US EPA ARCHIVE DOCUMENT

## *Disclaimer*

The document which accompanies this disclaimer is American Cyanamid's avian and aquatic risk assessments. The document presents the company's views. It does not represent EPA's views, which are posted separately at this homepage address. This document is being posted on the EPA homepage at American Cyanamid's request.

The reader may notice that several pages contain the statement "confidential." American Cyanamid has consented to the publication of this document, thereby waiving all claims that this document contains confidential business information.

US EPA ARCHIVE DOCUMENT

# IX. Appendices

## Appendix 1. Information on the Mode of Action of Chlorfenapyr

Chlorfenapyr is a member of a class of insecticide-miticides called pyrroles. *In vitro* studies have shown that it is converted to CL 303268. This molecule targets the mitochondria and the fatal biochemical effect is due primarily to uncoupling of oxidative phosphorylation (Treacy *et al.* 1994). The proton gradient across mitochondrial membranes is disrupted and the ability of the mitochondria to produce ATP from ADP is impeded. The impediment leads to cell death and may ultimately lead to the death of the organism (Treacy *et al.* 1994).

In order for a compound to act on the mitochondria in the manner described above, it must be lipophilic to pass the membrane and weakly acidic to disrupt the proton gradient (Treacy *et al.* 1994). Chlorfenapyr is lipophilic, but it is not weakly acidic. Indeed, studies have shown that AC 303630 is a "pro-insecticide" that is activated by oxidative removal of the N-ethoxymethyl group. The dealkylation of chlorfenapyr results in the lipophilic and weakly acidic CL 303268, which uncouples oxidative phosphorylation (Treacy *et al.* 1994).

This mode of action is supported by the following information. First, herbivorous insects generally are known to be able to oxidize xenobiotics (Hung *et al.* 1990). Second, CL 303268 has been identified in tobacco budworm (*Heliothis virescens)* larvae (Treacy *et al.* 1994). Third, Colorado potato beetle (*Leptinotarsa decemlineata*) adults, exposed to the microsomal mono-oxygenase inhibitor piperonyl butoxide were significantly less sensitive to chlorfenapyr than adults that were not exposed to piperonyl butoxide (R. M. Hollingworth, unpublished). Piperonyl butoxide would inhibit oxidative metabolism and the transformation of chlorfenapyr to CL 303268. And fourth, CL 303268 has been shown to be a potent uncoupler of oxidative phosphorylation in mouse liver mitochondria. CL 303268 stimulated state-4 respiration and decreased respiratory control in mouse liver mitochondria. Stimulation of state-4 respiration continued until oxygen was depleted. The $UC_{50}$ for CL 303268 in this system was 2.4 nM (nanoMolar), whereas the $UC_{50}$ for chlorfenapyr in the same system was >1000 nM (Treacy *et al.* 1994).

Differences in sensitivity between species could arise due to differences in oxidative activity or in the ability of CL 303268 to uncouple oxidative phosphorylation. It should be noted that the mitochondria are broadly similar ("conserved" in an evolutionary biology sense) across many taxa. Thus the site for action of CL 303268 should occur across many taxa and be similar as well. The consistent toxicity profile exhibited by chlorfenapyr *in vivo* suggests that such similarity occurs.

In mammals, there tends to be a lower titer of mixed function oxidases, and chlorfenapyr is metabolized by pathways such as dehalogenation, oxidation, and ring hydroxylation. This results in metabolites other than the potent uncoupler CL 303268. In the rat, approximately 85% of the administered dose is excreted in the feces within 48 hours. More sensitive taxa, such as insects, metabolize chlorfenapyr to CL 303268 to a greater degree than mammals.

