the lowest (0.075 lb ai/A). At the lowest application rate only a few modelled exposure periods exceeded the chronic level of concern for all species except the mourning dove, with no modelled exposure above the chronic level of concern.

It must be stressed that an assumed 10% use factor is lower than all avian census data reported by the registrant and does not account for the presence of chlorfenapyr residues in avian food resources in off-field habitat (the off-field residues are roughly 10% of on-field residues as reported in 444779-01). Actual avian uses of cotton fields and corresponding dietary exposures are likely to be higher.

Based on this analysis, EFED believes that, even with a very limited assumption for dietary exposure (10% avian diet from treated fields and no inclusion of chlorfenapyr contamination from field buffer areas) there remains a high potential for avian reproduction impairment for all application rates. It should be emphasized that, because of considerations of dietary exposures only, the actual exposure of a given bird in a treated cotton field could be higher than estimated in this risk assessment. Although there are limited test data to suggest that dermal exposure, by itself, may not result in toxic body burdens in birds, the combined burdens associated with dermal, inhalation, and drinking water exposures may be important contributions to the daily exposure of birds to chlorfenapyr.

Application Patterns and Corresponding Reproduction Periods for Avian Species

The most sensitive endpoint used in this avian risk assessment is the reproduction NOEC. Long-term exposure to chlorfenapyr leads to reduced egg production, reduced hatching success and reduced nestling survival in the avian species tested. **The fact that these effects occur at a chlorfenapyr doses above 0.059 mg/kg-bw/day (NOEL) active ingredient in the diet make chlorfenapyr one of the most reproductively toxic pesticides to avian species that EFED has evaluated.**

In an oral presentation by registrant representatives before EPA (April 1998), RQ values above the level of concern for reproduction effects were dismissed by the registrant because the application dates for chlorfenapyr were said to occur after reproduction periods of birds using cotton fields. However, MRID 444779-01 presents information on the reproduction periods of all avian species reported to occur in cotton fields. These reproduction periods are compared to windows of likely chlorfenapyr application to cotton fields. For southern cotton fields (Texas and eastward), 37 species are profiled, with 33 species (89%) exhibiting egg laying and/or nestling periods overlapping with the chlorfenapyr application window. For southern United States cotton areas and windows for application to control mites, 33 species are profiled, with all species' egg-laying and/or nestling periods overlapping the mite-control application window. For western cotton fields, 34 species were profiled, with all species' egg-laying and/or nestling periods overlapping the mite-control application window, and 31 species (91%) with egg-laying and/or nestling periods overlapping the armyworm-control application window.

The registrant, in the April 1998 oral presentation, argued that much of this overlap of reproductive periods with chlorfenapyr application periods is for second and third clutching attempts by birds, and suggested that effects at these periods may not be ecologically important. However, MRID 444779-01 states that standard cotton agricultural practices in the early season (i.e., early cultivation for weed control) are likely to cause a large number of nest failures or abandonment. It is therefore logical to expect that second and third clutch attempts at reproduction would be ecologically significant in the face of early reproduction disruption.

Based on this evaluation of registrant information, there appears to be substantial opportunity for chlorfenapyr applications to occur during critical reproduction events sensitive to chlorfenapyr intoxication. Contrary to the registrant opinion, EFED believes that impairment of second or third reproduction attempts would be of particular ecological importance for avian species adversely affected by early season standard agricultural practices.

Geographical Consideration of Cotton Acreage and Potentially Treated Areas

MRID 444779-01 presents an analysis of the total cotton acreage in the United States and the acreage potentially treated with chlorfenapyr. The registrant estimates that the cotton acres treated will average 6.7 million for budworm and bollworm, 0.88 million for beet armyworm, 0.38 million for fall armyworm, and 1.1 million for mites. This estimate is based on an assumption that chlorfenapyr will only be used in areas of outbreaks of pests resistant to other insecticidal treatments.

What remains an uncertainty associated with the treated acreage is the geographical distribution of treatments in a given year. Cotton production covers approximately 16 states. However, according to MRID 444779-01, predictions of exactly where within these states lepidopteran outbreaks will occur in any given year is quite problematic. If outbreaks of lepidopteran pests of cotton are regional, as suggested by past Section 18 requests, rather than throughout the entire cotton belt in scope, then chlorfenapyr treated acres would be concentrated within infested pockets within a particular region or region(s). Therefore, impacts to avian populations from year-to-year would not be dispersed throughout the cotton belt, but would be concentrated within more limited geographical areas and would enhance the potential adverse impacts of avian reproduction impairment to more localized populations.

Analysis for Parent Chlorfenapyr and Not for Potentially Toxic Degradates In Avian Food Items

MRID 444779-01 states that the chlorfenapyr metabolite AC 303268 is responsible for the parent compound toxicity. MRID 444779-01 also indicates that AC 303268 has been has been identified in chlorfenapyr-exposed tobacco budworms. However, the insect residue data submitted by the registrant (MRID 444642-01) are for analysis of parent chlorfenapyr only.

Available acute avian toxicity data indicate that AC 303268 is of comparable toxicity to parent chlorfenapyr. This risk assessment, based on parent chlorfenapyr residues alone, represents an underestimate of the total toxicological risk associated with chlorfenapyr and toxic metabolites. The lack of information on the concentration of AC 303268 residues in insects precludes an assessment of the extent to which this risk assessment underestimates exposure to important toxic metabolites.

Chlorfenapyr Stability in Soil and Its Implications for Risks From Repeated Annual Use

Laboratory aerobic soil and field dissipation studies for chlorfenapyr show that the compound is very stable. Indeed, chlorfenapyr's persistence in soil from annual treatment to annual treatment would contribute to increasing soil residues with time. Multiple-year applications of chlorfenapyr to cotton fields would therefore result in asymptotic increases in soil concentrations.

As discussed for multiple-year uniform applications in the environmental fate section, the 90 percent upper bound for aerobic soil metabolism half-life (1.4 years, approximately the same as the 1.3 year field disipation half-life), yields a calculated asymptotic first-order value approaching 2.5 times the annual application amount (1.5 leftover from previous applications plus 1.0 from the current year application). Using the average aerobic soil half-life of 0.96 year, rather than the upper 90% limit of 1.4 years, the asymptotic value becomes 2.0 times the annual amount (1.0 residual plus 1.0 current).

Under the assumption of minimal incidental soil ingestion, the effects of chlorfenapyr accumulation in soil to approximately 1.7 to 2.5 times the first year soil residue are essentially negligible, and do not alter the outcome of the risk assessment. However, if higher incidental soil ingestion rates are assumed (e.g., Bier et al. (1994) suggests soil incidental ingestion rates as high as 30% for some probing birds), then accumulation in soil may influence the outcome of the risk assessment to a greater extent. In addition, if other routes of exposure were to be considered (e.g., dermal), accumulation of chlorfenapyr from multiple years of use would serve to increase the exposure of chlorfenapyr in birds in any given year.

The Effect of Application Interval Upon Exposure Estimates

It should be noted that multiple application scenario risk quotients are based on oral doses (from diet) calculated using a 7-day application interval. The use of the 7-day application interval was predicated upon the available avian food item residue data and may not reflect maximum possible oral doses if the minimum labeled treatment interval of 5 days is considered. The stability of chlorfenapyr in soil, at first analysis, would suggest that interval differences of a few days would not be important. However, the dissipation of chlorfenapyr residues in plants and insects is more rapid than degradation of chlorfenapyr in soil, and reduction of the application interval from 7 to 5 days could produce higher residues in plants and insects.

The Importance of Other Routes of Exposure

As stated in the exposure assessment of this document, the risk assessment does not account quantitatively account for a number of additional exposure routes, including respiration of chlorfenapyr vapors or particulate-associated chlorfenapyr, dermal absorption of chlorfenapyr, and ingestion of chlorfenapyr during preening. Furthermore, bioconcentration of chlorfenapyr residues in fish (BCF 2,300), while less toxic than parent, have the potential for additional, but unquantified, toxic risks to piscivorous wildlife. Finally, there remains an unquantified concern regarding the potential for chlorfenapyr to accumulate in aquatic invertebrates (e.g. molluscs), which may not have the biochemical capability to degrade the parent compound. These accumulators may be additional dietary sources of chlorfenapyr for wildlife.

Interspecies Sensitivity Issues

This risk assessment has relied on the most sensitive measured toxicological endpoints for birds and mammals for generating deterministic risk quotients. Because of the departure from the usual EFED approach, which is based on estimated residues immediately post-application (Fletcher et al., 1994), this risk assessment does not incorporate EFED's usual conservative safety factors used to mitigate for uncertainties regarding interspecies sensitivity. However, consideration of the high risk level of concern (RQ values greater than or equal to 0.5 trigger the concern) accounts for uncertainties regarding *intraspecies* extrapolation.

Daily Dose Versus Cumulative Dose as a Predictor of Subacute Lethal Effects

The daily RQs calculated for subacute lethal dietary risk should be evaluated with some care. There is considerable uncertainty as to the minimum exposure duration required before test organisms exhibit a lethal response to chlorfenapyr. The role of pharmacodynamics and kinetics in the expression of the lethal response is uncertain. It is not clearly known whether mortality in birds occurs once a threshold cumulative internal dose is achieved or once a certain level of cellular injury occurs. In the case of chlorfenapyr in the passerine red-winged blackbird (MRID 444526-13), birds exposed to dietary concentrations as low as 10 ppm, exhibited all observed mortality before the end of the 5-day exposure period. For example, mortality of 50 percent of the treatment group occurred at the 10 ppm treatment level (1.52 mg/kg-bw/d) after 3 days of exposure for a total accumulated exposure of 4.56 mg/kg-bw (1.52 mg/kg-bw/d X 3 days = 4.56 mg/kg-bw). Assuming that the pharmacodynamics and kinetics for the calculated study LC50 of 10.75 ppm (1.63 mg/kg-bw/d) are similar to the 10 ppm (1.52 mg/kg-bw/d) treatment level, one could expect that the necessary exposure to result in 50 percent mortality would occur well before a full five days of exposure are completed. The accumulated dose could be similar to the 10 ppm treatment group such that the required period of exposure could be as little as three days, with an accumulated dose of approximately 4.89 mg/kg-bw (1.63 mg/kg-bw/d X 3 days = 4.89 mg/kg/d).

If accumulated dose is a controlling factor in chlorfenapyr subacute mortality, then daily RQs based on single-day dose predictions may not fully account for the risk of subacute mortality. Indeed, a single dose above the toxicity endpoint (1.63 mg/kg-bw/d) followed by a series of daily doses below the endpoint sufficient to achieve the cumulative dose on concern, or *vice versa,* could still result in sufficient exposure to chlorfenapyr to result in lethality equivalent to the present toxicity endpoint. Therefore, concern for lethal effects of chlorfenapyr in birds may not be limited to the days for which exposure is expected to be above the subacute toxicity endpoint.

Aquatic Risk Characterization

Cotton is grown as a major cash crop near aquatic habitats along all the Gulf coast states as well as the bayou regions and tributaries of the lower Mississippi River. To a lesser extent, cotton is grown in the riparian regions of the Southwest and California. The use of a pesticide with toxicity and risk profiles like chlorfenapyr on cotton is predicted to cause important adverse effects in aquatic communities. The likely adverse impacts in freshwater communities would be associated with acute short-term exposures. Freshwater acute RQ values exceed the acute high (0.5), restricted use (0.1), and endangered species (0.05) levels of concern. No freshwater chronic levels of concern were exceeded by the estimated MUSCRAT exposure values. However, the confidence in this finding regarding chronic effects is low because of the limited chronic freshwater toxicity data, the persistence of the chemical in aquatic systems. For estuarine/marine receptor species, there are high levels of exceedance of the chronic level of concern (over an order of magnitude), suggest that impacts to invertebrates may be severe. It should be noted that the invalid sheepshead minnow toxicity study precluded assessment of chronic risks to fish in estuarine/marine systems.

The exposure models predicted maximum initial residues of chlorfenapyr to be as high as 13 ppb (μg/L) in the water column after off-target entry from spray drift and surface runoff. Due to the high persistence of the chemical, the models predict that toxicologically significant amounts of residues will remain in the water column for a long time. It is also persistent in sediments. In a microcosm study fish exposed to direct sprays of at least 11.3 μg/L were killed within a few days. Also, decreased abundances of several invertebrate taxa, which are a food source for fish, were also observed. The data and risk profiles taken together indicate a high potential for fish kills and depletion of invertebrate communities to occur in waterways near fields treated with chlorfenapyr. Depletion of invertebrates in field studies with other insecticides caused decreased growth in fish. This effect is also likely to occur in aquatic habitats from use of chlorfenapyr.

Additionally, economically important organisms such as shrimp can be expected to be affected in estuaries near to where cotton is cultivated. These shrimp breed offshore and may be particularly at risk because they migrate for miles up the streams that feed the estuaries.

DATA GAPS

Appendix B is a table summarizing the data requirements relative to the use of chlorfenapyr as an insecticide/miticide on cotton.

Terrestrial

Because no definitive avian terrestrial field study has been submitted, the registrant is still required to submit a terrestrial field test using the active ingredient chlorfenapyr. EEB requested a field study November 4, 1994, because the active ingredient is in a new class of pesticides (pyrroles) and has a reported new mode of action (uncouples oxidative phosphorylation in the mitochondria). The registrant has submitted a field study to only assess the potential for avian acute lethal effects in cotton fields treated with chlorfenapyr (MRID 444526-16). However, EFED requests for field testing of chlorfenapyr effects in birds (e.g., DP Barcode 210808) have stressed that an appropriate field study should emphasize an investigation of avian **reproductive** effects. The results of this risk assessment, incorporating biological data specific to a number of species found in cotton fields and measured residues in avian food items has (1) allowed EFED to reduce some uncertainties relative to exposure of avian wildlife and (2) increased EFED confidence in concluding that avian wildlife would be at risk for reproduction impairment. Therefore, EFED does not require a field study incorporating reproduction endpoints at this time.

,In an April 1998 oral presentation before the Agency, the registrant presented preliminary results of an avian reproduction toxicity test that utilized a modified exposure regime. This study used variable dietary concentrations to simulate the decreasing concentrations of chlorfenapyr observed for weed seed head, cotton plant, and insect residues. The oral presentation of the resultant data suggested that some information from the study may be applicable to assessing the risks of field residues of chlorfenapyr to avian reproduction. However, written presentation of these data has not been made available to EFED at the time of preparation of this risk assessment. In the absence of data to the contrary, the existing avian toxicity data set, when combined with residue data, is sufficient to suggest that there exists a substantial risk to avian reproduction for the species evaluated for this risk assessment.

Aquatic

A major unanswered question in the last risk assessment for chlorfenapyr is the bioavailabililty of chlorfenapyr to benthic organisms. In order to answer this vital question, sediment toxicity testing was required. To address the question of sediment toxicity an acute sediment toxicity test was conducted using the EPA test protocols. The freshwater organisms tested was the amphipod *Hyallea azteca*. Although this study has been classified as supplemental, it can still be upgraded to core status with the submission of additional data. In addition, the data from this study can be utilized in a risk assessment. On the other hand, the marine amphipod study has only just recently been submitted to the Ecological Hazard Branch/EFED for review.

At the time EPA requested sediment toxicity testing, the only protocol which had been fully developed was a 10-day acute sediment toxicity test. However, at this time EPA has developed a *provisional* guideline protocol for a 28-day chronic sediment test. Although specific criteria for requiring a chronic toxicity test have yet to be published, one criterion will include the persistence of the compound. Since chlorfenapyr has been characterized as a persistent compound, EFED will require a chronic sediment toxicity test. In the case of marine sediment toxicity, a chronic test is clearly justified because the LOCs appear to be exceeded by the results of the acute study submitted by the registrant. Because of the recent development of protocols for chronic sediment toxicity testing, EFED recommends that any study protocols (including the selection of test species) developed by the registrant to address these data requirements be submitted to the Agency for approval prior to test initiation.

Upon review of all sediment toxicity data (including the studies listed above), additional higher tier information may be necessary to clarify the long-term effects from the use of a highly persistent chemical when it reaches the aquatic environment. These higher tier needs may include studies to determine the community-level effects of persistent chlorfenapyr in sediments.

Invalid acute and/or chronic aquatic tests which need to be repeated at this time are listed in Table 53.

It should be noted that limited tests were performed on two different degradates of chlorfenapyr. The major degradate CL 312,094 (the desbromo derivative of chlorfenapyr), was tested only on bluegill sunfish. The photolytic degradate in water, CL 357,806, however, was tested on rainbow trout and *Daphnia magna*. The purpose of testing these two degradates on different species was not revealed in any of the material submitted. The registrant should explain this selectivity before EFED considers additional testing on degradates.

The acute LC_{50} of the major degradate CL 312,094 was greater than 928 μg/L, the highest concentration tested. Since the toxicity of this degradate is much lower than the parent compound, additional data will not be required at this time.

LABELING AND MITIGATION

Chlorfenapyr meets the criteria for classification as a **Restricted Use Pesticide** with regard to risks to aquatic organisms and birds (40 CFR 152.170 (c)(1)(iii)). EFED therefore recommends that chlorfenapyr be classified as a Restricted Use Pesticide. This recommendation is consistent with the proposed product labels.

The following language found on the proposed product labels is consistent with EFED conclusions:

> This pesticide is toxic to fish and wildlife.
>
> Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate.
>
> This product is toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.
>
> This product must not be used in areas where impact on threatened or endangered species is likely. Notify state and/o Federal authorities and American Cyanamid Company immediately if you observe any adverse environmental effects due to the use of Alert Insecticide-Miticide (or Pirate Cotton Insecticide).

There is an important inconsistency between the Pirate and Alert product labels. The Alert label contains the following statement, which does not appear on the Pirate label:

> **Do not make more than two consecutive applications of Alert;** then rotate to another product from a different class based on mode of action. Alert has a unique mode of action and can be an important component of a resistance management program in cotton.

EFED recommends that the above language be incorporated into the Pirate label. This recommendation is not based on a pest resistance concern, but on the available avian food item residue data and stability of the compound that suggest repeated applications of chlorfenapyr to a field result in increasing residues in environmental compartments. By limiting applications to two consecutive treatments followed by a treatment period using another pesticide, the Pirate label-listed low application rate scenario 0.15 lb ai/A would be limited to two consecutive instead of three consecutive applications. This would allow some time for reduction in avian food item residues before a third (and still label consistent) application would be made. However, the stability of chlorfenapyr in soil would preclude this strategy from reducing residues available to runoff and erosion.

Both the Pirate and Alert proposed labels have language regarding spray drift precautions. EFED recommends that this language be compared to current spray drift best management practices and any required modifications be made to the labels to achieve consistency with current spray drift management practices.

Table 1. Recommended Application Rates and Application Periods of Chlorfenapyr Formulations[1]

Pest	PIRATE (lbs a.i./acre)	PIRATE Application Number and Interval	ALERT (lbs a.i./acre)	ALERT Application Number and Interval	Remarks
Mites (incl. Two-spotted, carmine, Pacific, and strawberry)	0.15	Maximum 3 applications @ 5-7 day interval	0.075 Cotton height <12"	Maximum 6* applications @ 5-7 day interval	Use adequate spray volume to insure thorough coverage. For best results, treat when pest populations are in early stages of development.
	0.20	Maximum 2 applications @ 5-7 day interval	0.15 Cotton height <12"	Maximum 3* applications @ 5-7 day interval	
			0.15 Cotton height>12"	Maximum 3* applications @ 5-7 day interval	
			0.25 Cotton height>12"	Maximum 2 applications @ 5-7 day interval	
Beet armyworm	0.2	Maximum 2 applications @ 5-7 day interval	0.2	Maximum 2 applications @ 5-7 day interval	Apply according to local economic thresholds such as 5 active "hits" per 100 row feet
Tobacco budworm, cotton bollworm	0.2-0.25	Maximum 2 applications @ 5-7 day interval	0.2-0.25	Maximum 2 applications @ 5-7 day interval	Rates of 0.2 to 0.25 lbs/acre should be used only in tank mixture combinations with larvicides approved for use on cotton at their recommended label rates. When cotton bollworm is the predominant species, pyrethroid combinations are recommended.
	0.3	Maximum single annual application	0.3	Maximum single annual application	Rate of 0.3 lbs/acre has been shown to be effective when used alone. Apply on a 5 to 7 day schedule or as determined by field scouting

[1] Pirate used in states east of the Rocky Mountains, ALERT used west of the Rocky Mountains

*These maximum number of applications are consistent with the confining maximum annual application of 0.5 lb ai/A. However, the proposed label for ALERT indicates that actual consecutive applications be limited to two applications.