Efficacy information for the target pests which are sensitive to chlorfenapyr can provide insights into the potential effects of the compound on non-target organisms. Laboratory screening tests employing the technique of dipping leaves into solutions of chlorfenapyr in water and acetone showed that it is toxic to larvae of Lepidoptera (butterflies and moths), adult and larval Homoptera (leafhoppers), and adult and nymphal Acari (mites) (Lovell *et al.* 1990). The compound exhibited translaminar activity against mites, as demonstrated by spraying only the top surfaces of lima bean leaves, but caging mites on both the top and the under surfaces of the leaves. Mite mortality was 62% on the top surfaces and 46% on the under surfaces. This translaminar activity may be expressed in the field, but is a complex function of leaf morphology (cuticle thickness, number of pores) (Treacy *et al.* 1990). The activity observed in the laboratory translated into effective control of Lepidoptera, Coleoptera, Homoptera, and Acari in an extensive series of field efficacy tests (Miller *et al.* 1990).

One very important result from the laboratory evaluations was the relative toxicity of the compound by the oral and the dermal routes of exposure. Screening work had shown that the compound is toxic to insects by both routes of exposure (Lovell *et al.* 1990). Treacy *et al.* (1990) evaluated the toxicity of chlorfenapyr to 5$^{th}$ instar tobacco budworm larvae by oral gavage and by topical application. The 48 hour oral $LD_{50}$ was 5.7 mcg/gram, whereas the 48 hour dermal $LD_{50}$ was greater than 450 mcg/gram. For tobacco budworm larvae, it is not clear if the difference between oral and dermal toxicity is due to activation of the chlorfenapyr to CL 303268 in the hindgut, or to limited absorption through the cuticle, or to some combination of these factors (Treacy *et al.* 1990). The low vapor pressure of chlorfenapyr strongly suggests that insects will be not be exposed by the inhalation route. The work by Treacy *et al.* (1990) also provides a working level for concentrations in dying insects. This value, 5.7 mcg/gram wet weight, was obtained in tobacco budworm larvae that averaged 212 mg in weight.

Treacy *et al.* (1990) also demonstrated the expected decrease in susceptibility of non-molting tobacco budworm larvae as they age. In leaf dip bioassays with 1$^{st}$ instar larvae, expected weight 0.7 mg, (C. Kukel, Unpublished Data), the $LC_{50}$ was 2.75 ppm. The same bioassay with 3$^{rd}$ instar larvae, expected weight 11 mg, (C. Kukel, Unpublished Data) resulted in an $LC_{50}$ of 7.5 ppm. Another decrease in susceptibility can certainly be expected for 5$^{th}$ instar larvae as well. These facts explain why applications of chlorfenapyr for control of tobacco budworm are timed to the hatch or to early instar larvae.

Information on the relative toxicity of chlorfenapyr by different routes of exposure is available for the rat. The results are in very good agreement with what might be expected based on the results obtained for insects. Activity is greatest by the oral route, and less by both the inhalation and dermal routes.

## Appendix 2. Labels for Use of PIRATE 3SC and ALERT 2SC in Cotton

**RESTRICTED USE PESTICIDE**

**DUE TO TOXICITY TO AQUATIC AND AVIAN ORGANISMS.**

For retail sale to, and use only by Certified Applicators or persons under the direct supervision of a Certified Applicator, and only for those uses covered by the Certified Applicator's certification.

American Cyanamid Company endorses Certification to promote the responsible use of pesticides to insure the protection of man and the environment.

# PIRATE® Cotton Insecticide

ACTIVE INGREDIENT:
4-bromo-2-(4-chlorophenyl)-1-(ethoxymethyl)-5-(trifluoromethyl)-1*H*-pyrrole-3-carbonitrile ..... 30.83%
INERT INGREDIENTS: ..... 69.17%
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TOTAL ..... 100.00%

(1 gallon contains 3.0 pounds of active ingredient)

Patent No. 5,010,098
EPA Reg. No. 241-GAT

EPA Est. No. 5905-GA-01

**KEEP OUT OF REACH OF CHILDREN**

**WARNING / AVISO**

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Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail).