Table 2. Weed Seed Head and Weed Seed Residues of Chlorfenapyr from Treated Fields for 0.35, 0.18, 0.035, and 0.01 lb/ai/application Treatment Rates for Three Treatments (MRID 444526-08)

Weed Seed Head Residues (mg/kg fresh weight)

Treatment	Days After First Application	0.35 lb ai/A/application	0.18 lb ai/A/application	0.035 lb ai/A/application	0.01 lb ai/A/application
Treatment 1	0.1	27.2*	11.4	1.7	0.38
	3	11.1	4.0	0.81	0.25
	7	10.8	3.02	0.38	0.15
Treatment 2	7.1	32.7	17.4 (17.2, 17.6)	2.36	0.52
	10	24.6	12.7	1.34 (1.34, 1.34)	0.41
	14	19.5 (19.3, 19.7)**	7.71	0.9	0.3 (0.287, 0.386)
Treatment 3	14.1	36.5	7.99	2.52	0.64
	15	42.4 (41.9, 42.9)	16.3	1.79	0.76 (0.733, 0.795)
	17	22.2	13.05	1.22	0.51
	21	17.7	6.92 (6.36, 7.48, 5.46)	0.86 (0.839, 0.873)	0.31 (0.296, 0.331)
	24	9.5 (7.95, 10.1, 10.5)	5.63 (5.46, 5.80)	0.71 (0.691, 0.692, 0.735)	0.26 (0.295, 0.217)
	28	16.0 (13.5, 13.7, 20.9)	5.12 (5.34, 4.89)	0.78 (0.772, 0.784)	0.31 (0.305, 0.326, 0.301)
	35	6.32	1.93 (1.98, 1.88, 1.98)	0.47	0.18
	42	5.79	1.85	0.44 (0.435, 0.435)	0.17

Weed Seed Residues by Treatment 3 (mg/kg fresh weight)

Species	0.35 lb ai/A/application	0.18 lb ai/A/application	0.035 ai/A/application	0.01 lb ai/A/application
browntop millet	14.2	5.7	1.15 (1.11, 1.19)	0.32
crabgrass	110 (105, 115)	44 (44.2, 43.7)	3.98	1.08
foxtail	12.4	5.7 (5.59, 5.80)	0.95	0.32
goosegrass/ smartweed	32.6 (37.0, 28.2)	18.4 (19.5, 17.2)	2.66	0.86
maximum	110	44	3.98	1.08
average	42.3	18.5	3.11	0.65

* All values without parenthetical entries are for a single analysis of one field sample

**Average of multiple chemical analyses of a single field sample, values in parenthesis are measured values contributing to the average

Table 3. Chlorfenapyr residues in Adult and Larval Beet Armyworms (MRID444642-01)

Armyworm Life Stage	Days After Treatment	Residues for 0.2 lb ai/A (mg/kg)	Residues for 0.35 lb ai/A (mg/kg)
Adults	0.1	0.573, 4.23, **7.96**	3.12, **4.23**
	7	<0.05, **0.0655**	<0.05, <0.05, <0.05
	14	<0.05, <0.05, **0.452**	<0.05, 0.112, **0.249**
	21	0.195, 0.451, **0.532**	0.647, 0.704, **1.84**
	28	0.107, 0.277, **0.652**	<0.05, <0.05, **0.152**
Larvae	0.1	0.152, 0.298, 0.585, 0.831, 1.13, **1.87**	0.565, 1.0, 1.25, 3.21, **3.24**
	1	0.0551, 0.0995, 0.644, **1.46**	0.2, 1.55, 1.92, 2.08, **4.34**
	3	0.28, 0.351, **0.543**	0.565, 1.12, **1.38**
	4	0.353, 0.453, **0.583**	0.804, 1.23, **1.59**
	7	0.0796, 0.1748, **0.179**	0.176, 0.321, **0.352**
	14	0.0799, 0.0873, **0.127**	<0.05, <0.05, <0.05
	21	<0.05, <0.05, **0.0551**	<0.05, <0.05, <0.05
	28	<0.05, <0.05, <0.05	<0.05, <0.05, <0.05

Numbers in **bold** represent the maximum values per sample period as used in the exposure assessment

Table 4. Chlorfenapyr Residues in Cotton (MRID444642-01)

Days After Treatment	Mean Residues for 0.2 lb ai/A (mg/kg)	Mean Residues for 0.35 lb ai/A (mg/kg)
0.1	45.9 (SD 26.7, n=2)	60.5 (15.3, n=2)
1	14.3 (n=1)	30.6 (n=1)
3	7.00 (SD 2.52, n=3)	15.02 (SD 4.69, n=4)
4	4.59 (SD 0.88, n=4)	16.1 (SD 7.09, n=3)
7	1.50 (SD 0.99, n=5)	3.28 (SD 3.52, n=5)
14	0.68 (SD 0.18, n=5)	0.73 (SD 0.42, n=5)
21	0.44 (SD 0.22, n=5)	0.76 (SD 0.59, n=5)
28	0.50 (SD 0.01, n=5)	0.76 (SD 0.36, n=2)

All values calculated conservatively assuming samples reported below LOQ are equivalent to LOQ (0.05 mg/kg)

Table 5. Acute Oral Toxicity to Avian Species (Parent Chlorfenapyr)

Species	% A.I.	End Point (mg ai/kg)	Toxicity Category	MRID No. Author/Year	Study Classification
Northern Bobwhite *(Colinus virginianus)*	94.5	LD_{50}= 34 NOEL (Wt., Feed) = 2	Highly Toxic	427702-28 Helsten, 1993	Core
Mallard *(Anas platyrhynchus)*	94.5	LD_{50} = 8.3 NOEL (Wt., Feed) = 1	Very Highly Toxic	427702-27 Helsten, 1993	Core
Red-winged Blackbird *(Agelaius phoeniceus)*	94.5	LD_{50} = 2.21 NOEL (Wt.)= 0.63	Very Highly Toxic	438870-04 Brewer, 1995	Supplemental*

* Not a required study.

Table 6. Acute Oral Toxicity of Four Environmental Metabolites

Metabolite	Species	% A.I.	LD_{50} (mg ai/kg)	Toxicity Category	MRID No. Author/Year	Study Classification
AC 303,268	Northern Bobwhite *(Colinus virginianus)*	100.3	LD_{50} = 25 NOEL (wt.) = 3	Highly Toxic	434928-09 Campbell, 1993	Supplemental
	Mallard *(Anas plathryhnchus)*	100.3	LD_{50} = 77 NOEL (wt.) = 20	Moderately Toxic	434928-08 Campbell, 1993	Supplemental
AC 312,094	Northern Bobwhite *(Colinus virginianus)*	96.3	LD_{50} = 1685 NOEL (wt.) = 160	Slightly Toxic	438870-06 Brewer, 1995	Supplemental
	Mallard *(Anas platyrhynchus)*	96.3	LD_{50} = >2400 NOEL = >2400	Practically non-toxic	438870-05 Brewer, 1995	Supplemental
CL 303,267	Northern Bobwhite *(Colinus virginianus)*	98.1	LD_{50} = >2250 NOEL (wt.) = 1350	Practically non-toxic	444526-11 Gagne et al., 1997a	Supplemental
	Mallard *(Anas plathryhnchus)*	98.1	LD_{50} = >2250 NOEL = 2250	Practically non-toxic	444526-12 Gagne et al., 1997b	Supplemental
CL 325,195	Northern Bobwhite *(Colinus virginianus)*	97.0	LD_{50} = 741 NOEL = 192	Slightly Toxic	444526-11 Gagne et al., 1997a	Supplemental
	Mallard *(Anas plathryhnchus)*	97.0	LD_{50} = >2250 NOEL (wt.) = 2250	Practically non-toxic	444526-12 Gagne et al., 1997b	Supplemental

Table 7. Avian Subacute Dietary Toxicity Studies with Parent Chlorfenapyr

Species	% A.I.	End Point (mg/kg diet)	Toxicity Category	MRID No. Author/Year	Study Classification
Northern Bobwhite *(Colinus virginianus)*	94.5	LC_{50} = 132 NOEL = 10 (clinical signs)	Highly Toxic	427702-30 Gagne, 1993	Core
Mallard *(Anas platyrhynchus)*	94.5	LC_{50} = 8.6 NOEL (wt.) = <4	Very Highly Toxic	427702-29 Gagne, 1993	Core
Red-winged Blackbird *(Agelaius phoeniceus)*	94.9	LC_{50} = 10.75 NOEL (mort.) = 6.93	Very Highly Toxic	444526-13 Gagne et al., 1997c	Supplemental*

* Not a required study.

Table 8. Chronic Avian Toxicity Studies (Reproduction) with Parent Chlorfenapyr

Species	% A.I.	NOEC/LOEC (mg/kg diet)	Endpoints Affected	MRID No. Author/Year	Study Classification
Northern Bobwhite *(Colinus virginianus)*	94.5	NOEL = 0.5 LOEL = 1.5	14 day survivors at 4.5 mg/kg hatchling weight at 1.5 mg/kg	434928-11 Bryan/1994	Supplemental
Mallard *(Anas platyrhynchus)*	94.5	NOEL = 0.5 LOEL = 1.5	adult female body weight at 1.5 mg/kg food consumption at 1.5 mg/kg reproductive parameters at 2.5 mg/kg	434928-13 Helsten/1994	Core

Table 9. Mammalian Toxicity Tests conducted with Technical Chlorfenapyr and Formulations 2SC (ALERT) and 3SC (PIRATE) and Select Metabolites

Species	% A.I.	Test Type	Endpoint	Toxicity Category	MRID No.
AC 303,630 Technical					
Rat	94.5	Acute Oral Toxicity (Technical)	LD_{50} (males) = 441 mg/kg LD_{50} (females) = 1152 mg/kg LD_{50} (both) = 626 mg/kg	Moderately to Slightly Toxic	427702-07 427702-01
Mouse	94.5	Acute Oral Toxicity (Technical)	LD_{50} (males) = 45 mg/kg LD_{50} (females) = 78 mg/kg LD_{50} (both) = 55 mg/kg	Highly to Moderately Toxic	434928-28
Mouse	94.5	Sub-chronic Feeding - 3 month	NOEL = 40 ppm (7.1 mg/kg/day) LOEL = 80 ppm (14.8 mg/kg/day)	n/a	434928-30
Rat	94.5	Sub-chronic Feeding - 3 month	NOEL = 300 ppm (21 mg/kg/day) LOEL = 600 ppm (48.4 mg/kg/day)	n/a	427702-19
Rat	94.5	2 Generation Reproduction	Systemic Toxicity NOEL = 60 ppm (5 mg ai/kg/day) LOEL = 300 ppm (22 mg ai/kg/day) Reproductive Toxicity NOEL = 60 ppm (5 mg ai/kg/day) LOEL = 300 ppm (22 mg ai/kg/day)	n/a	434928-36
AC 303,630 Formulations 2SC (ALERT) and 3SC (PIRATE)					
Rat	21.44	Acute Oral Toxicity (AC 303,630 2SC)	LD_{50} (males) = 560 mg/kg LD_{50} (females) = 567 mg/kg	Slightly Toxic	432682-04
Rat	33.3	Acute Oral Toxicity (AC 303,630 3SC)	LD_{50} (males) = 283 mg/kg LD_{50} (females) = 999 mg/kg LD_{50} (both) = 626 mg/kg	Moderately to Slightly Toxic	427702-14
Metabolites					
Rat	100.3	Acute Oral Toxicity (AC 303,268)	LD_{50} (males) = 27.0 mg/kg LD_{50} (females) = 29.4 mg/kg LD_{50} (both) = 28.7 mg/kg	Highly Toxic	434928-24
Rat	96.3	Acute Oral Toxicity (AC 303,094)	LD_{50} (males) = >5000 mg/kg LD_{50} (females) = >5000 mg/kg LD_{50} (both) = >5000 mg/kg	Practically Non-toxic	434928-25
Rat	89.0	Acute Oral Toxicity (AC 312,250)	LD_{50} (males) = >5000 mg/kg LD_{50} (females) = 2500 mg/kg	Practically Non-toxic	434928-26
Rat	89.0	Acute Oral Toxicity (AC 325,195)	LD_{50} (males) = 776 mg/kg LD_{50} (females) = 1367 mg/kg	Slightly Toxic	434928-27

Table 10. Nontarget insect acute contact toxicity of Technical Chlorfenapyr and AC 303,630 3SC (PIRATE™)

Species	% A.I.	End Point	Toxicity Category	MRID No. Author/Year	Study Classification
Acute Contact Toxicity Honey Bee *(Apis mellifera)*	94.5	LD_{50} = 0.12 *ug*/bee	Highly Toxic	427702-33 Kirkland/1994	Core
Acute Foliar Toxicity Honey Bee *(Apis mellifera)*	33.3	No significant mortality at 0.34 and 0.43 lbs ai/acre	n/a	434928-45	Core

Table 11. Nontarget Soil Organism Toxicity of Technical Chlorfenapyr and AC 303,630 3SC (PIRATE™)

Species	Product % A.I.	End Point	MRID No. Author/Year	Study Classification
Acute Toxicity Earthworm *(Eisenia fetida)*	Technical 94.5 %	LC_{50} = $\leq$22 ppm NOEL (wt) = 8.4 ppm	434928-07 England/1994	Supplemental*
Sublethal Toxicity Earthworm *(Eisenia fetida)*	AC 303,630 3SC 30.3 %	No adult mortality, adult body weight or reproductive effects at 0.26 and 1.3 lbs ai/acre.	438870-10 Canez/1995	Supplemental*

* Not required studies.

Table 12. Terrestrial Field Studies

Species	Formulation	End Point	MRID No. Author/Year	Study Classification
Food Choice Study Northern Bobwhite *(Colinus virginianus)*	Technical (94.5% ai)	NOEL - Adult Testing Survival = 250 ppm Weight = 250 ppm Food Consumption = 250 ppm NOEL - Juvenile Testing Survival = 140 ppm Weight = 140 ppm Food Consumption = 70 ppm	438870-07 Fairbrother 1995	Supplemental
Simulated Field(pen) Study Northern Bobwhite *(Colinus virginianus)*	AC 303,630 3SC (33.3% ai)	No mortality or morbidity at an application rate of 0.35 lb ai/acre. However, flawed study design limits usefulness of the data.	438870-07 434928-14 Ahmed/1995	Supplemental
Dermal Toxicity Northern Bobwhite *(Colinus virginianus)*	AC 303,630 3SC (33.3% ai)	No mortality or morbidity at an 1.4 lbs ai/acre. Study design limits interpretation to contact exposure to chemical after drying.	438870-07 434928-14 Driver/1995	Supplemental
Single application foliar residue and ecotoxicological study	AC 303,630 3SC (33.3% ai)	At 0.2 and 0.4 lbs ai/acre residues on cotton leaf 127% and 183% of Fletcher value. By day 28 residues on cotton leaf about 3 ppm. Residues in seeds collected from weeds in adjacent field border were below the method detection limit. Residues in live insects collected in the cotton field and in adjacent habitat had mean residue concentrations of 5.7 ppm through day 2 and below MDL, respecitvely.	434928-14 Sullivan/1994	Supplemental
Avian Census of Cottonfield Habitat	No active ingredient	Good preliminary census in preparation for a full-blown field study.	434928-14 Gagne/1995	Supplemental
Avian Census of Cottonfields in Arizona,Texas, Mississippi, and Alabama	No active ingredient	Protocol would essentially repeat the above mentioned study.	444642-02 Gagne/1998	Preliminary Review
Avian field study to Assess the potential for Acute Effects	AC 303,630 3SC (33.3% ai)	Study Under Review	444526-16 Gagne et al./ 1995	Undr review

Table 13. Five Most Common Avian Species Observed During the 1993 Census of Cotton Fields and Adjacent Habitats (mean number observed per sampling period)

Arizona **51 total species**	**Texas** **62 total species**	**Mississippi/Alabama** **66 total species**
Red-winged Blackbird (10.62)	Horned Lark (1.13)	Northern Cardinal (2.67)
Yellow-headed Blackbird (4.60)	Cliff Swallow (1.04)	Red-winged Blackbird (1.96)
Cliff Swallow (1.57)	Northern Mockingbird (0.84)	Horned Lark (1.73)
Abert's Towhee (1.29)	Red-winged Blackbird (0.63)	Indigo Bunting (1.66)
Gambel's Quail (1.25)	Lark Sparrow (0.60)	Blue Jay (1.08)

Table 14. Freshwater Fish Acute Toxicity Findings (Parent Chlorfenapyr)

Species	**% A.I.**	**LC_{50} (ppb)**	**MRID No. Author/Year**	**Toxicity Category**	**Fulfills Guideline Requirement?**
Rainbow trout	94.5	LC_{50} = 7.44	427702-31, 1991	Very Highly Toxic	Yes
Bluegill sunfish	94.5	LC_{50} = 11.6	428078-01, 1991	Very Highly Toxic	Yes
Channel catfish	94.9	LC_{50} = 12.3	443648-01, 1996	Very Highly Toxic	Yes

Table 15. Freshwater Fish Acute Toxicity Findings for the Metabolite CL 312,094

Species	**% A.I.**	**LC_{50} (ppb)**	**MRID No. Author/Year**	**Toxicity Category**	**Fulfills Guideline Requirement?**
Bluegill sunfish	93.6	LC_{50} > 928	428078-15, Davis, J.W., Youngerman, Wisk, J.D, 1994	Highly Toxic	Yes

Table 16. Freshwater Fish Acute Toxicity Findings for the Metabolite CL 303,267

Species	% A.I.	LC_{50} (ppb)	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement?
Bluegill sunfish	97	LC_{50} = 70	444526-17, Olivieri, C.E., Ward, T.J., Magazu, J.P., Boeri, R.L., 1997	Very Highly Toxic	No

Table 17. Freshwater Fish Acute Toxicity Findings for the Metabolite CL 325,195

Species	% A.I.	LC_{50} (ppb)	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement?
Bluegill sunfish	97	LC_{50} = 2,100	444526-17, Olivieri, C.E., Ward, T.J., Magazu, J.P., Boeri, R.L., 1997	Moderately Toxic	No

Table 18. Fish Early Life-Stage Toxicity Findings (Parent Chlorfenapyr)

Species	% A.I.	NOEC/LOEC (ppb)	MATC (ppb)	MRID No. Author/Year	Endpoints Affected	Fulfills Guideline Requirement?
Rainbow trout	94.5	NOEC = 3.68 LOEC = 7.64	NA*	434928-19, Ward, G. Scott, McElwee, C., Lintott, D., Wisk, Joseph D., 1993	Survival of juvenile rainbow	Yes

*NA - not applicable, EFED risks to be based on NOEC when survival is the endpoint