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## STATEMENT OF PRACTICAL TREATMENT

**If swallowed:** Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.

**If on skin:** Wash with plenty of soap and water. Get medical attention.

**If inhaled:** Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. *Get medical attention.*

**If in eyes:** Flush eyes with plenty of water. Call a physician if irritation persists.

**IN CASE OF AN EMERGENCY ENDANGERING LIFE OR PROPERTY INVOLVING THIS PRODUCT, CALL COLLECT, DAY OR NIGHT, AREA CODE (973) 683-3100**

Net Contents: 1 Gallon

® Registered Trademark of American Cyanamid Company

12/97

## PRECAUTIONARY STATEMENTS

### HAZARDS TO HUMANS (AND DOMESTIC ANIMALS)

### WARNING

May be fatal if swallowed or absorbed through the skin. Do not get in eyes, on skin, or on clothing. Harmful if inhaled. Avoid breathing spray or mist. Causes moderate eye irritation.

**Personal Protective Equipment (PPE):**

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category C on an EPA chemical resistance category selection chart.

Applicators and other handlers must wear:

- Coveralls over short-sleeved shirt and short pants
- Chemical-resistant gloves such as barrier laminate or butyl rubber or nitrile rubber or polyvinyl chloride (PVC) or viton neoprene
- Chemical-resistant footwear plus socks
- Chemical-resistant headgear for overhead exposure
- Chemical-resistant apron when cleaning equipment, mixing, or loading

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

### ENGINEERING CONTROLS STATEMENTS

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

**User Safety Recommendations:**

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

## ENVIRONMENTAL HAZARDS

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 the 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/or Federal authorities and American Cyanamid Company immediately if you observe any adverse environmental effects due to the use of PIRATE Cotton Insecticide.

## DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible to pesticide regulation. This label must be in the possession of the user at the time of pesticide application.

### AGRICULTURAL USE REQUIREMENTS

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

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

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

- Coveralls over short-sleeved shirt and short pants
- Chemical-resistant gloves such as barrier laminate or butyl rubber or nitrile rubber or polyvinyl chloride (PVC) or viton neoprene
- Chemical-resistant footwear plus socks
- Chemical-resistant headgear for overhead exposure

### STORAGE AND DISPOSAL

**STORAGE:**
DO NOT store below 32° degrees. DO NOT store in direct sunlight or heat.

**PESTICIDE DISPOSAL:**
DO NOT contaminate water, food or feed by storage or disposal. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL:**
Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, by incineration or, if allowed by State and local authorities by burning. If burned, stay out of smoke.

## GENERAL INFORMATION

PIRATE is a member of the pyrrole class of chemistry. It has a unique mode of action that controls target pests by interfering with the energy-producing process within cells. It has both contact and stomach activity. Although PIRATE does not move systemically through the plant, it does move translaminarly from the top to bottom of treated leaves.

**SPRAY PREPARATION:**
To assure a uniform spray solution, agitate or shake containers of this product immediately prior to use. Prepare no more spray mixture than is needed for the immediate operation. Add one-half to three-quarters of the required amount of clean water to the spray tank. Use a calibrated measuring device to measure the required amount of PIRATE. Add PIRATE to the spray tank while agitating. Fill the tank with the remainder of the water. If tank mixes are used, PIRATE must be fully dispersed in water first, followed by the addition of the tank-mix materials.

**COMPATIBILITY:**
PIRATE is compatible with a wide range of spray products, however, the full range of compatibilities under local conditions may not be known. Therefore, before using PIRATE in any tank mixture, the compatibility of the mixture should be established. Add proportionate amounts of each ingredient to a pint or quart jar, cap, shake, and allow to stand for 15 minutes. Formation of precipitates that do not readily redisperse indicates an incompatible mixture and should not be used.