Table 19. Freshwater Invertebrate Toxicity Findings (Parent Chlorfenapyr)

Species	% A.I.	LC_{50}/ EC_{50} (ppb)	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement?
Daphnid *Daphnia magna*	94.5%	LC50 = 5.83	427702-32/1991	Very highly toxic	Yes

Table 20. Freshwater Invertebrate Toxicity Findings (Parent Chlorfenapyr)

Species	% A.I.	LC_{50}/ EC_{50} (ppb)	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement?
Daphnid *Daphnia magna*	97%	LC_{50} = 18	438870-09, Davis, J.W., Dunham, H.R., Wisk, J.D., 1995.	Very highly toxic	Yes

Table 21. Freshwater Invertebrate Acute Toxicity Findings for the Metabolite CL 303,094

Species	% A.I.	LC_{50} (ppb)	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement?
Daphnia magna	98	LC_{50} = 560	444526-18 Olivieri, C.E., Ward, T.J., Magazu, J.P., Boeri, R.L., 1997	Highly Toxic	No

Table 22. Freshwater Invertebrate Acute Toxicity Findings for the Metabolite CL 303,195

Species	% A.I.	LC_{50} (ppb)	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement?
Daphnia magna	97	LC_{50} = 1700	444526-17, Olivieri, C.E., Ward, T.J., Magazu, J.P., Boeri, R.L., 1997	Moderately Toxic	No

Table 23. Freshwater Invertebrate Acute Toxicity Findings for the Metabolite CL 303,267

Species	% A.I.	LC_{50} (ppb)	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement?
Daphnia magna	98.1	LC_{50} = 107	444526-17, Olivieri, C.E., Ward, T.J., Magazu, J.P., Boeri, R.L., 1997	Highly Toxic	No

Table 24. Aquatic Invertebrate Life-Cycle Toxicity Findings (Parent Chlorfenapyr)

Species	% A.I.	NOEC/LOEC (ppb)	MATC (ppb)	MRID No. Author/Year	Endpoints Affected	Fulfills Guideline Requirement?
Daphnid *Daphnia magna*	94.3	NOEC = 3.57 LOEC = 7.7	NA*	434928-22, Davis, J.W., Wisk, J.D., 1994.	Survival, Reproduction, weight, and length	Yes

*NA - not applicable, EFED risks to be based on NOEC when survival is the endpoint

Table 25. Estuarine/Marine Acute Toxicity Findings (Parent Chlorfenapyr)

Species	% A.I.	LC_{50}/EC_{50} (ppb)	MRID No. Author/Year	Toxicity Category	Fulfills Guideline Requirement?
Eastern Oyster shell deposition	-	-	-	-	No
Mysid shrimp	96.8	LC_{50} = 2.03	434928-18, Davis, J.W., Ward, 1994	Very highly toxic	Yes
Sheepshead minnow	94.5	LC_{50} = 60.2	434928-16, Ward, G.S., Wisk, J.D., 1993	Very highly toxic	Yes

Table 26. Estuarine/Marine Chronic Toxicity Findings (Parent Chlorfenapyr)

Species	% A.I.	NOEC/LOEC (ppb)	MATC (ppb)	MRID No. Author/Year	Endpoints Affected	Fulfills Guideline Requirement?
Mysid	94.5	NOEC= 0.172 LOEC= 0.385	NA*	434928-21, Ward, G. Scott, Wisk, Joseph D., Davis, Jay W., 1994.	Survival	May be up-graded to core upon submission of missing data.
Sheepshead Minnow	94.5	-	-	434928-20, McElwee, Cindy, Ward, G. Scott, and Wisk, Joseph D. 1994.	N/A	Invalid

*NA - not applicable, EFED risks to be based on NOEC when survival is the endpoint

Table 27. Acute Sediment Toxicity Tests (Parent Chlorfenapyr)

Species	% A.I.	LC_{50}/ EC_{50} (mg/kg)	MRID No. Author/Year	Study Classification	Fulfills Guideline Requirement?
Hyallela azteca (freshwater)	94.9%	LC_{50} = 19.6	444526-19, Hui (Jeff) Liu, Wisk, J.D., 1997.	Supplemental	Yes
Leptocheirus plumulosus (marine/estuarine)	>99%	LC_{50} = 0.18	445600-02, Hui (Jeff) Liu, Wisk, J.D., Olivieri C.E. 1998.	Preliminary Review	Determination pending

Sediment Total Organic Carbon (TOC) and moisture content were not reported for the *Hyallea* test. These measurements are required for all sediment toxicity tests. If these measurements can be submitted this test could be up-graded to Core status.

Table 28. Chlorfenapyr Residues in Weed Seed Heads*

Region	Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Label application rate (lb ai/A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Minimum label interval (days)	5	5	5	5	5	not applicable	5	5	5
Tested application rate (lb ai/A)	0.18	0.18	0.18	0.18	0.035	0.35	0.18	0.18	0.18
Tested interval (days)	7	7	7	7	7	7	7	7	7
Ratio of label to tested application rates	1.39	1.11	1.11	0.83	2.14	0.86	1.39	1.11	0.83
Days after first application	Weed seed head residue (mg/kg)	Weed seed head residue (mg/kg)	Weed seed head residue (mg/kg)	Weed seed head residue (mg/kg)	Weed seed head residue (mg/kg)	Weed seed head residue (mg/kg)	Weed seed head residue (mg/kg)	Weed seed head residue (mg/kg)	Weed seed head residue (mg/kg)
application 1 0.1	1.58E+01	1.27E+01	1.27E+01	9.46E+00	3.64E+00	2.34E+01	1.58E+01	1.27E+01	9.46E+00
3	5.56E+00	4.44E+00	4.44E+00	3.32E+00	1.73E+00	9.55E+00	5.56E+00	4.44E+00	3.32E+00
7	4.20E+00	3.35E+00	3.35E+00	2.51E+00	8.10E-01	9.29E+00	4.20E+00	3.35E+00	2.51E+00
application 2 7.1	2.42E+01	1.93E+01	1.93E+01	1.44E+01	5.05E+00	–	2.42E+01	1.93E+01	1.44E+01
14	1.07E+01	8.56E+00	8.56E+00	6.40E+00	1.93E+00	–	1.07E+01	8.56E+00	6.40E+00
application 3 (if any) 14.1	–	–	–	6.63E+00	5.39E+00	–	–	–	6.63E+00
21	–	–	–	5.74E+00	1.84E+00	–	–	–	5.74E+00
application 4 (if any) 21.1	–	–	–	5.74E+00	5.48E+00	–	–	–	5.74E+00
28	–	–	–	4.25E+00	2.48E+00	–	–	–	4.25E+00

*Residues are based on the in-field weed seed residues from MRID 444526-08, adjusting for differences in application rate by multiplying measured residues by the ratio of label rate to tested rate.

** – indicates that the application scenario does not allow for a number of applications at or beyond this point.

Note: applications beyond 2 have been included because of inconsistencies in labelling language between Pirate and Alert regarding maximum number of applications

Data presented for time periods consistent with assessment periods from larval data

Table 29. Chlorfenapyr Residues in Insect Larvae*

Region	Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Label application rate (lb ai/A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Tested application rate (lb ai/A)	0.2	0.2	0.2	0.2	0.2	0.35	0.2	0.2	0.2
Tested application interval (days)	7	7	7	7	7	not applicable	7	7	7
Ratio of label to tested application rates	1.25	1	1	0.75	0.375	0.86	1.25	1	0.75
Days after first application	Larval Insect (mg/kg)	Larval Insect (mg/kg)	Larval Insect (mg/kg)	Larval Insect (mg/kg)	Larval Insect (mg/kg)	Larval Insect (mg/kg)	Larval Insect (mg/kg)	Larval Insect (mg/kg)	Larval Insect (mg/kg)
application 1 0.1	2.34E+00	1.87E+00	1.87E+00	1.38E+00	7.00E-01	2.80E+00	2.34E+00	1.87E+00	1.38E+00
3	6.80E-01	5.43E-01	5.43E-01	4.10E-01	2.00E-01	8.10E-01	6.80E-01	5.43E-01	4.10E-01
7	2.20E-01	1.79E-01	1.79E-01	1.30E-01	7.00E-02	2.70E-01	2.20E-01	1.79E-01	1.30E-01
application 2 7.1	2.56E+00	2.05E+00	2.05E+00	1.51E+00	7.70E-01	2.70E-01	2.20E-01	2.05E+00	1.51E+00
14	3.80E-01	3.06E-01	3.06E-01	2.20E-01	1.20E-01	1.90E-01	3.80E-01	3.06E-01	2.20E-01
application 3 (if any) 14.1	3.80E-01	3.06E-01	3.06E-01	1.60E+00	8.20E-01	1.90E-01	3.80E-01	3.06E-01	1.60E+00
21	2.30E-01	1.82E-01	1.82E-01	2.60E-01	1.40E-01	8.00E-02	2.30E-01	1.82E-01	2.60E-01
application 4 (if any) 21.1	2.30E-01	1.82E-01	1.82E-01	2.60E-01	8.40E-01	8.00E-02	2.30E-01	1.82E-01	2.60E-01
28	7.00E-02	5.51E-02	5.51E-02	1.30E-01	1.40E-01	<7.00E-02	7.00E-02	5.51E-02	1.30E-01

* values are based on maximum measured values from MRID 444642-01 adjusted for differences between label rate and application rate used in residue study

values below detection limit assigned a value of 0.00 (note: this is not a conservative assumption)

-- denotes time periods for which extrapolation of available residue data are not reliable

Note: applications beyond 2 have been included because of inconsistencies in labelling language between Pirate and Alert regarding maximum number of applications

Table 30. Chlorfenapyr Residues in Cotton for Use as Forage Surrogate*

Region	Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Label application rate (lb ai/A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Tested application rate (lb ai/A)	0.2	0.2	0.2	0.2	0.2	0.35	0.2	0.2	0.2
Tested application interval (days)	7	7	7	7	7	not applicable	7	7	7
Ratio of label to tested application rates	1.25	1	1	0.75	0.375	0.86	1.25	1	0.75
Days after first application	Cotton leaf residue (mg/kg)	Cotton leaf residue (mg/kg)	Cotton leaf residue (mg/kg)	Cotton leaf residue (mg/kg)	Cotton leaf residue (mg/kg)	Cotton leaf residue (mg/kg)	Cotton leaf residue (mg/kg)	Cotton leaf residue (mg/kg)	Cotton leaf residue (mg/kg)
application 1 0.1	5.74E+01	4.59E+01	4.59E+01	3.44E+01	1.72E+01	6.89E+01	5.74E+01	4.59E+01	3.44E+01
3	8.75E+00	7.00E+00	7.00E+00	5.25E+00	2.63E+00	1.05E+01	8.75E+00	7.00E+00	5.25E+00
7	1.88E+00	1.50E+00	1.50E+00	1.13E+00	5.63E-01	2.25E+00	1.88E+00	1.50E+00	1.13E+00
application 2 7.1	5.93E+01	4.74E+01	4.74E+01	3.56E+01	1.78E+01	2.25E+00	5.93E+01	4.74E+01	3.56E+01
14	2.72E+00	2.18E+00	2.18E+00	1.64E+00	8.17E-01	1.02E+00	2.72E+00	2.18E+00	1.64E+00
application 3 (if any) 14.1	2.72E+00	2.18E+00	2.18E+00	3.61E+01	1.80E+01	1.02E+00	2.72E+00	2.18E+00	3.61E+01
21	1.40E+00	1.12E+00	1.12E+00	1.97E+00	9.83E-01	6.63E-01	1.40E+00	1.12E+00	1.97E+00
application 4 (if any) 21.1	1.40E+00	1.12E+00	1.12E+00	1.97E+00	1.82E+01	6.63E-01	1.40E+00	1.12E+00	1.97E+00
28	1.18E+00	9.46E-01	9.46E-01	1.22E+00	1.17E+00	7.55E-01	1.18E+00	9.46E-01	1.22E+00

* values are based on maximum measured values from MRID 444642-01 adjusted for differences between label rate and application rate used in residue study

values below detection limit assigned a value of 0.00 (note: this is not a conservative assumption)

-- denotes time periods for which extrapolation of available residue data are not reliable

Note: applications beyond 2 have been included because of inconsistencies in labelling language between Pirate and Alert regarding maximum number of applications

Table 31. Chlorfenapyr Residues in Soil (0-3 cm depth)

Region		Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest		Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Label application rate (lb aI/A)		0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications		2	2	2	3	6	1	2	2	3
Application interval (days)		7	7	7	7	7	not applicable	7	7	7
Days after first application		soil residue mg/kg	soil residue mg/kg	soil residue mg/kg	soil residue mg/kg	soil residue mg/kg	soil residue mg/kg	soil residue mg/kg	soil residue mg/kg	soil residue mg/kg
application 1	0.1	6.91E-01	5.53E-01	5.53E-01	4.15E-01	2.07E-01	8.30E-01	6.91E-01	5.53E-01	4.15E-01
	3	6.88E-01	5.51E-01	5.51E-01	4.13E-01	2.07E-01	8.26E-01	6.88E-01	5.51E-01	4.13E-01
	7	6.84E-01	5.48E-01	5.48E-01	4.11E-01	2.05E-01	8.21E-01	6.84E-01	5.48E-01	4.11E-01
application 2	7.1	1.38E+00	1.10E+00	1.10E+00	8.25E-01	4.13E-01	8.21E-01	1.38E+00	1.10E+00	8.25E-01
	14	1.36E+00	1.09E+00	1.09E+00	8.17E-01	4.09E-01	--	1.36E+00	1.09E+00	8.17E-01
application 3 (if any)	14.1	--	--	--	1.23E+00	6.16E-01	--	--	--	1.23E+00
	21	--	--	--	1.22E+00	6.10E-01	--	--	--	1.22E+00
application 4 (if any)	21.1	--	--	--	1.22E+00	8.17E-01	--	--	--	1.22E+00
	28	--	--	--	1.21E+00	8.09E-01	--	--	--	1.21E+00

Residues in soil assume a degradation half-life of 496 days and a soil density of 1.35 g/cc.

Residues are estimated to 28 days to be compatable with exposure period for weed seed and insect larvae residue data

-- indicates time periods for which other residue data cannot be predicted with reliability

Note: applications beyond 2 have been modelled because of inconsistencies in labelling language between Pirate and Alert regarding maximum number of applications

Table 32. Avian Dietary Parameters For Use in Exposure Assessment (wet weight basis)

Species	BW(g)	Free-Living Metabolic Rate* FMR = 2.123*BW**0.749 (kcal)(a)	Bodyweight Normalized FMR NFMR (kcal/g)	Proportion of Diet as Insect Matter insect P	Proportion of Diet as Seeds seed P	Proportion of Diet as Fruit fruit P	Insect P*ME (kcal/g)	seed P*ME (kcal/g)	fruit P*ME (kcal/g)	Avg ME (kcal/g)	NIR Total Bodyweight Normalized Total Intake Rate total NIR = NFMR/Avg ME (g/g/day)	insect NIR = total NIR*insect P (g/g/day)	seed NIR = total NIR*seed P (g/g/day)	fruit NIR = total NIR*other P (g/g/day)
Carolina wren	21	2.08E+01	9.89E-01	9.40E-01	3.00E-02	3.00E-02	1.08E+00	1.04E-01	2.11E-02	1.21E+00	8.18E-01	7.69E-01	2.46E-02	2.46E-02
white-eyed vireo	11	1.28E+01	1.16E+00	9.00E-01	0.00E+00	1.00E-01	1.04E+00	0.00E+00	7.04E-02	1.11E+00	1.05E+00	9.45E-01	0.00E+00	1.05E-01
northern cardinal	45	3.67E+01	8.17E-01	7.10E-01	1.45E-01	1.45E-01	8.18E-01	5.04E-01	1.02E-01	1.42E+00	5.74E-01	4.07E-01	8.32E-02	8.32E-02
blue grosbeak	28	2.58E+01	9.20E-01	6.00E-01	4.00E-01	0.00E+00	6.91E-01	1.39E+00	0.00E+00	2.08E+00	4.42E-01	2.65E-01	1.77E-01	0.00E+00
morning dove	118	4.08E+01	3.46E-01	1.00E-02	9.90E-01	0.00E+00	1.15E-02	3.44E+00	0.00E+00	3.45E+00	1.00E-01	1.00E-03	9.93E-02	0.00E+00
red-winged blackbird	53	4.15E+01	7.84E-01	5.50E-01	4.50E-01	0.00E+00	6.34E-01	1.56E+00	0.00E+00	2.20E+00	3.57E-01	1.96E-01	1.61E-01	0.00E+00

Food item	Gross Energy (kcal/g)	Assimilation Efficiency	ME: Metabolized Energy (kcal/g)
insect	1.6	7.20E-01	1.15E+00
seed	4.63	7.50E-01	3.47E+00
fruit	1.1	6.40E-01	7.04E-01

Species	BW(g)	insect NIR (g/g/day)	seed NIR (g/g/day)	fruit NIR (g/g/day)	Insect Ingestion (kg/d)	Seed Ingestion (kg/d)	Fruit Ingestion (kg/d)	Total Ingestion (kg/d)
Carolina wren	21	7.69E-01	2.46E-02	2.46E-02	1.62E-02	5.16E-04	5.16E-04	1.72E-02
white-eyed vireo	11	9.45E-01	0.00E+00	1.05E-01	1.04E-02	0.00E+00	1.16E-03	1.16E-02
northern cardinal	45	4.07E-01	8.32E-02	8.32E-02	1.83E-02	3.74E-03	3.74E-03	2.58E-02
blue grosbeak	28	2.65E-01	1.77E-01	0.00E+00	7.43E-03	4.95E-03	0.00E+00	1.24E-02
morning dove	118	1.00E-03	9.93E-02	0.00E+00	1.18E-04	1.17E-02	0.00E+00	1.18E-02
red-winged blackbird	53	1.96E-01	1.61E-01	0.00E+00	1.04E-02	8.51E-03	0.00E+00	1.89E-02

*Avian field metabolic rates as per Chapter 4 of Wildlife exposure factors handbook (EPA 1993) for passerine birds except morning dove

(a) morning dove FMR calculated as 1.146*Bw**0.749

Gross Energy for insects from average of beetles, grasshoppers, crickets (EPA 1993)

Gross Energy for seeds 5.1 dry weightX.907 (EPA 1993)

Gross Energy for fruit pulp and skin 1.1 (EPA 1993)

Assimilation Efficiency (AE) insect for birds consuming terrestrial insects 72% (EPA 1993)

AE seed for passerine birdsconsuming wild seeds 75% (EPA 1993)

AE fruit for birds consuming pulp and skin 64% (EPA 1993)

Bodyweights as per Dunning (1984)

Proportion of diet attributed to food items as per MRID 444779-01 literature search

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Table 33. Mammalian Dietary Parameters For Use in Exposure Assessment

Species	BW(g)	Free-Living Metabolic Rat*e FMR = 2.514*BW**0.507 (kcal)	Bodyweight Normalized FMR NFMR (kcal/g)	Proportion of Diet as Insect Matter insect P	Proportion of Diet as Seeds seed P	Proportion of Diet as Other Vegetation other P	Insect P*ME (kcal/g)	seed P*ME (kcal/g)	other plant P*ME (kcal/g)	Avg ME (kcal/g)	NIR Total Bodyweight Normalized Total Intake Rate total NIR = NFMR/Avg ME (g/g/day)	insect NIR = total NIR*insect P (g/g/day)	seed NIR = total NIR*seed P (g/g/day)	other NIR = total NIR*other P (g/g/day)
white-footed mouse	21	1.18E+01	5.60E-01	2.52E-01	2.59E-01	4.89E-01	3.51E-01	1.02E+00	2.82E-01	1.65E+00	3.39E-01	8.55E-02	8.78E-02	1.66E-01

Food Item	Gross Energy (kcal/g)	Assimilation Efficiency	Metabolized Energy (kcal/g)
insect	1.6	8.70E-01	1.39E+00
seed	4.63	8.50E-01	3.94E+00
other plant	0.76	7.60E-01	5.78E-01

Species	BW(g)	insect NIR (g/g/day)	seed NIR (g/g/day)	other plant NIR (g/g/day)	Insect (kg/d)	Seed (kg/d)	other plant (kg/d)	Total (kg/d)
white-footed mouse	21	8.55E-02	8.78E-02	1.66E-01	1.79E-03	1.84E-03	3.48E-03	7.12E-03

*Calculations as per Chapter 4 Wildlife Exposure Handbook (EPA 1993)

Gross Energy insect from average of beetles, grasshoppers, crickets (EPA 1993)

Gros Energy seed 5.1 dry weight X.907 (EPA 1993)

Gross Energy Energy other plant is 4.2 X (0.18) average of young grasses and dicot leaves (EPA 1993)

AE insect for rodents consuming terrestrial insects 87% (EPA 1993)

AE seed for rodents consuming seeds 85% (EPA 1993)

AE fruit for rodents consuming herbivory 76% (EPA 1993)

Bodyweight for species (EPA 1993)

Table 34. Carolina Wren Oral Exposure

Region	Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Application rate (lb ai /A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Interval (days)	7	7	7	7	7	not applicable	7	7	7
Days after first application	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day
0.1	2.59	2.07	2.07	1.53	0.72	3.32	2.59	2.07	1.53
3.0	0.81	0.64	0.64	0.49	0.24	1.11	0.81	0.64	0.49
7.0	0.39	0.31	0.31	0.23	0.10	0.68	0.39	0.31	0.23
7.1	3.18	2.54	2.54	1.88	0.85	–	1.38	2.54	1.88
14.0	0.84	0.67	0.67	0.50	0.19	–	0.84	0.67	0.50
14.1	–	–	–	1.58	0.91	–	–	–	1.58
21.0	–	–	–	0.50	0.21	–	–	–	0.50
21.1	–	–	–	0.50	0.93	–	–	–	0.50
28.0	–	–	–	0.33	0.24	–	–	–	0.33

All oral exposure models terminated at 28 days of exposure following first appliation, regardless of the total number of applications possible.

– value not estimated due to limitations of individual compartment residue data

Table 35. White-Eyed Vireo Oral Exposure

Region	Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Application rate (lb ai /A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Interval (days)	7	7	7	7	7	not applicable	7	7	7
Days after first application	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day
0.1	3.89	3.11	3.11	2.31	1.05	5.12	3.89	3.11	2.31
3.0	1.24	0.99	0.99	0.74	0.38	1.79	1.24	0.99	0.74
7.0	0.66	0.53	0.53	0.40	0.16	1.25	0.66	0.53	0.40
7.1	4.99	3.99	3.99	2.96	1.27	–	2.78	3.99	2.96
14.0	1.51	1.21	1.21	0.90	0.32	–	1.51	1.21	0.90
14.1	–	–	–	2.23	1.35	–	–	–	2.23
21.0	–	–	–	0.87	0.34	–	–	–	0.87
21.1	–	–	–	0.87	1.39	–	–	–	0.87
28.0	–	–	–	0.59	0.41	–	–	–	0.59

All oral exposure models terminated at 28 days of exposure following first appliation, regardless of the total number of applications possible.

– value not estimated due to limitations of individual compartment residue data

Chemical No: 129093

DATA REQUIREMENTS FOR
CHLORFENAPYR ON COTTON

Data Requirement	Use Pattern[1]	Does EPA Have Data To Satisfy This Requirement? (Yes, No, Partial, or Under Review)	Bibliographic Citation	Must Additional Data Be Submitted for This U Under FIFRA 3(c)(2)(B)? ' (Yes, No, or Reserved) [2]
§158.490 WILDLIFE AND AQUATIC ORGANISMS	3			
71-1(a) Acute Avian Oral, Quail/Duck		Y	427702-28 427702-27	N
71-2(a) Acute Avian Diet, Quail		Y	427702-30	N
71-2(b) Acute Avian Diet, Duck		Y	427702-29	N
71-3 Wild Mammal Toxicity		N		N
71-4(a) Avian Reproduction Quail		P	434928-11	N
71-4(b) Avian Reproduction Duck		Y	434928-13	N
71-5(a) Simulated Terrestrial Field Study		N	438870-07 434928-14 (pen study)	N
71-5(b) Actual Terrestrial Field Study		UR	444526-16 (mortalityonly, no data for EFED request for reproduction)	N
72-1(a) Acute Fish Toxicity Bluegill		Y	428078-01	N
72-1(b) Acute Fish Toxicity (TEP)		N		N
72-1(c) Acute Fish Toxicity Rainbow Trout		Y	427702-31	N
72-1(d) Acute Fish Toxicity Rainbow Trout (TEP)		N		N
72-2(a) Acute Aquatic Invertebrate		Y	427702-31	N
72-2(b) Acute Aquatic Invertebrate (TEP)		N		N
72-3(a) Acute Est/Mar Toxicity Fish		Y	434928-16	N
72-3(b) Acute Est/Mar Toxicity Mollusk		N	**434928-17 (invalid)**	Y
72-3(c) Acute Est/Mar Toxicity Shrimp		Y	434928-18	N
72-3(d) Acute Est/Mar Toxicity Fish (TEP)		N		N
72-3(e) Acute Est/Mar Toxicity Mollusk (TEP)		N		N
72-3(f) Acute Est/Mar Toxicity Shrimp (TEP)		N		N
72-4(a) Early Life Stage Fish		Y	434928-19	N

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Data Requirement	Use Pattern[1]	Does EPA Have Data To Satisfy This Requirement? (Yes, No, Partial, or Under Review)	Bibliographic Citation	Must Additional Data Be Submitted for This U Under FIFRA 3(c)(2)(B)? (Yes, No, or Reserved)[2]
72-4(b) Life Cycle Aquatic Invertebrate		Y	434928-22	N
72-5 Life Cycle Fish		N	443648-03 (INVALID)	Y
72-6 Aquatic Organism Accumulation		N		R
72-7(a) Simulated Aquatic Field Study		Y	434928-23 (Microcosm)	R
72-7(b) Actual Aquatic Field Study		N		R
§158.540 PLANT PROTECTION				
122-1(a) Seed Germ.,Seedling Enmergence		N		N
122-2 Aquatic Plant Growth		N		N
122-1(a) Seed Germ./Seedling Emerg.		N		N
122-1(b) Vegetative Vigor		N		N
123-1(a) Seed Germ./Seedling Emerg.		N		N
123-1(b) Vegetative Vigor		N		N
123-2 Aquatic Plant Growth		N		N
124-1 Terrestrial Field Study		N		N
124-2 Aquatic Field Study		N		N
§158.490 NONTARGET INSECT TESTING				
141-1 Honey Bee Acute Contact		Y	427702-33	N
141-2 Honey Bee Residue on Foliage		Y	434928-45	N
141-5 Field Test for Pollinators		N		N
PROVISIONAL SEDIMENT TOXICITY TESTING				
850.1735 Acute Freshwater Invertebrate		Y	444526-19	N
850.1735 Acute Freshwater Invertebrate		UR	445600-02	N
Chronic Invertebrate		N		R

Data Requirement	Use Pattern[1]	Does EPA Have Data To Satisfy This Requirement? (Yes, No, Partial, or Under Review)	Bibliographic Citation	Must Additional Data Be Submitted for This I Under FIFRA 3(c)(2)(B)? (Yes, No, or Reserved) [2]
§158.290 ENVIRONMENTAL FATE				
Degradation Studies-Lab:				
161-1 Hydrolysis		Y	427702--40	N
161-2 Photodegradation In Water		Y	434928-46, 427702-41	N
161-3 Photodegradation On Soil		Y	427702-42	N
Metabolism Studies-Lab:				
162-1 Aerobic Soil		Y	427702-43, 438870-02, 444526-21	N
162-2 Anaerobic Soil		Y	434928-47	N
162-4 Aerobic Aquatic		P	439042-02	N
Mobility Studies:				
163-1 Leaching- Adsorption/Desorp.		Y	427702-44, 434928-49, 434928-48	N
163-2 Volatility (Lab)		N		N
Dissipation Studies-Field:				
164-1 Soil		P	434928-50, 444526-22, 444526-23	N
164-5 Soil Long-Term		P	444526-24	N
Accumulation Studies:				
165-4 In Fish		Y	427702-45, 434928-52	N
Ground Water Monitoring Studies:				
166-1 Small-Scale Prospective		N		N
§158.440 SPRAY DRIFT				
201-1 Droplet Size Spectrum		N		Y*
202-1 Drift Field Evaluation		N		Y*

FOOTNOTES:

1. 1=Terrestrial Food; 2=Terrestrial Feed; 3=Terrestrial Non-Food; 4=Aquatic Food; 5=Aquatic Non-Food(Outdoor); 6=Aquatic Non-Food (Industrial); 7=Aquatic Non-Food (Residential); 8=Greenhouse Food; 9=Greenhouse Non-Food; 10= Forestry; 11=Residential Outdoor; 12=Indoor Food; 13=Indoor Non-Food; 14=Indoor Medicinal; 15=Indoor Residential.
2. Reserved studies: aquatic simulated and actual field tests reserved pending considration of all requested sediment toxicity tests.

* These data may be supplied through the pending Spray Drift Task Force Database and associated modeling scenarios.

Table 36. Northern Cardinal Oral Exposure

Region	Western/	Western/	Western/	Western/	Western/	Eastern/	Eastern/	Eastern/	Eastern/
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Application rate (lb ai /A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Interval (days)	7	7	7	7	7	not applicable	7	7	7
Days after first application	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day
0.1	3.59	2.88	2.88	2.14	0.89	5.04	3.59	2.88	2.14
3.0	1.21	0.97	0.97	0.72	0.37	1.93	1.21	0.97	0.72
7.0	0.80	0.64	0.64	0.48	0.17	1.66	0.80	0.64	0.48
7.1	5.08	4.06	4.06	3.02	1.16	–	4.13	4.06	3.02
14.0	1.95	1.56	1.56	1.16	0.37	–	1.95	1.56	1.16
14.1	–	–	–	1.77	1.24	–	–	–	1.77
21.0	–	–	–	1.07	0.37	–	–	–	1.07
21.1	–	–	–	1.07	1.26	–	–	–	1.07
28.0	–	–	–	0.77	0.48	–	–	–	0.77

All oral exposure models terminated at 28 days of exposure following first appliation, regardless of the total number of applications possible.

-- value not estimated due to limitations of individual compartment residue data

Table 37. Blue Grosbeak Oral Exposure

Region	Western/	Western/	Western/	Western/	Western/	Eastern/	Eastern/	Eastern/	Eastern/
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Application rate (lb ai /A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Interval (days)	5	5	5	5	5	not applicable	5	5	5
Days after first application	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day
0.1	3.42	2.75	2.75	2.04	0.83	4.89	3.42	2.75	2.04
3.0	1.17	0.93	0.93	0.70	0.36	1.91	1.17	0.93	0.70
7.0	0.81	0.64	0.64	0.48	0.16	1.72	0.81	0.64	0.48
7.1	4.97	3.97	3.97	2.95	1.10	–	4.35	3.97	2.95
14.0	2.01	1.60	1.60	1.20	0.38	–	2.01	1.60	1.20
14.1	–	–	–	1.61	1.18	–	–	–	1.61
21.0	–	–	–	1.10	0.37	–	–	–	1.10
21.1	–	–	–	1.10	1.20	–	–	–	1.10
28.0	–	–	–	0.80	0.48	–	–	–	0.80

All oral exposure models terminated at 28 days of exposure following first appliation, regardless of the total number of applications possible.

– value not estimated due to limitations of individual compartment residue data

Table 38. Mourning Dove Oral Exposure

Region	Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Application rate (lb ai /A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Interval (days)	5	5	5	5	5	not applicable	5	5	5
Days after first application	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day
0.1	1.57	1.26	1.26	0.94	0.36	2.33	1.57	1.26	0.94
3.0	0.55	0.44	0.44	0.33	0.17	0.95	0.55	0.44	0.33
7.0	0.42	0.33	0.33	0.25	0.08	0.92	0.42	0.33	0.25
7.1	2.41	1.92	1.92	1.43	0.50	--	2.41	1.92	1.43
14.0	1.07	0.85	0.85	0.64	0.19	--	1.07	0.85	0.64
14.1	--	--	--	0.66	0.54	--	--	--	0.66
21.0	--	--	--	0.57	0.18	--	--	--	0.57
21.1	--	--	--	0.57	0.55	--	--	--	0.57
28.0	--	--	--	0.42	0.25	--	--	--	0.42

All oral exposure models terminated at 28 days of exposure following first appliation, regardless of the total number of applications possible.

-- value not estimated due to limitations of individual compartment residue data

Table 39. Red-Winged Blackbird Oral Exposure

Region	Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Application rate (lb ai /A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Interval (days)	7	7	7	7	7	not applicable	7	7	7
Days after first application	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day
0.1	3.00	2.41	2.41	1.79	0.72	4.31	3.00	2.41	1.79
3.0	1.03	0.82	0.82	0.62	0.32	1.70	1.03	0.82	0.62
7.0	0.72	0.58	0.58	0.43	0.15	1.55	0.72	0.58	0.43
7.1	4.40	3.51	3.51	2.61	0.97	--	3.94	3.51	2.61
14.0	1.80	1.44	1.44	1.08	0.34	--	1.80	1.44	1.08
14.1	--	--	--	1.39	1.03	--	--	--	1.39
21.0	--	--	--	0.98	0.33	--	--	--	0.98
21.1	--	--	--	0.98	1.05	--	--	--	0.98
28.0	--	--	--	0.72	0.43	--	--	--	0.72

All oral exposure models terminated at 28 days of exposure following first appliation, regardless of the total number of applications possible.

-- value not estimated due to limitations of individual compartment residue data

Table 40. White-Footed Mouse Oral Exposure

Region	Western	Western	Western	Western	Western	Eastern	Eastern	Eastern	Eastern
Pest	Mites, Bollworm and Budworm	Bollworm and Budworm	Armyworm	Mites	Mites	Bollworm and Budworm	Armyworm	Mites and Armyworm	Mites
Application rate (lb ai /A)	0.25	0.2	0.2	0.15	0.075	0.3	0.25	0.2	0.15
Number of applications	2	2	2	3	6	1	2	2	3
Interval (days)	7	7	7	7	7	not applicable	7	7	7
Days after first application	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day	Exposure mg/kg/day
0.1	11.11	8.89	8.89	6.66	3.24	13.72	11.11	8.89	6.66
3.0	2.00	1.60	1.60	1.20	0.61	2.65	2.00	1.60	1.20
7.0	0.70	0.56	0.56	0.42	0.17	1.22	0.70	0.56	0.42
7.1	12.18	9.74	9.74	7.29	3.46	–	11.98	9.74	7.29
14.0	1.43	1.15	1.15	0.86	0.32	–	1.43	1.15	0.86
14.1	–	–	–	6.71	3.54	–	–	–	6.71
21.0	–	–	–	0.86	0.34	–	–	–	0.86
21.1	–	–	–	0.86	3.58	–	–	–	0.86
28.0	–	–	–	0.59	0.43	–	–	–	0.59

All oral exposure models terminated at 28 days of exposure following first appliation, regardless of the total number of applications possible.

– value not estimated due to limitations of individual compartment residue data

Table 41. MUSCRAT (PRZM 3.1.1 & EXAMS 2.97.5) and PRZM 3.1.2/EXAMS Estimates of Chlorfenapyr Concentrations in Water and Sediment

Census of Ag Region	Application (lbs/ac)	Peak	96 Hour	21 Day	60 Day	90 Day	Annual
MUSCRAT Dissolved Concentration Water Column (ppb)							
Region 4	0.3 July 7 0.2 July 15	3.51	2.87	2.14	1.9	1.83	1.73
Region 6	0.3 July 7 0.2 July 15	3.96	3.36	2.52	2.17	2.12	2
Region 7	0.3 July 7 0.2 July 15	5.35	4.16	2.74	2.43	2.35	2.12
Region 11	0.2 June 15 0.3 July 15	2.13	1.7	1.17	1	0.97	0.8
PRZM 3.1.2/EXAMS Dissolved Concentration Water Column (ppb)							
Standard EFED MS Cotton Site	0.2 June 15 0.3 July 15	2.49	1.97	1.49	1.28	1.25	1.04
MUSCRAT Adsorbed Concentration Benthic Layer (μg/kg)							
Region 4	0.3 July 7 0.2 July 15	830	829	828	817	810	778
Region 6	0.3 July 7 0.2 July 15	955	955	952	944	938	910
Region 7	0.3 July 7 0.2 July 15	1040	1040	1030	1020	1020	961
Region 11	0.2 June 15 0.3 July 15	426	426	424	418	415	397
PRZM 3.1.2/EXAMS Adsorbed Concentration Benthic Layer (μg/kg)							
Standard EFED MS Cotton Site	0.3 July 7 0.2 July 15	533	532	529	520	516	473

Table 42. Risk Presumption, Risk Quotient Derivation and Risk Threshold Used for Floral and Faunal Risk Assessment

RISK PRESUMPTION	RISK QUOTIENT	LEVEL OF CONCERN
Birds		
Acute High Risk	EEC[1]/LC_{50} or LD_{50}/day	0.5
Acute Restricted Use	EEC/LC_{50} or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} or LD_{50}/day	0.1
Chronic Risk	EEC/NOEC	1
Wild Mammals		
Acute High Risk	EEC/LC_{50} or LD50/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 LD50/sqft or LD_{50}/day	0.1
Chronic Risk	EEC/NOEC	1

[1] abbreviation for Estimated Environmental Concentration; designated ppm in avian/mammalian food items

RISK PRESUMPTION	RISK QUOTIENT	LEVEL OF CONCERN
Aquatic Animals		
Acute High 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/MATC or NOEC	1

[1] abbreviation for Estimated Environmental Concentration; designated ppb/ppm in water

RISK PRESUMPTION	RISK QUOTIENT	LEVEL OF CONCERN
Terrestrial and Semi-Aquatic Plants		
Acute High Risk	EEC[1]/EC_{25}	1
Acute Endangered Species	EEC/EC_{05} or NOEC	1
Aquatic Plants		
Acute High Risk	EEC[2]/EC_{50}	1
Acute Endangered Species	EEC/EC_{05} or NOEC	1

[1] abbreviation for Estimated Environmental Concentration; designated lb ai/A
[2] abbreviation for Estimated Environmental Concentration; designated ppb/ppm in water