**SPRAYING INSTRUCTIONS:**
Maintain agitation during application.

Thorough coverage of the cotton plant is essential for effective performance of this product. Apply with ground or aerial equipment using sufficient water to obtain full coverage of foliage. Use a minimum of 5 gallons per acre with ground equipment or 3 gallons per acre by aircraft. Higher gallonage will provide better coverage. Under extreme pest populations and dense foliage, increase spray volumes to 10 gallons per acre by ground and 5 gallons per acre by air. The addition of spray adjuvants may enhance coverage and canopy penetration.

Do not apply this product through any type of irrigation system.

**APPLICATION TIMING:**
Applications should not begin until target pest populations have reached local economic threshold levels. Consult the Cooperative Extension Service or crop advisor to determine recognized economic threshold levels in your area.

For best results on lepidopteran pests, time applications to control small larvae still feeding on leaf surfaces, and before migration to protected areas such as squares, blooms and bolls has occurred.

**PESTS CONTROLLED:**

| CROP | PEST | DOSAGE PER ACRE: Pounds Active | DOSAGE PER ACRE: Fluid Ounces | REMARKS |
|---|---|---|---|---|
| Cotton (Except AZ and CA) | Tobacco Budworm<br>Cotton Bollworm | 0.2 - 0.25 | 8.5 - 10.5 | **Rates of 8.5-10.5 fluid ounces (0.2 - 0.25 lbs. active) should be used <u>only</u> 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 | 13 | **Rate of 13 fluid ounces (0.3 lbs. active) have been shown to be effective when used alone.**<br>Apply on a 5-7 day schedule or as determined by field scouting.<br>Use higher rates when pest pressure is heavy or large larvae (>¼ inch) predominate. As pest pressure increases, it may be necessary to shorten spray interval.<br>If loopers and other armyworms are present in the field at time of application, these pests will also be controlled. |
| | Beet Armyworm | 0.2 | 8.5 | Apply Pirate according to local economic thresholds such as 5 active "hits" per 100 row feet. |
| | Mites | 0.15 - 0.2 | 6.5 - 8.5 | Use adequate spray volume to insure thorough coverage. For best results, treat when pest populations are in early stages of development.<br>Apply as determined by field scouting. |

**<u>Resistance and Pest Management</u>:** Some insects and mites are known to develop resistance to crop protection products used repeatedly for control. Since the development of resistance cannot be predicted, PIRATE should always be used in resistance pest management programs that are suitable for the crop pest complex involved.

Any pest management program undertaken should coordinate different chemistry classes of insecticides in their spray schedules, thorough coverage of targeted crop/pest(s), use of proper chemical rates per label directions, monitoring pest populations, and other factors as conditions warrant.

PIRATE has a unique mode of action and can be an important component of a resistance management program in cotton. Consult your Cooperative Extension Service or crop advisor for suggestions on minimizing insecticide resistance.

## USE RESTRICTIONS

Do not allow livestock to graze fields.
Do not apply less than 21 days before harvest.
Do not apply more that 21 fl. oz. (0.5 lbs. ai/A) of PIRATE per acre per year.

## ROTATIONAL CROPS

Do not plant root crops within 60 days of the last application of PIRATE. For all other crops, do not plant within 30 days of the last application of PIRATE.

## SPRAY DRIFT PRECAUTIONS

All aerial and ground application equipment must be properly maintained and calibrated using appropriate carriers.

*Spray Drift Management*: Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

*Buffer Zone Requirements:* Do not apply by ground equipment within 25 feet, or by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries, and commercial fish farm ponds. Due to the hazard to avian and aquatic organisms, the application of this product by air is prohibited within one mile of designated National Wildlife Refuges. Contact state Fish and Wildlife Service for information on National Wildlife Refuges in your area.

*Recommendations for Aerial Applicators*: The following drift management requirements must be followed to avoid off-target drift movement from aerial applications to agricultural field crops. These requirements do not apply to forestry applications, public health uses or to applications using dry formulations.

1. The distance of the outer most nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.
2. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.

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

   The applicator should be familiar with and take into account the information covered in the Aerial Drift Reduction Advisory Information.

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

*Controlling Droplet Size:*

- Volume - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.

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

*Boom Length:* For aerial applications, the spray boom should be mounted on the aircraft so as to minimize drift caused by wingtip or rotor vortices. For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

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

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

*Wind Speed Restrictions*: Drift potential is lowest between wind speeds of 2-10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given speed. Do not apply when wind velocity exceeds 10 mph. Application should be avoided below 2 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

*Temperature and Humidity*: When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

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

*Sensitive Areas*: The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g. when wind is blowing away from the sensitive areas).

*Runoff Management*: Do not cultivate within 25 feet of aquatic areas to allow growth of a vegetative filter strip.

## DISCLAIMER

The label instructions for the use of this product reflect the opinion of experts based on research and field use. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the use of, or application of the product contrary to label instructions, all of which are beyond the control of American Cyanamid Company. All such risks shall be assumed by the user.

American Cyanamid Company shall not be responsible for losses or damages resulting from use of this product in any manner not set forth on this label. User assumes all risks associated with the use of this product in any manner not specifically set forth on this label.

American Cyanamid Company warrants only that the material contained herein conforms to the chemical description of the label and is reasonably fit for the use therein described when used in accordance with the directions for use, subject to the risks referred to above. **CYANAMID DOES NOT MAKE OR AUTHORIZE ANY AGENT OR REPRESENTATIVE TO MAKE ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, AND EXPRESSLY EXCLUDES AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

**BUYER'S EXCLUSIVE REMEDY AND AMERICAN CYANAMID'S EXCLUSIVE LIABILITY, WHETHER IN CONTRACT, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, SHALL BE LIMITED TO REPAYMENT OF THE PURCHASE PRICE OF PIRATE** Cotton Insecticide. In no case shall Cyanamid or the seller be liable for consequential, special or indirect damages resulting from the use or handling of this product.

**American Cyanamid Company**
**North America Agricultural Products Division**
**Crop Protection Products Department**
**One Campus Drive, Parsippany, NJ 07054 ©1997**

**RESTRICTED USE PESTICIDE**

**DUE TO TOXICITY TO AQUATIC AND AVIAN ORGANISMS.**

For retail sale to, and use only by Certified Applicators or persons under the direct supervision of a Certified Applicator, and only for those uses covered by the Certified Applicator's certification.

American Cyanamid Company endorses Certification to promote the responsible use of pesticides to insure the protection of man and the environment.

# ALERT® Insecticide-Miticide

ACTIVE INGREDIENT:
4-bromo-2-(4-chlorophenyl)-1-(ethoxymethyl)-5-(trifluoromethyl)-1H-pyrrole-3-carbonitrile..... 21.44%
INERT INGREDIENTS:..... 78.56%
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TOTAL..... 100.00%

(1 gallon contains 2.0 pounds of active ingredient)

Patent No. 5,010,098
EPA Reg. No. 241-GAI EPA Est. No. 5905-GA-01

**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**

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Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail).

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## STATEMENT OF PRACTICAL TREATMENT

**If swallowed:** Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.

**If on skin:** Wash with plenty of soap and water. Get medical attention.

**If inhaled:** Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

**If in eyes:** Flush eyes with plenty of water. Call a physician if irritation persists.

**IN CASE OF AN EMERGENCY ENDANGERING LIFE OR PROPERTY INVOLVING THIS PRODUCT, CALL COLLECT, DAY OR NIGHT, AREA CODE (973) 683-3100**

Net Contents: 1 Gallon
® Registered Trademark of American Cyanamid Company

12/97

## PRECAUTIONARY STATEMENTS

### HAZARDS TO HUMANS (AND DOMESTIC ANIMALS)

### CAUTION

Harmful if swallowed or absorbed through the skin. Do not get in eyes, on skin, or on clothing. Harmful if inhaled. Avoid breathing spray or mist. Causes moderate eye irritation.

**Personal Protective Equipment (PPE):**

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category C on an EPA chemical resistance category selection chart.