Table 43. Avian Risk Quotients

Application rate lb ai/A	0.25				0.2				0.15				0.3				0.075			
Number of applications	2				2				3				1				6			
Interval	7				7				7				na				7			
Days after first application	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ
Carolina Wren																				
0.1	2.59	1.17	1.59	43.85	2.07	0.94	1.27	35.10	1.53	0.69	0.94	25.98	3.32	1.50	2.03	56.21	0.72	0.33	0.44	12.21
3.0	0.81	0.37	0.50	13.68	0.64	0.29	0.40	10.93	0.49	0.22	0.30	8.22	1.11	0.50	0.68	18.74	0.24	0.11	0.15	4.10
7.0	0.39	0.17	0.24	6.55	0.31	0.14	0.19	5.27	0.23	0.10	0.14	3.90	0.68	0.31	0.42	11.48	0.10	0.04	0.06	1.64
7.1	3.18	1.44	1.95	53.90	2.54	1.15	1.56	43.09	1.88	0.85	1.15	31.90	--	--	--	--	0.85	0.38	0.52	14.36
14.0	0.84	0.38	0.52	14.24	0.67	0.30	0.41	11.42	0.50	0.22	0.30	8.42	--	--	--	--	0.19	0.09	0.12	3.28
14.1	--	--	--	--	--	--	--	--	1.58	0.71	0.97	26.72	--	--	--	--	0.91	0.41	0.56	15.35
21.0	--	--	--	--	--	--	--	--	0.50	0.23	0.31	8.51	--	--	--	--	0.21	0.09	0.13	3.53
21.1	--	--	--	--	--	--	--	--	0.30	0.14	0.19	5.12	--	--	--	--	0.93	0.42	0.57	15.74
28.0	--	--	--	--	--	--	--	--	0.33	0.15	0.20	5.57	--	--	--	--	0.24	0.11	0.15	4.11
White-Eyed Vireo																				
0.1	3.89	1.76	2.38	65.87	3.11	1.41	1.91	52.77	2.31	1.04	1.42	39.10	5.12	2.32	3.14	86.82	1.05	0.47	0.64	17.77
3.0	1.24	0.56	0.76	21.04	0.99	0.45	0.61	16.80	0.74	0.34	0.46	12.63	1.79	0.81	1.10	30.27	0.38	0.17	0.23	6.36
7.0	0.66	0.30	0.41	11.25	0.53	0.24	0.33	9.03	0.40	0.18	0.24	6.70	1.25	0.56	0.77	21.16	0.16	0.07	0.10	2.64
7.1	4.99	2.26	3.06	84.59	3.99	1.80	2.45	67.60	2.96	1.34	1.81	50.12	--	--	--	--	1.27	0.57	0.78	21.47
14.0	1.51	0.68	0.93	25.62	1.21	0.55	0.74	20.53	0.90	0.41	0.55	15.21	--	--	--	--	0.32	0.15	0.20	5.50
14.1	--	--	--	--	--	--	--	--	2.23	1.01	1.37	37.88	--	--	--	--	1.35	0.61	0.83	22.95
21.0	--	--	--	--	--	--	--	--	0.87	0.40	0.54	14.82	--	--	--	--	0.34	0.15	0.21	5.74
21.1	--	--	--	--	--	--	--	--	0.87	0.40	0.54	14.82	--	--	--	--	1.39	0.63	0.85	23.51
28.0	--	--	--	--	--	--	--	--	0.59	0.27	0.36	10.08	--	--	--	--	0.41	0.19	0.25	6.95

Single oral dose mg/kd	2.21	single oral dose RQ = exposure/2.21
Subacute lethal dose mg/kg/d	1.63	subacute oral dose RQ = exposure/1.63
Chronic dose mg/kg/d	0.059	chronic oral dose RQ = expposure/0.059

-- risk quotients not calculated because of limitations in residue data

Table 44. Avian Risk Quotients

Application rate lb ai/A	0.25				0.2				0.15				0.3				0.075			
Number of applications	2				2				3				1				6			
Interval	7				7				7				na				7			
Days after first application	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ
Northern Cardinal																				
0.1	3.59	1.62	2.20	60.84	2.88	1.30	1.77	48.82	2.14	0.97	1.31	36.28	5.04	2.28	3.09	85.47	0.89	0.40	0.55	15.14
3.0	1.21	0.55	0.74	20.50	0.97	0.44	0.59	16.37	0.72	0.33	0.44	12.27	1.93	0.87	1.18	32.68	0.37	0.17	0.23	6.30
7.0	0.80	0.36	0.49	13.49	0.64	0.29	0.39	10.79	0.48	0.22	0.29	8.05	1.66	0.75	1.02	28.22	0.17	0.07	0.10	2.81
7.1	5.08	2.30	3.12	86.17	4.06	1.84	2.49	68.80	3.02	1.37	1.85	51.19	–	–	–	–	1.16	0.52	0.71	19.63
14.0	1.95	0.88	1.20	33.06	1.56	0.71	0.96	26.46	1.16	0.53	0.71	19.72	–	–	–	–	0.37	0.17	0.23	6.35
14.1	–	–	–	–	–	–	–	–	1.77	0.80	1.09	29.98	–	–	–	–	1.24	0.56	0.76	20.98
21.0	–	–	–	–	–	–	–	–	1.07	0.49	0.66	18.22	–	–	–	–	0.37	0.17	0.23	6.27
21.1	–	–	–	–	–	–	–	–	1.07	0.49	0.66	18.22	–	–	–	–	1.26	0.57	0.77	21.41
28.0	–	–	–	–	–	–	–	–	0.77	0.35	0.47	13.12	–	–	–	–	0.48	0.22	0.29	8.12
Blue Grosbeak																				
0.1	3.42	1.55	2.10	57.99	2.75	1.24	1.69	46.57	2.04	0.92	1.25	34.63	4.89	2.21	3.00	82.87	0.83	0.38	0.51	14.09
3.0	1.17	0.53	0.72	19.83	0.93	0.42	0.57	15.84	0.70	0.32	0.43	11.86	1.91	0.86	1.17	32.40	0.36	0.16	0.22	6.12
7.0	0.81	0.37	0.50	13.68	0.64	0.29	0.40	10.93	0.48	0.22	0.30	8.17	1.72	0.78	1.06	29.19	0.16	0.07	0.10	2.77
7.1	4.97	2.25	3.05	84.27	3.97	1.80	2.43	67.27	2.95	1.34	1.81	50.08	–	–	–	–	1.10	0.50	0.68	18.66
14.0	2.01	0.91	1.23	33.99	1.60	0.73	0.98	27.20	1.20	0.54	0.73	20.30	–	–	–	–	0.38	0.17	0.23	6.39
14.1	–	–	–	–	–	–	–	–	1.61	0.73	0.99	27.26	–	–	–	–	1.18	0.53	0.72	19.94
21.0	–	–	–	–	–	–	–	–	1.10	0.50	0.67	18.56	–	–	–	–	0.37	0.17	0.23	6.24
21.1	–	–	–	–	–	–	–	–	1.10	0.50	0.67	18.56	–	–	–	–	1.20	0.54	0.74	20.33
28.0	–	–	–	–	–	–	–	–	0.80	0.36	0.49	13.51	–	–	–	–	0.48	0.22	0.30	8.19

Single oral dose mg/kd 2.21 single oral dose RQ = exposure/2.21

Subacute lethal dose mg/kg/d 1.63 subacute oral dose RQ = exposure/1.63

Chronic dose mg/kg/d 0.059 chronic oral dose RQ = expposure/0.059

– risk quotients not calculated because of limitations in residue data

Table 45. Avian Risk Quotients

Application rate lb ai/A	0.25				0.2				0.15				0.35				0.075			
Number of applications	2				2				3				1				6			
Interval	7				7				7				na				7			
Days after first application	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-acute Lethal RQ	Chronic RQ
Mourning Dove																				
0.1	1.57	0.71	0.97	26.66	1.26	0.57	0.78	21.43	0.94	0.43	0.58	15.96	2.33	1.05	1.43	39.47	0.36	0.16	0.22	6.15
3.0	0.55	0.25	0.34	9.39	0.44	0.20	0.27	7.50	0.33	0.15	0.20	5.61	0.95	0.43	0.58	16.13	0.17	0.08	0.11	2.92
7.0	0.42	0.19	0.26	7.10	0.33	0.15	0.20	5.66	0.25	0.11	0.15	4.24	0.92	0.42	0.57	15.67	0.08	0.04	0.05	1.37
7.1	2.41	1.09	1.48	40.83	1.92	0.87	1.18	32.58	1.43	0.65	0.88	24.30	--	--	--	--	0.50	0.23	0.31	8.53
14.0	1.07	0.48	0.65	18.07	0.85	0.39	0.52	14.45	0.64	0.29	0.39	10.81	--	--	--	--	0.19	0.09	0.12	3.26
14.1	--	--	--	--	--	--	--	--	0.66	0.30	0.41	11.23	--	--	--	--	0.54	0.24	0.33	9.11
21.0	--	--	--	--	--	--	--	--	0.57	0.26	0.35	9.71	--	--	--	--	0.18	0.08	0.11	3.12
21.1	--	--	--	--	--	--	--	--	0.57	0.26	0.35	9.71	--	--	--	--	0.55	0.25	0.34	9.27
28.0	--	--	--	--	--	--	--	--	0.42	0.19	0.26	7.20	--	--	--	--	0.25	0.11	0.15	4.20
Red-Winged Blackbird																				
0.1	3.00	1.36	1.84	50.87	2.41	1.09	1.48	40.85	1.79	0.81	1.10	30.39	4.31	1.95	2.64	73.07	0.72	0.33	0.44	12.26
3.0	1.03	0.47	0.63	17.48	0.82	0.37	0.51	13.96	0.62	0.28	0.38	10.45	1.77	0.80	1.09	30.05	0.32	0.14	0.20	5.40
7.0	0.72	0.33	0.44	12.25	0.58	0.26	0.35	9.78	0.43	0.20	0.26	7.31	1.55	0.70	0.95	26.28	0.15	0.07	0.09	2.46
7.1	4.40	1.99	2.70	74.55	3.51	1.59	2.15	59.51	2.61	1.18	1.60	44.32	--	--	--	--	0.97	0.44	0.59	16.36
14.0	1.80	0.82	1.11	30.55	1.44	0.65	0.88	24.45	1.08	0.49	0.66	18.25	--	--	--	--	0.34	0.15	0.21	5.70
14.1	--	--	--	--	--	--	--	--	1.39	0.63	0.85	23.52	--	--	--	--	1.03	0.47	0.63	17.47
21.0	--	--	--	--	--	--	--	--	0.98	0.44	0.60	16.63	--	--	--	--	0.33	0.15	0.20	5.55
21.1	--	--	--	--	--	--	--	--	0.98	0.44	0.60	16.63	--	--	--	--	1.05	0.48	0.64	17.81
28.0	--	--	--	--	--	--	--	--	0.72	0.32	0.44	12.15	--	--	--	--	0.43	0.20	0.26	7.31

Single oral dose mg/kd	2.21	single oral dose RQ = exposure/2.21
Subacute lethal dose mg/kg/d	1.63	subacute oral dose RQ = exposure/1.63
Chronic dose mg/kg/d	0.059	chronic oral dose RQ = expposure/0.059

-- risk quotients not calculated because of limitations in residue data

Table 46. Mammal Risk Quotients

Application rate lb ai/A	0.25				0.2				0.15				0.35				0.075			
Number of applications	2				2				3				1				6			
Interval	7				7				7				na				7			
Days after first application	Exposure mg/kg/d	Single Oral Dose RQ	Sub-chronic RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-chronic RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-chronic RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-chronic RQ	Chronic RQ	Exposure mg/kg/d	Single Oral Dose RQ	Sub-chronic RQ	Chronic RQ
White-Footed Mouse																				
0.1	11.11	0.20	1.56	2.22	8.89	0.16	1.25	1.78	6.66	0.12	0.94	1.33	13.72	0.25	1.93	2.74	3.24	0.06	0.46	0.65
3.0	2.00	0.04	0.28	0.40	1.60	0.03	0.23	0.32	1.20	0.02	0.17	0.24	2.65	0.05	0.37	0.53	0.61	0.01	0.09	0.12
7.0	0.70	0.01	0.10	0.14	0.56	0.01	0.08	0.11	0.42	0.01	0.06	0.08	1.22	0.02	0.17	0.24	0.17	0.00	0.02	0.03
7.1	12.18	0.22	1.72	2.44	9.74	0.18	1.37	1.95	7.29	0.13	1.03	1.46	--	--	--	--	3.46	0.06	0.49	0.69
14.0	1.43	0.03	0.20	0.29	1.15	0.02	0.16	0.23	0.86	0.02	0.12	0.17	--	--	--	--	0.32	0.01	0.04	0.06
14.1	--	--	--	--	--	--	--	--	6.71	0.12	0.94	1.34	--	--	--	--	3.54	0.06	0.50	0.71
21.0	--	--	--	--	--	--	--	--	0.86	0.02	0.12	0.17	--	--	--	--	0.34	0.01	0.05	0.07
21.1	--	--	--	--	--	--	--	--	0.86	0.02	0.12	0.17	--	--	--	--	3.58	0.07	0.50	0.72
28.0	--	--	--	--	--	--	--	--	0.59	0.01	0.08	0.12	--	--	--	--	0.43	0.01	0.06	0.09

Acute oral dose 55 single oral dose RQ = exposure/55

Subchronic dose 7.1 subchronic oral dose RQ = exposure/7.1

Chronic dose 5 chronic oral dose RQ = exppoure/5

-- risk quotients not calculated because of limitations in residue data

Table 47. Risk Quotients (RQs) for Freshwater Fish Based On a Rainbow Trout LC_{50} of 7.44 ppb and a Rainbow Trout NOEC of 3.68 ppb in Regions 4, 6, 7, and 11

Region/ Application Method and Rate (lb ai/a)	LC_{50} (ppb)	NOEC (ppb)	EEC Initial (ppb)	EEC 60-Day (ppb)	Acute RQ (EEC/LC_{50})	Chronic RQ (EEC/NOEC)
Region 4/Cotton/aerial & ground 0.3	7.44	3.68	3.51	1.90	0.47	0.52
Region 6/Cotton/aerial & ground 0.3	7.44	3.68	3.96	2.17	0.53	0.59
Region 7/Cotton/aerial & ground 0.3	7.44	3.68	4.16	2.43	0.56	0.66
Region 11/Cotton/aerial &ground 0.3	7.44	3.68	1.7	1	0.23	0.27

Table 48. Risk Quotients (RQs) for Freshwater Invertebrates Based On a *Daphnia magna* EC_{50}/LC_{50} of 5.83 and a *Daphnia magna* NOEC of 3.57 ppb in Regions 4,6, 7, and 11

Region/ Application Method and Rate (lb ai/a)	LC_{50} (ppb)	NOEC (ppb)	EEC Initial (ppb)	EEC 21-Day Average	Acute RQ (EEC/LC_{50})	Chronic RQ (EEC/NOEC)
Region 4/Cotton/aerial & ground 0.3	5.83	3.57	3.51	2.14	0.60	0.60
Region 6/ground & aerial 0.3	5.83	3.57	3.96	2.52	0.68	0.71
Region 7/Cotton/aerial & ground 0.3	5.83	3.57	4.16	2.74	0.71	0.77
Region 11/ground & aerial 0.3	5.83	3.57	1.70	1.17	0.29	0.33

Table 49. Risk Quotients (RQs) for Estuarine/Marine Organisms in Regions 4, 6, 7, and 11

Region/Application Method and Rate (lb ai/a)	Species	LC_{50} (ppb)	NOEC (ppb)	EEC Initial (ppb)	EEC 21-Day Average	EEC 56-Day Average	Acute RQ (EEC/LC_{50})	Chronic RQ (EEC/ NOEC)
Region 4/aerial & ground 0.3	Mysid	2.03	0.172	3.51	2.14	1.90	1.73	12.44
	Sheepshead Minnow	60.2	-	3.51	2.14	1.90	0.06	-
Region.6/Aerial & ground 0.3	Mysid	2.03	0.172	3.36	2.52	2.17	1.66	14.65
	Sheepshead Minnow	60.2	-	3.36	2.52	2.17	0.06	-
Region 7/aerial & ground 0.3	Mysid	2.03	0.172	5.35	2.74	2.43	2.64	15.93
	Sheepshead Minnow	60.2	-	5.35	2.74	2.43	0.09	-
Region.11/Aerial & ground 0.3	Mysid	2.03	0.172	2.13	1.17	1.00	1.05	6.80
	Sheepshead Minnow	60.2	-	2.13	1.17	1.00	0.04	-

Table 50. Risk Quotients (RQs) for the Freshwater Amphipod Based On a *Hyalellea azteca* EC_{50}/LC_{50} of 19.6 mg/kg in Regions 4,6, 7, and 11

Region/ Application Method and Rate (lb ai/a)	LC_{50} (μ/Kg)	NOEC	EEC Initial (ppb)	EEC 21-Day Average	Acute RQ (EEC/LC_{50})	Chronic RQ (EEC/NOEC)
Region 4/Cotton/aerial & ground 0.3	19,600	-	830	828	0.04	-
Region 6/ground & aerial 0.3	19,600	-	955	952	0.05	-
Region 7/Cotton/aerial & ground 0.3	19,600	-	1040	1030	0.05	-
Region 11/ground & aerial 0.3	19,600	-	426	424	0.02	-

[1]No chronic data available to EPA at this time

Table 51. Risk Quotients (RQs) for the Marine Amphipod Based On a *Leptocheirus plumulosus* EC_{50}/LC_{50} of 0.18 mg/kg in Regions 4,6, 7, and 11

Region/ Application Method and Rate (lb ai/a)	LC_{50} (μ/Kg)	NOEC	EEC Initial (ppb)	EEC 21-Day Average	Acute RQ (EEC/LC_{50})	Chronic RQ (EEC/NOEC)
Region 4/Cotton/aerial & ground 0.3+ .2	180	-	830	828	4.61	-
Region 6/ground & aerial 0.3 +0.2	180	-	955	952	5.31	-
Region 7/Cotton/aerial & ground 0.3 + 0.2	180	-	1040	1030	5.78	-
Region 11/ground & aerial 0.3 +0.2	180	-	426	424	2.37	-

Table 52. Population Status of Risk Assessment Bird Species in Cotton States

State	Trends in Breeding Bird populations 1966-1996					
	Carolina Wren	White-Eyed Vireo	Northern Cardinal	Blue Grosbeak	Mourning Dove	Red-Winged Blackbird
AL	negative	positive	negative	positive	negative	negative*
AR	negative	negative*	positive	positive	negative	positive*
AZ	no data	no data	negative	positive	negative	positive
CA	no data	no data	no data	positive	negative*	positive
FL	positive	negative	negative	positive	positive	negative*
GA	positive	negative	negative*	positive	negative	negative*
LA	positive	negative	negative	positive	positive	negative
MO	positive	negative	negative*	positive	negative*	positive
MS	positive	positive	negative	negative	negative	negative*
NC	positive	positive	negative	positive	negative	negative
NM	no data	no data	no data	positive	negative	negative
OK	positive	positive	positive	negative	negative*	positive
SC	negative	stable	negative*	positive	negative	negative*
TN	positive	negative*	negative*	positive	negative	positive
TX	positive	negative*	positive	negative	negative*	negative
VA	positive	positive	negative*	positive	negative	negative*

* denotes declines significant to $p<0.05$

Table 53. Required Aquatic Testing

GUIDELINE #	STUDY	REASON
72-1	LC_{50} Rainbow trout	**Optional.** To be repeated at the discretion of the registrant (see study description). Invalid test due to failure to measure test concentration on photolytic degradate (Cl 357,806). The purported LC_{50} of 2.6 ppb implies that this compound is more toxic than the parent.
72-3	EC_{50} Oyster Shell Deposition Study	Invalid study due to inadequate shell growth in controls (MRID 434928-17) Since an embryo-larvae study was not conducted, this study must be repeated.
72-4	Sheepshead minnow Early life (marine/estuarine)	Invalid study due to low Dissolved Oxygen level throughout the experiment. The required fish full life-cyle study listed directly below would satisfy this requirement.
72-5	Sheephead minnow Life-cycle Study	The EEC is greater than 0.1 of the NOEL in the fish early life and invertebrate Life-Cycle study. The studies submitted under MRID 443648-02 and MRID 443648-03 need to be repeated due to control contamination.

Figure 1. Proposed Degradation Pathway for Chlorfenapyr in Outdoor Cotton Field Soil

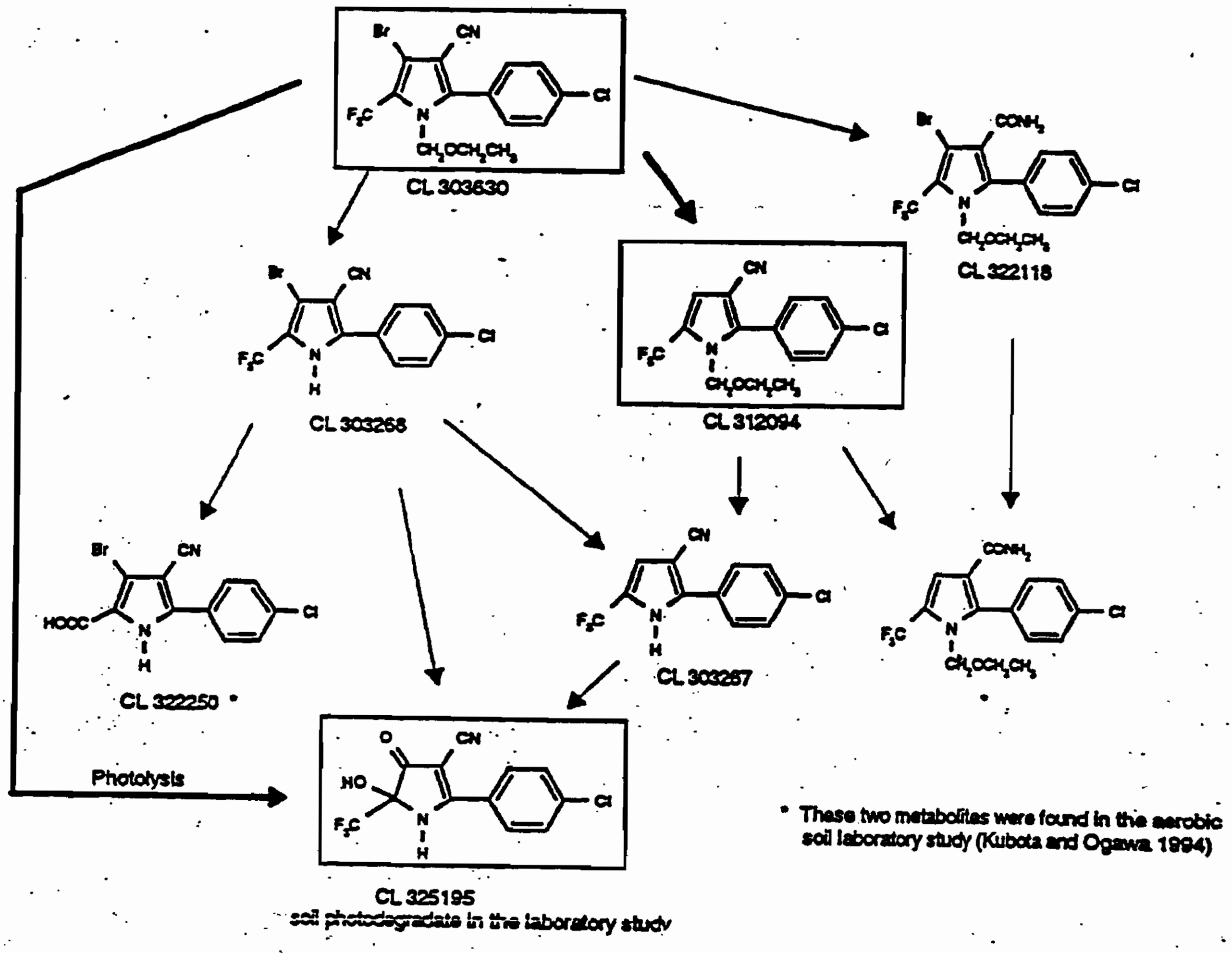


Figure 2. The Effect of Half-Life on Acumulation in Environmental Compartment (assumes unit annual applications)

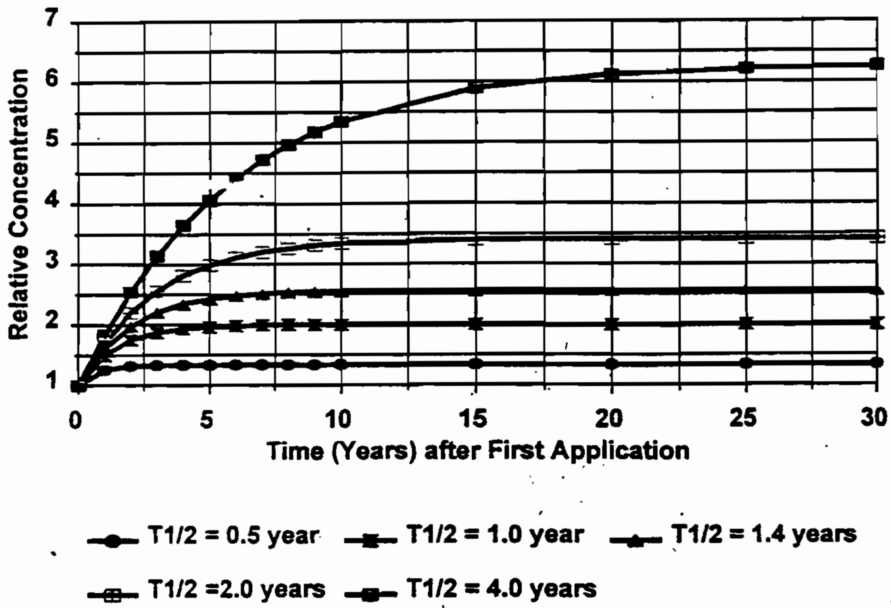
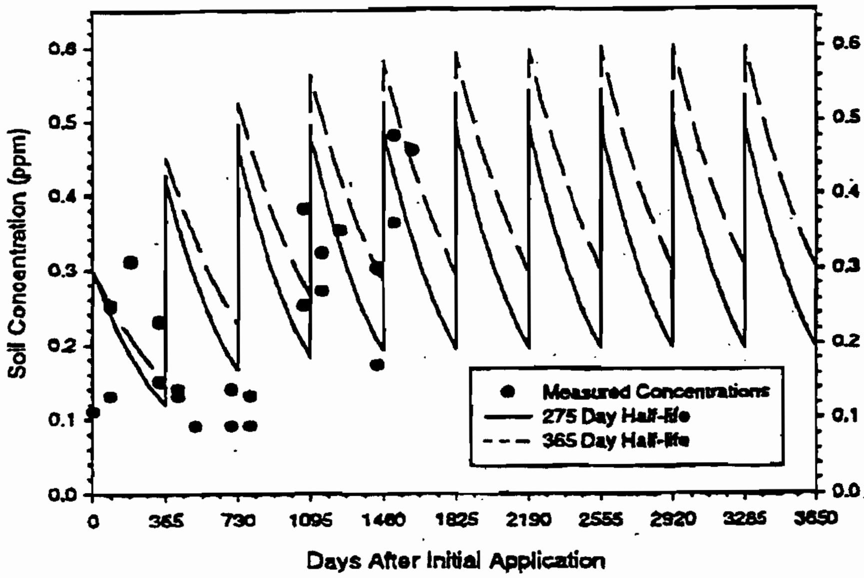


Figure 3. Soil Accumulation Graphs for Crops in the United Kingdom and Italy



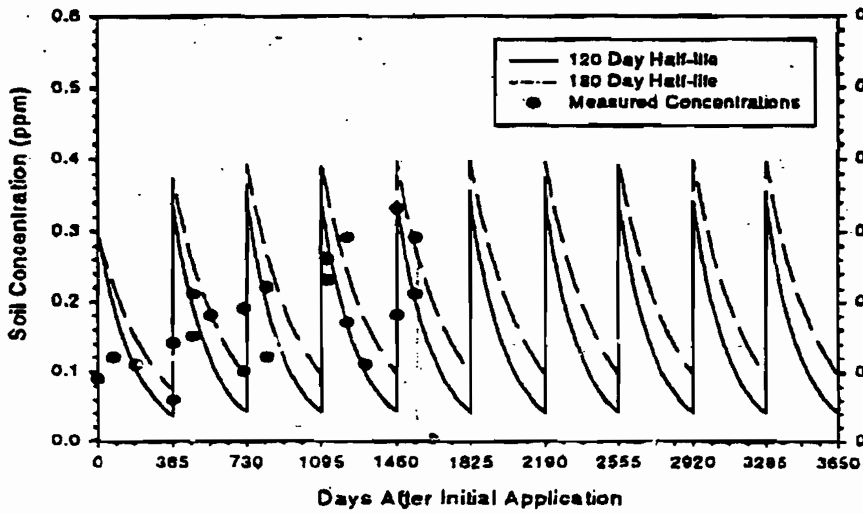
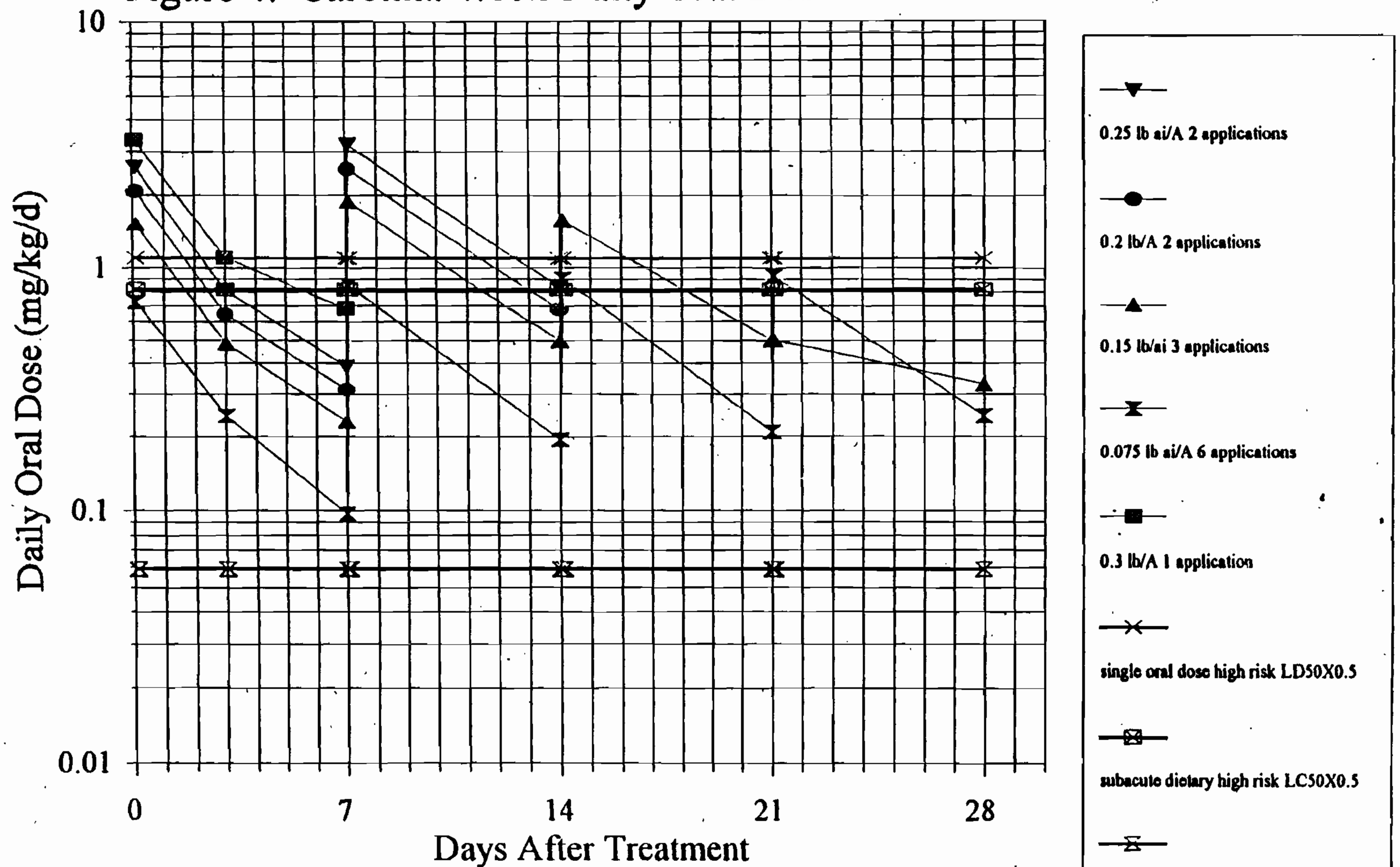


Figure 4. Carolina Wren Daily Oral Dose Estimates



This figure indicates for at least 14 days avian dietary exposure from all labeled uses exceeds the chronic reproduction endpoint. In addition, the acute oral LD50 or subacute dietary lethal endpoint high risk levels are equalled or exceeded by all application rates for multiple days. The exposure model for this figure assumes 100% field use; uses weed seed residues as surrogate for fruit portions of the diet; uses maximum armyworm larval residues; and assumes a minimal soil intake rate of 2% diet.

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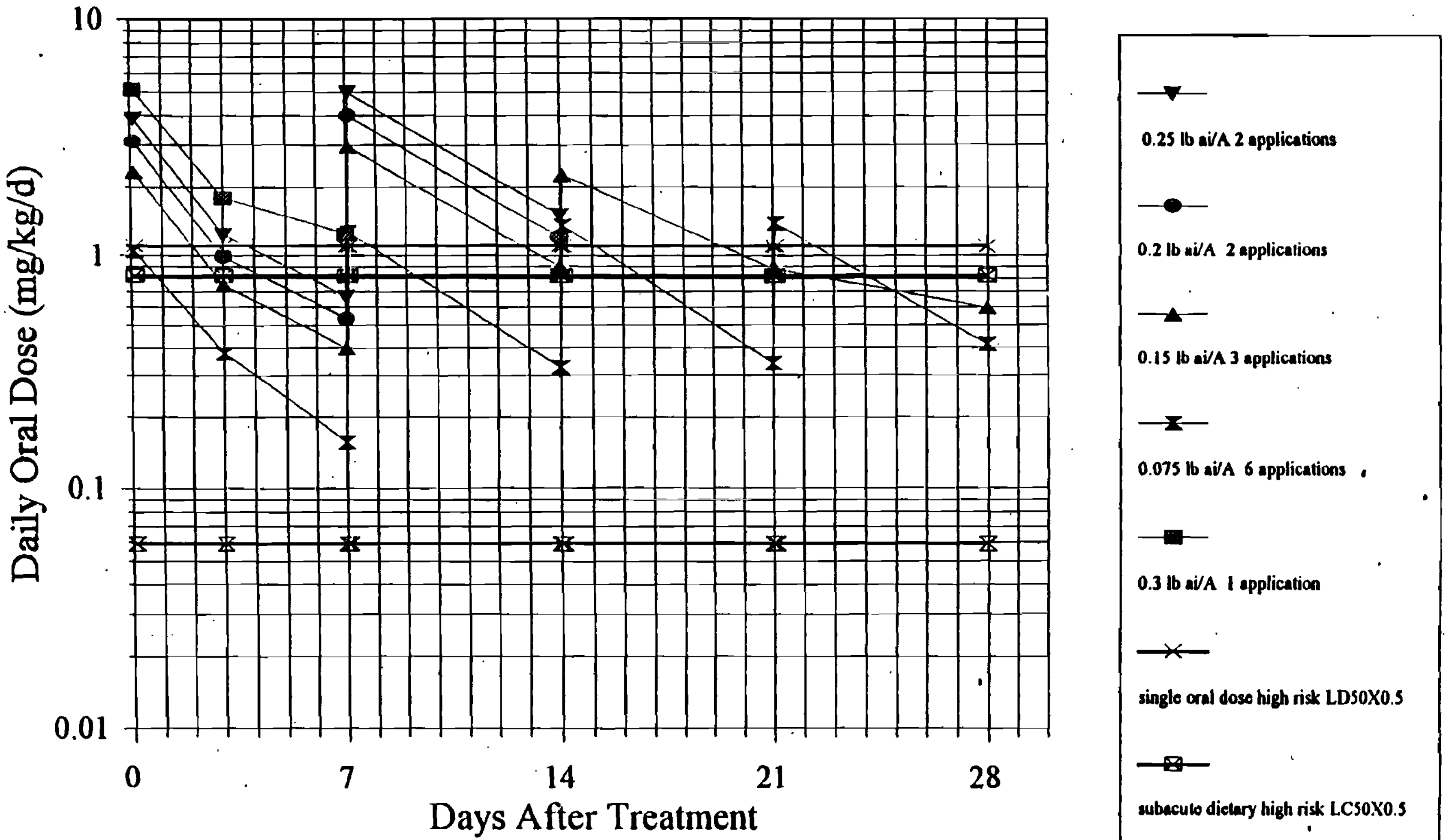
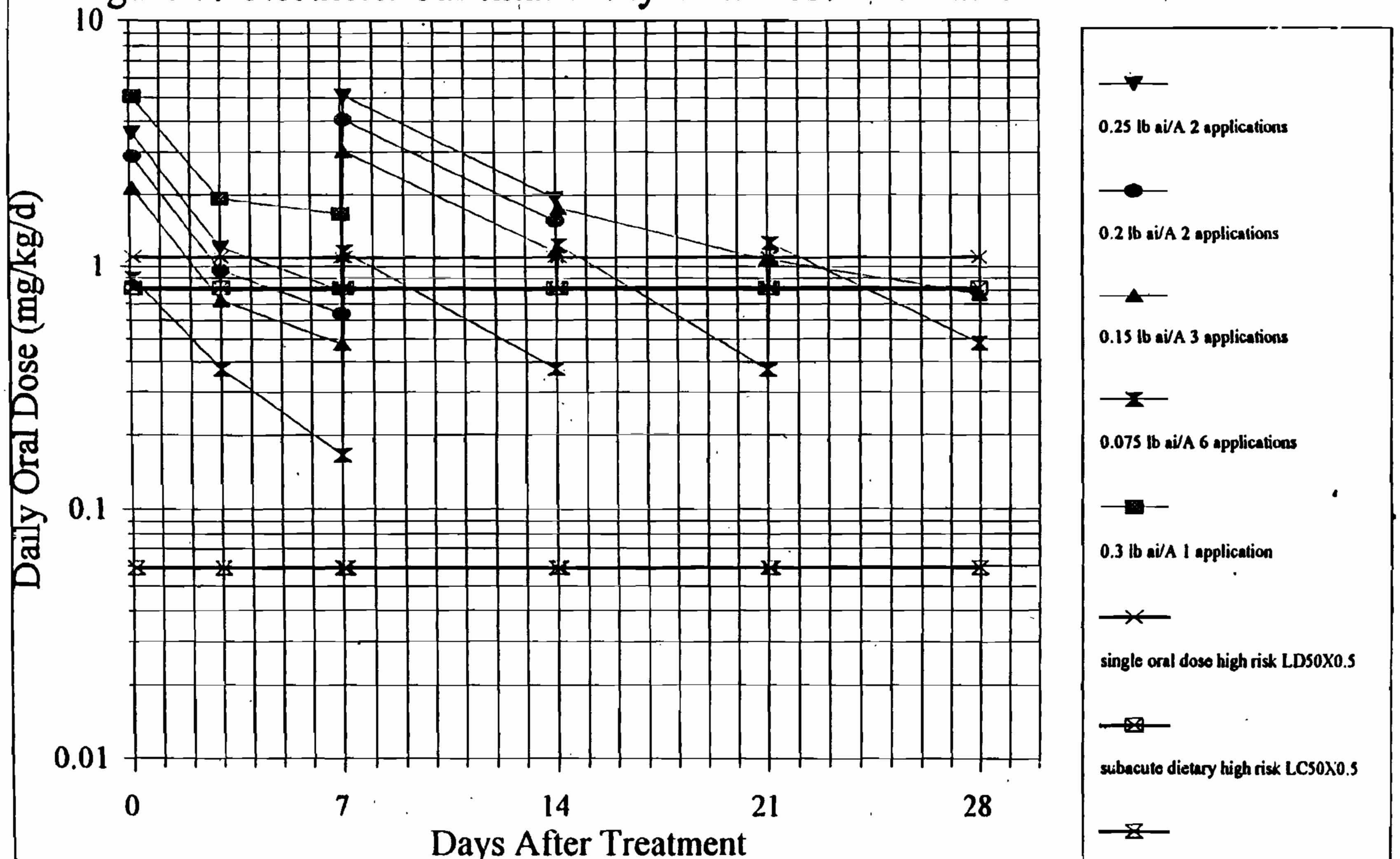
Figure 5. White-Eyed Vireo Daily Oral Dose Estimates



This figure indicates for at least 14 days avian dietary exposure from all labeled uses exceeds the chronic reproduction endpoint. In addition, the acute oral LD50 and subacute dietary lethal endpoint hig risk levels are exceeded by all but the lowest application rate for multiple days. The exposure model for this figure assumes 100% field use; uses weed seed residues as surrogate for fruit portions of the diet; uses maximum armyworm larval residues; and assumes a minimal soil intake rate of 2% diet.