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Chemical-resistant gloves such as barrier laminate or butyl rubber or nitrile rubber or polyvinyl chloride (PVC) or viton neoprene
- Shoes plus socks

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

### ENGINEERING CONTROLS STATEMENTS

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

**User Safety Recommendations:**

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

## ENVIRONMENTAL HAZARDS

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 the 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/or Federal authorities and American Cyanamid Company immediately if you observe any adverse environmental effects due to the use of ALERT Insecticide-Miticide.

## DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible to pesticide regulation. This label must be in the possession of the user at the time of pesticide application.

## AGRICULTURAL USE REQUIREMENTS

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

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

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

- Coveralls
- Chemical-resistant gloves such as barrier laminate or butyl rubber or nitrile rubber or polyvinyl chloride (PVC) or viton neoprene
- Shoes plus socks

## STORAGE AND DISPOSAL

**STORAGE:**
DO NOT store below 32° degrees. DO NOT store in direct sunlight or heat.

**PESTICIDE DISPOSAL:**
DO NOT contaminate water, food or feed by storage or disposal. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL:**
Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, by incineration or, if allowed by State and local authorities by burning. If burned, stay out of smoke.

## GENERAL INFORMATION

ALERT is a member of the pyrrole class of chemistry. It has a unique mode of action that controls target pests by interfering with the energy-producing process within cells. It has both contact and stomach activity. Although ALERT does not move systemically through the plant, it does move translaminarly from the top to bottom of treated leaves.

**SPRAY PREPARATION:**
To assure a uniform spray solution, agitate or shake containers of this product immediately prior to use. Prepare no more spray mixture than is needed for the immediate operation. Add one-half to three-quarters of the required amount of clean water to the spray tank. Use a calibrated measuring device to measure the required amount of ALERT. Add ALERT to the spray tank while agitating. Fill the tank with the remainder of the water. If tank mixes are used, ALERT must be fully dispersed in water first, followed by the addition of the tank-mix materials.

**COMPATIBILITY:**
ALERT is compatible with a wide range of spray products, however, the full range of compatibilities under local conditions may not be known. Therefore, before using ALERT in any tank mixture, the compatibility of the mixture should be established. Add proportionate amounts of each ingredient to a pint or quart jar, cap, shake, and allow to stand for 15 minutes. Formation of precipitates that do not readily redisperse indicates an incompatible mixture and should not be used.

**SPRAYING INSTRUCTIONS**
Maintain agitation during application.

Thorough coverage of the cotton plant is essential for effective performance of this product. Apply with ground or aerial equipment using sufficient water to obtain full coverage of foliage. For better coverage increase gallonage and/or use drop nozzles if possible. Use a minimum of 5 gallons per acre with ground equipment or 3 gallons per acre by aircraft. Higher gallonage will provide better coverage. Under extreme pest populations and dense foliage, increase spray volumes to 10 gallons per acre by ground and 5 gallons per acre by air.

The addition of spray adjuvants may enhance coverage and canopy penetration.

Do not apply this product through any type of irrigation system.

**APPLICATION TIMING:**
Applications should not begin until target pest populations have reached local economic threshold levels. Consult the Cooperative Extension Service or crop advisor to determine recognized economic threshold levels in your area.

For best results of lepidopteran pests, time applications to control small larvae still feeding on leaf surfaces, and before migration to protected areas such as squares, blooms and bolls has occurred.