Figure 6. Northern Cardinal Daily Oral Dose Estimates



This figure indicates for at least 14 days avian dietary exposure from all labeled uses exceeds the chronic reproduction endpoint. In addition, the acute oral LD50 and subacute dietary lethal endpoint high risk levels are exceeded by all application rates for multiple days. The exposure model for this figure assumes 100% field use; uses weed seed residues as surrogate for fruit portions of the diet; uses maximum armyworm larval residues; and assumes a minimal soil intake rate of 2% diet.

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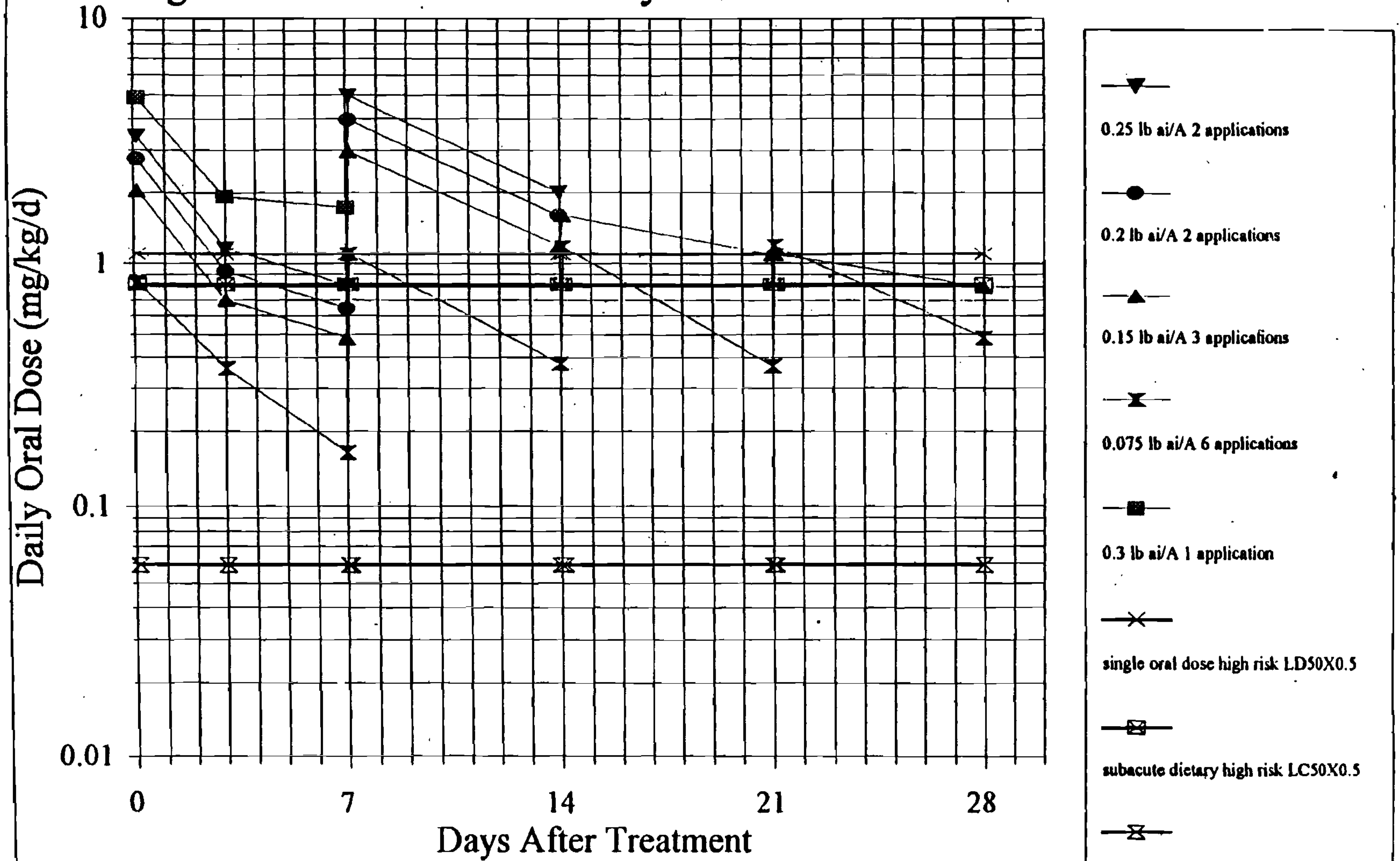
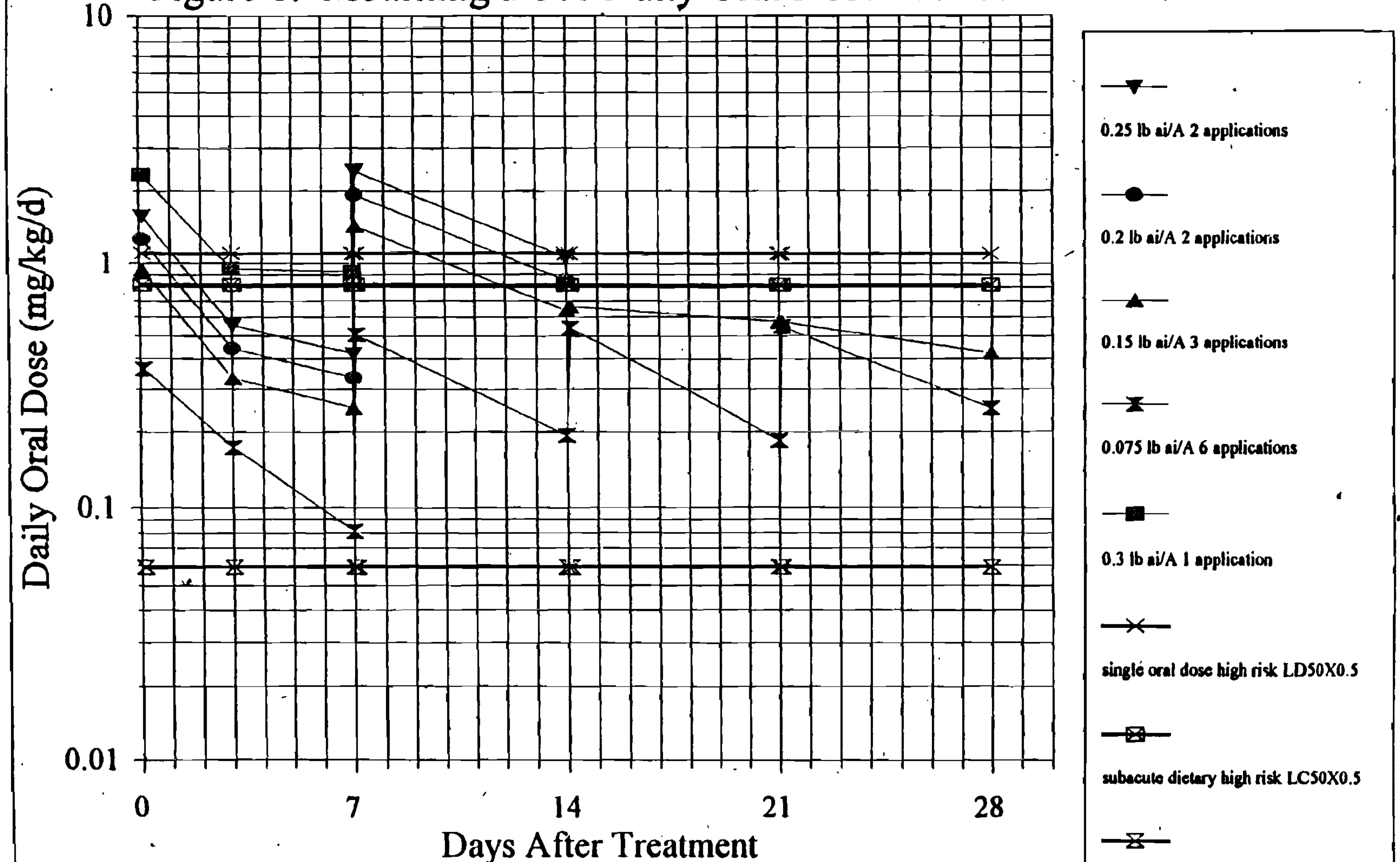
Figure 7. Blue Grosbeak Daily Oral Dose Estimates



This figure indicates for at least 14 days avian dietary exposure from all labeled uses exceeds the chronic reproduction endpoint. In addition, the acute oral LD50 and subacute dietary lethal endpoint high risk levels are exceeded by all application rates for multiple days. The exposure model for this figure assumes 100% field use; uses weed seed residues as surrogate for fruit portions of the diet; uses maximum armyworm larval residues; and assumes a minimal soil intake rate of 2% diet.

Figure 8. Mourning Dove Daily Oral Dose Estimates



This figure indicates for at least 14 days avian dietary exposure from all labeled uses exceeds the chronic reproduction endpoint. In addition, the subacute dietary lethal endpoint highrisk level is exceeded by all but the lowest application scenarios for one or more days. The 0.3, 0.25, and 0.15 lb ai/A application scenarios also exceed the single oral dose high risk level. The exposure model for this figure assumes 100% field use; uses weed seed residues as surrogate for fruit portions of the diet; uses maximum armyworm larval residues; and assumes a minimal soil intake rate of 2% diet.

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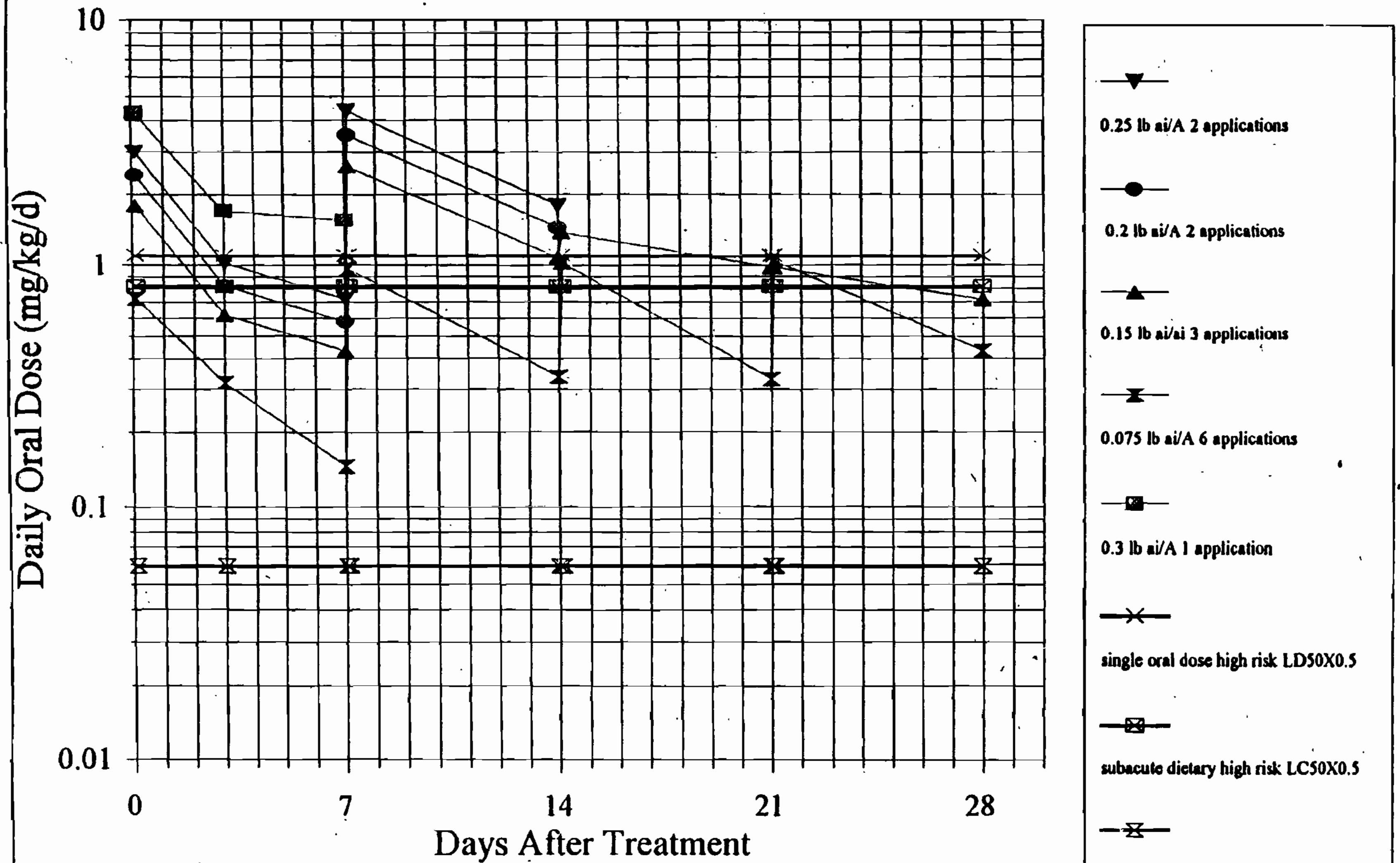
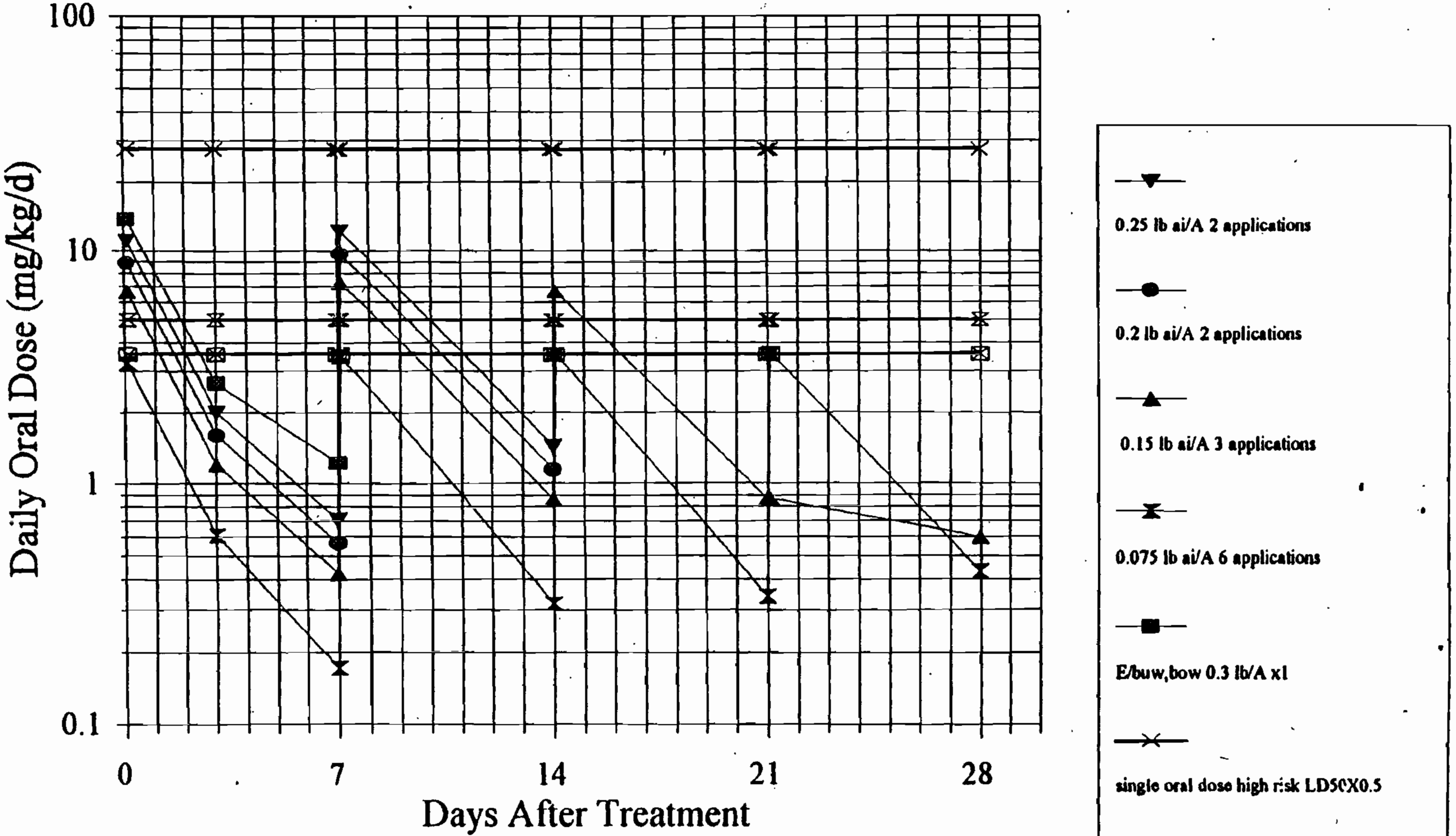
Figure 9. Red-Winged Blackbird Daily Oral Dose Estimates



This figure indicatesfor at least 14 days avian dietary exposure from all labeled uses exceeds the chronic reproduction endpoint. In addition, the acute oral LD50 or the subacute dietary lethal endpoint high risk levels are exceeded by all application rates for multiple days. The exposure model for this figure assumes 100% field use; uses weed seed residues as surrogate for fruit portions of the diet; uses maximum armyworm larval residues; and assumes a minimal soil intake rate of 2% diet.

Figure 10. White-Footed Mouse Daily Oral Dose Estimates



This figure indicates that the daily dietary exposure from all labeled uses does not exceed the acute oral LD50 high risk level. However, the high risk level subchronic dietary toxicity is exceeded or reached by all application rates for multiple days. The chronic dietary endpoint is exceeded immediately post-application for all application rates. The exposure model for this figure assumes 100% field use; uses maximum armyworm larval residues; and assumes a minimal soil intake rate of 2% diet.

Appendix A

Endangered Species Listing for Cotton-Growing Areas

ENDANGERED SPECIES-COTTON-NATIONWIDE

SPECIES KNOWN	GROUP	STATUS
Alabama		
BAT, INDIANA	MAMMAL	E,CH
STORK, WOOD	BIRD	E
MOUSE, ALABAMA BEACH	MAMMAL	E,CH
MOUSE, PERDIDO KEY BEACH	MAMMAL	E,CH
PLOVER, PIPING	BIRD	E,T
SNAKE, EASTERN INDIGO	REPTILE	T
STURGEON, ALABAMA	FISH	E,CH
STURGEON, GULF	FISH	T
TURTLE, ALABAMA RED-BELLIED	REPTILE	E
TURTLE, GREEN SEA	REPTILE	E,T
TURTLE, KEMP'S (ATLANTIC) RIDLEY SEA	REPTILE	E
TURTLE, LOGGERHEAD SEA	REPTILE	T
WOODPECKER, RED-COCKADED	BIRD	E
EAGLE, BALD	BIRD	T
KIDNEYSHELL, TRIANGULAR	CLAM	E
PIGTOE, DARK	CLAM	E
TURTLE, FLATTENED MUSK	REPTILE	T
SALAMANDER, RED HILLS	AMPHIBIAN	T
SCULPIN, PYGMY	FISH	T
SHINER, BLUE	FISH	E
SNAIL, TULOTOMA	SNAIL	E
ACORNSHELL, SOUTHERN	CLAM	E
BAT, GRAY	MAMMAL	E
CAVEFISH, ALABAMA	FISH	E,CH
PEARLYMUSSEL, ORANGE-FOOTED	CLAM	E
PEARLYMUSSEL, PINK MUCKET	CLAM	E
PEARLYMUSSEL, WHITE WARTYBACK	CLAM	E
PIGTOE, ROUGH	CLAM	E
CLUBSHELL, OVATE	CLAM	E
CLUBSHELL, SOUTHERN	CLAM	E
POCKETBOOK, FINE-LINED	CLAM	T
DARTER, WATERCRESS	FISH	E
HEELSPLITTER, INFLATED	CLAM	T
MUCKET, ORANGE-NACRE	CLAM	T
MUSSEL, JUDGE TAIT'S	CLAM	E
MUSSEL, MARSHALL'S	CLAM	E
MUSSEL, PENITENT	CLAM	E
STIRRUP SHELL	CLAM	E
CAVEFISH, ALABAMA	FISH	E,CH
DARTER, SLACKWATER	FISH	T,CH
DARTER, BOULDER	FISH	E
DARTER, SNAIL	FISH	T
PIGTOE, SHINY	CLAM	E
RIVERSNAIL, ANTHONY'S	SNAIL	E
PIGTOE, FINE-RAYED	CLAM	E
PIGTOE, SHINY	CLAM	E
RIFFLESHELL, TAN	CLAM	E

SHRIMP, ALABAMA CAVE	CRUSTACEAN	E
TORTOISE, GOPHER	REPTILE	T
TURTLE, LEATHERBACK SEA	REPTILE	E,CH
TURTLE, LOGGERHEAD SEA	REPTILE	T
MUCKET, ORANGE-NACRE	CLAM	T
STIRRUP SHELL	CLAM	E
COMBSHELL, UPLAND	CLAM	E
DARTER, GOLDLINE	FISH	T
SHINER, CAHABA	FISH	E
SNAIL, TULOTOMA	SNAIL	E

Arizona

CATFISH, YAQUI	FISH	T,CH
CHUB, YAQUI	FISH	E,CH
CRANE, WHOOPING	BIRD	E,CH
EAGLE, BALD	BIRD	T
FALCON, NORTHERN APLOMADO	BIRD	E
FALCON, PEREGRINE	BIRD	E,SA
JAGUARUNDI	MAMMAL	E
OCELOT	MAMMAL	E
OWL, MEXICAN SPOTTED	BIRD	T
PUPFISH, DESERT	FISH	E,CH
RATTLESNAKE, NEW MEXICAN RIDGE-NOSED	REPTILE	T,CH
SHINER, BEAUTIFUL	FISH	T,CH
TOPMINNOW, GILA (YAQUI)	FISH	E
WOLF, GRAY	MAMMAL	E,T,CH
MINNOW, LOACH	FISH	T,CH
OWL, MEXICAN SPOTTED	BIRD	T
PYGMY-OWL, CACTUS FERRUGINOUS	BIRD	E
SPIKEDACE	FISH	T,CH
SQUIRREL, MOUNT GRAHAM RED	MAMMAL	E,CH
SUCKER, RAZORBACK	FISH	E,CH
TROUT, APACHE	FISH	T
CHUB, BONYTAIL	FISH	E,CH
RAIL, YUMA CLAPPER	BIRD	E
PRONGHORN, SONORAN	MAMMAL	E
AMBERSNAIL, KANAB	SNAIL	E
CHUB, VIRGIN RIVER	FISH	E
TORTOISE, DESERT	REPTILE	T
VOLE, HUALAPAI MEXICAN	MAMMAL	E
BOBWHITE, MASKED	BIRD	E
TALUSSNAIL, SAN XAVIER	CRUSTACEAN	E
MINNOW, LOACH	FISH	T,CH
LIZARD, FLAT-TAILED HORNED	REPTILE	T
PELICAN, BROWN	BIRD	E

ARKANSAS

EAGLE, BALD	BIRD	T
PEARLYMUSSEL, PINK MUCKET	CLAM	E
POCKETBOOK, FAT	CLAM	E
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
WOODPECKER, RED-COCKADED	BIRD	E
STURGEON, PALLID	FISH	E
TERN, INTERIOR (POPULATION) LEAST	BIRD	E

CALIFORNIA

SPECIES	GROUP	STATUS
BEETLE, VALLEY ELDERBERRY LONGHORN	INSECT	T,CH
EAGLE, BALD	BIRD	T
FALCON, PEREGRINE	BIRD	E,SA
FOX, SAN JOAQUIN KIT	MAMMAL	E
LIZARD, BLUNT-NOSED LEOPARD	REPTILE	E
RAT, FRESNO KANGAROO	MAMMAL	E,CH
RAT, GIANT KANGAROO	MAMMAL	E
SNAKE, GIANT GARTER	REPTILE	E
TROUT, LITTLE KERN GOLDEN	FISH	T,CH
TROUT, PAIUTE CUTTHROAT	FISH	T
CHUB, BONYTAIL	FISH	E,CH
GOOSE, ALEUTIAN CANADA	BIRD	T
LIZARD, FLAT-TAILED HORNED	REPTILE	T
PELICAN, BROWN	BIRD	E
PUPFISH, DESERT	FISH	E,CH
RAIL, YUMA CLAPPER	BIRD	E
SQUAWFISH, COLORADO	FISH	CH
SUCKER, RAZORBACK	FISH	E,CH
TOAD, ARROYO SOUTHWESTERN	AMPHIBIAN	E
TORTOISE, DESERT	REPTILE	T
CONDOR, CALIFORNIA	BIRD	E,CH
MOTH, KERN PRIMROSE SPHINX	INSECT	T
RAT, TIPTON KANGAROO	MAMMAL	E
VIREO, LEAST BELL'S	BIRD	E,CH
BEETLE, VALLEY ELDERBERRY LONGHORN	INSECT	T,CH
TROUT, LAHONTAN CUTTHROAT	FISH	T
TROUT, PAIUTE CUTTHROAT	FISH	T
LINDERIELLA, CALIFORNIA	CRUSTACEAN	E
SHRIMP, CONSERVANCY FAIRY	CRUSTACEAN	E
SHRIMP, VERNAL POOL FAIRY	CRUSTACEAN	E
CHECKERSPOT, QUINO	INSECT	E
FLY, DELHI SANDS FLOWER-LOVING	INSECT	E
GNATCATCHER, COASTAL CALIFORNIA	BIRD	E
LIZARD, COACHELLA VALLEY FRINGE-TOED	REPTILE	T,CH
LIZARD, FLAT-TAILED HORNED	REPTILE	T
RAIL, YUMA CLAPPER	BIRD	E
RAT, STEPHENS' KANGAROO	MAMMAL	T
SALAMANDER, DESERT SLENDER	AMPHIBIAN	E
SHRIMP, RIVERSIDE FAIRY	CRUSTACEAN	E
VIREO, LEAST BELL'S	BIRD	E,CH
TROUT, LITTLE KERN GOLDEN	FISH	T,CH

FLORIDA

SPECIES	GROUP	STATUS
SNAKE, EASTERN INDIGO	REPTILE	T
STORK, WOOD	BIRD	E
STURGEON, GULF	FISH	T
MOUSE, PERDIDO KEY BEACH	MAMMAL	E,CH
PLOVER, PIPING	BIRD	E,T
TURTLE, GREEN SEA	REPTILE	E,T
TURTLE, HAWKSBILL SEA	REPTILE	E,CH
TURTLE, KEMP'S (ATLANTIC) RIDLEY SEA	REPTILE	E
TURTLE, LEATHERBACK SEA	REPTILE	E,CH
TURTLE, LOGGERHEAD SEA	REPTILE	T
WOODPECKER, RED-COCKADED	BIRD	E
BAT, GRAY	MAMMAL	E
BAT, INDIANA	MAMMAL	E,CH
DARTER, OKALOOSA	FISH	E
PLOVER, PIPING	BIRD	E,T
MOUSE, CHOCTAWHATCHEE BEACH	MAMMAL	E,CH

GEORGIA

SPECIES	GROUP	STATUS
EAGLE, BALD	BIRD	T
SNAKE, EASTERN INDIGO	REPTILE	T
STORK, WOOD	BIRD	E
STURGEON, SHORTNOSE	FISH	E
WOODPECKER, RED-COCKADED	BIRD	E
BAT, GRAY	MAMMAL	E
BAT, INDIANA	MAMMAL	E,CH
CLUBSHELL, OVATE	CLAM	E
COMBSHELL, UPLAND	CLAM	E
DARTER, CHEROKEE	FISH	T
DARTER, ETOWAH	FISH	E
KIDNEYSHELL, TRIANGULAR	CLAM	E
MOCCASINSHELL, ALABAMA	CLAM	T
STURGEON, SHORTNOSE	FISH	E
PEARLYMUSSEL, PINK MUCKET	CLAM	E
CLUBSHELL, SOUTHERN	CLAM	E
COUGAR, EASTERN	MAMMAL	E
MOCCASINSHELL, COOSA	CLAM	E
PIGTOE, SOUTHERN	CLAM	E
POCKETBOOK, FINE-LINED	CLAM	T
SHINER, BLUE	FISH	E
CRANE, WHOOPING	BIRD	E,CH

LOUISIANA

SPECIES	GROUP	STATUS
FALCON, ARCTIC PEREGRINE	BIRD	T
STURGEON, PALLID	FISH	E
EAGLE, BALD	BIRD	T
WOODPECKER, RED-COCKADED	BIRD	E
BEAR, LOUISIANA BLACK	MAMMAL	T,CH
BEAR, AMERICAN BLACK	MAMMAL	T,SA
PEARLSHELL, LOUISIANA	CLAM	T
TERN, CALIFORNIA LEAST	BIRD	E

MISSISSIPPI

SPECIES	GROUP	STATUS
BEAR, LOUISIANA BLACK	MAMMAL	T,CH
STURGEON, PALLID	FISH	E
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
DARTER, BAYOU	FISH	T
TURTLE, RINGED SAWBACK	REPTILE	T
STURGEON, GULF	FISH	T
MUSSEL, JUDGE TAIT'S	CLAM	E
MUSSEL, PENITENT	CLAM	E
PEARLYMUSSEL, CURTIS'	CLAM	E
WOODPECKER, RED-COCKADED	BIRD	E
POCKETBOOK, FAT	CLAM	E

MISSOURI

SPECIES	GROUP	STATUS
BEETLE, AMERICAN BURYING	INSECT	E
STURGEON, PALLID	FISH	E
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
FERRET, BLACK-FOOTED	MAMMAL	E,XN
GAMBUSIA, PECOS	FISH	E
OWL, MEXICAN SPOTTED	BIRD	T
SHINER, PECOS BLUNTNOSE	FISH	T,CH
TERN, INTERIOR (POPULATION) LEAST	BIRD	E

NEW MEXICO

SPECIES	GROUP	STATUS
CRANE, WHOOPING	BIRD	E,CH
EAGLE, BALD	BIRD	T
FALCON, NORTHERN APLOMADO	BIRD	E
FALCON, PEREGRINE	BIRD	E,SA
FERRET, BLACK-FOOTED	MAMMAL	E,XN
OWL, MEXICAN SPOTTED	BIRD	T
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
GAMBUSIA, PECOS	FISH	E
SHINER, PECOS BLUNTNOSE	FISH	T,CH
RATTLESNAKE, NEW MEXICAN RIDGE-NOSED	REPTILE	T,CH
SPIKEDACE	FISH	T,CH

LOUISIANA

SPECIES	GROUP	STATUS
FALCON, ARCTIC PEREGRINE	BIRD	T
STURGEON, PALLID	FISH	E
EAGLE, BALD	BIRD	T
WOODPECKER, RED-COCKADED	BIRD	E
BEAR, LOUISIANA BLACK	MAMMAL	T,CH
BEAR, AMERICAN BLACK	MAMMAL	T,SA
PEARLSHELL, LOUISIANA	CLAM	T
TERN, CALIFORNIA LEAST	BIRD	E

MISSISSIPPI

SPECIES	GROUP	STATUS
BEAR, LOUISIANA BLACK	MAMMAL	T,CH
STURGEON, PALLID	FISH	E
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
DARTER, BAYOU	FISH	T
TURTLE, RINGED SAWBACK	REPTILE	T
STURGEON, GULF	FISH	T
MUSSEL, JUDGE TAIT'S	CLAM	E
MUSSEL, PENITENT	CLAM	E
PEARLYMUSSEL, CURTIS'	CLAM	E
WOODPECKER, RED-COCKADED	BIRD	E
POCKETBOOK, FAT	CLAM	E

MISSOURI

SPECIES	GROUP	STATUS
BEETLE, AMERICAN BURYING	INSECT	E
STURGEON, PALLID	FISH	E
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
FERRET, BLACK-FOOTED	MAMMAL	E,XN
GAMBUSIA, PECOS	FISH	E
OWL, MEXICAN SPOTTED	BIRD	T
SHINER, PECOS BLUNTNOSE	FISH	T,CH
TERN, INTERIOR (POPULATION) LEAST	BIRD	E

NEW MEXICO

SPECIES	GROUP	STATUS
CRANE, WHOOPING	BIRD	E,CH
EAGLE, BALD	BIRD	T
FALCON, NORTHERN APLOMADO	BIRD	E
FALCON, PEREGRINE	BIRD	E,SA
FERRET, BLACK-FOOTED	MAMMAL	E,XN
OWL, MEXICAN SPOTTED	BIRD	T
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
GAMBUSIA, PECOS	FISH	E
SHINER, PECOS BLUNTNOSE	FISH	T,CH
RATTLESNAKE, NEW MEXICAN RIDGE-NOSED	REPTILE	T,CH
SPIKEDACE	FISH	T,CH

/ 3

WOLF, GRAY	MAMMAL	E,T,CH
SHINER, BEAUTIFUL	FISH	T,CH
OWL, MEXICAN SPOTTED	BIRD	T
TROUT, GILA	FISH	E

NORTH CAROLINA

SPECIES	GROUP	STATUS
EAGLE, BALD	BIRD	T
STURGEON, SHORTNOSE	FISH	E
WOODPECKER, RED-COCKADED	BIRD	E
TURTLE, GREEN SEA	REPTILE	E,T
TURTLE, KEMP'S (ATLANTIC) RIDLEY SEA	REPTILE	E
TURTLE, LOGGERHEAD SEA	REPTILE	T
WOLF, RED	MAMMAL	E,XP
WOODPECKER, RED-COCKADED	BIRD	E
BAT, INDIANA	MAMMAL	E,CH
SPINYMUSSEL, TAR RIVER	CLAM	E
SHREW, DISMAL SWAMP SOUTHEASTERN	MAMMAL	T
MUSSEL, DWARF WEDGE	CLAM	E
SHINER, CAPE FEAR	FISH	E,CH
PLOVER, PIPING	BIRD	E,T
MUSSEL, DWARF WEDGE	CLAM	E
SQUIRREL, CAROLINA NORTHERN FLYING	MAMMAL	E
HEELSPLITTER, CAROLINA	CLAM	E
WARBLER, BACHMAN'S	BIRD	E

OKLAHOMA

SPECIES	GROUP	STATUS
CRANE, WHOOPING	BIRD	E,CH
EAGLE, BALD	BIRD	T
PLOVER, PIPING	BIRD	E,T
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
VIREO, BLACK-CAPPED	BIRD	E
FALCON, PEREGRINE	BIRD	E,SA

SOUTH CAROLINA

SPECIES	GROUP	STATUS
COUGAR, EASTERN	MAMMAL	E
STORK, WOOD	BIRD	E
WOODPECKER, RED-COCKADED	BIRD	E
STURGEON, SHORTNOSE	FISH	E
FALCON, ARCTIC PEREGRINE	BIRD	T
SNAKE, EASTERN INDIGO	REPTILE	T
PLOVER, PIPING	BIRD	E,T
TURTLE, LOGGERHEAD SEA	REPTILE	T

TENNESSEE

SPECIES	GROUP	STATUS
BAT, INDIANA	MAMMAL	E,CH
EAGLE, BALD	BIRD	T
STURGEON, PALLID	FISH	E
TERN, INTERIOR (POPULATION) LEAST	BIRD	E
BAT, GRAY	MAMMAL	E
COUGAR, EASTERN	MAMMAL	E
PEARLYMUSSEL, ALABAMA LAMP	CLAM	E
PEARLYMUSSEL, CUMBERLAND MONKEYFACE	CLAM	E
PEARLYMUSSEL, PALE LILLIPUT	CLAM	E
PIGTOE, SHINY	CLAM	E
SNAIL, PAINTED SNAKE COILED FOREST	SNAIL	T
FANSHELL	CLAM	E
MUSSEL, RING PINK (=GOLF STICK PEARLY)	CLAM	E
PEARLYMUSSEL, CRACKING	CLAM	E
PEARLYMUSSEL, ORANGE-FOOTED	CLAM	E
PEARLYMUSSEL, PINK MUCKET	CLAM	E
PEARLYMUSSEL, WHITE WARTYBACK	CLAM	E
PIGTOE, ROUGH	CLAM	E
DARTER, SLACKWATER	FISH	T,CH
DARTER, BOULDER	FISH	E
DARTER, SNAIL	FISH	T
PEARLYMUSSEL, BIRDWING	CLAM	E
PEARLYMUSSEL, CUMBERLAND MONKEYFACE	CLAM	E
PIGTOE, FINE-RAYED	CLAM	E
RIFFLESHELL, TAN	CLAM	E

TEXAS

SPECIES	GROUP	STATUS
CRANE, WHOOPING	BIRD	E,CH
EAGLE, BALD	BIRD	T
PRAIRIE-CHICKEN, ATTWATER'S GREATER	BIRD	E
TOAD, HOUSTON	AMPHIBIAN	E,CH
FALCON, PEREGRINE	BIRD	E,SA
VIREO, BLACK-CAPPED	BIRD	E
WARBLER, GOLDEN-CHEEKED	BIRD	E
PELICAN, BROWN	BIRD	E
PLOVER, PIPING	BIRD	E,T
TURTLE, GREEN SEA	REPTILE	E,T
TURTLE, KEMP'S (ATLANTIC) RIDLEY SEA	REPTILE	E
TURTLE, LEATHERBACK SEA	REPTILE	E,CH
TURTLE, LOGGERHEAD SEA	REPTILE	T
BEAR, LOUISIANA BLACK	MAMMAL	T,CH
DARTER, FOUNTAIN	FISH	E,CH
FALCON, NORTHERN APLOMADO	BIRD	E
JAGUARUNDI	MAMMAL	E
MINNOW, RIO GRANDE SILVERY	FISH	E
OCELOT	MAMMAL	E
PELICAN, BROWN	BIRD	E

Appendix B

Data Requirements for Chlorfenapyr on Cotton

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