| CROP | PEST | DOSAGE PER ACRE Pounds Active | DOSAGE PER ACRE Fluid Ounces | REMARKS |
|---|---|---|---|---|
| Cotton (Arizona & California) | Spider Mites (Cotton<12") Twospotted Carmine Pacific Strawberry | 0.075 - 0.15 | 5 - 9.5 | Use adequate spray volume to insure thorough coverage. For best results, treat when pest populations are in early stages of development. |
| | Spider Mites (Cotton>12") Twospotted Carmine Pacific Strawberry | 0.15 - 0.25 | 9.5 - 16 | Apply as determined by field scouting. |
| | Beet Armyworm | 0.2 | 13 | Apply ALERT according to local economic thresholds such as 5 active "hits" per 100 row feet. |
| | Tobacco Budworm Cotton Bollworm | 0.2 - 0.25 | 8.5 - 10.5 | **Rates of 8.5-10.5 fluid ounces (0.2 - 0.25 lbs. active) should be used <u>only</u> 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 | 13 | **Rate of 13 fluid ounces (0.3 lbs. Active) have been shown to be effective when used alone.** Apply on a 5-7 day schedule or as determined by field scouting. Use higher rates when pest pressure is heavy or large larvae (>¼ inch) predominate. As pest pressure increases, it may be necessary to shorten spray interval. If loopers and other armyworms are present in the field at time of application, these pests will also be controlled. |

**Resistance and Pest Management:** Some insects and mites are known to develop resistance to crop protection products used repeatedly for control. Since the development of resistance cannot be predicted, ALERT should always be used in resistance pest management programs that are suitable for the crop pest complex involved.

Any pest management program undertaken should coordinate different chemistry classes of insecticides in their spray schedules, thorough coverage of targeted crop/pest(s), use of proper chemical rates per label directions, monitoring pest populations, and other factors as conditions warrant.

**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. Consult your Cooperative Extension Service or crop advisor for suggestions on minimizing insecticide resistance.

## USE RESTRICTIONS

Do not allow livestock to graze fields.
Do not apply less than 21 days before harvest.
Do not apply more that 32 fl. oz. (0.5 lbs ai/A) of ALERT per acre per year.

## ROTATIONAL CROPS

Do not plant root crops within 60 days of the last application of ALERT. For all other crops, do not plant within 30 days of the last application of ALERT.

## SPRAY DRIFT PRECAUTIONS

All aerial and ground application equipment must be properly maintained and calibrated using appropriate carriers.

*Spray Drift Management*: Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

*Buffer Zone Requirements:* Do not apply by ground equipment within 25 feet, or by air within 150 feet of lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries, and commercial fish farm ponds. Due to the hazard to avian and aquatic organisms, the application of this product by air is prohibited within one mile of designated National Wildlife Refuges. Contact state Fish and Wildlife Service for information on National Wildlife Refuges in your area.

*Recommendations for Aerial Applicators*: The following drift management requirements must be followed to avoid off-target drift movement from aerial applications to agricultural field crops. These requirements do not apply to forestry applications, public health uses or to applications using dry formulations.

1. The distance of the outer most nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.

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

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

   The applicator should be familiar with and take into account the information covered in the Aerial Drift Reduction Advisory Information.

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

*Controlling Droplet Size:*

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

*Boom Length:* For aerial applications, the spray boom should be mounted on the aircraft so as to minimize drift caused by wingtip or rotor vortices. For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

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

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

*Wind Speed Restrictions:* Drift potential is lowest between wind speeds of 2-10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given speed. Do not apply when wind velocity exceeds 10 mph. Application should be avoided below 2 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

*Temperature and Humidity:* When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

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

*Sensitive Areas*: The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g. when wind is blowing away from the sensitive areas).

*Runoff Management*: Do not cultivate within 25 feet of aquatic areas to allow growth of a vegetative filter strip.

## DISCLAIMER

The label instructions for the use of this product reflect the opinion of experts based on research and field use. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the use of, or application of the product contrary to label instructions, all of which are beyond the control of American Cyanamid Company. All such risks shall be assumed by the user.

American Cyanamid Company shall not be responsible for losses or damages resulting from use of this product in any manner not set forth on this label. User assumes all risks associated with the use of this product in any manner not specifically set forth on this label.

American Cyanamid Company warrants only that the material contained herein conforms to the chemical description of the label and is reasonably fit for the use therein described when used in accordance with the directions for use, subject to the risks referred to above. **CYANAMID DOES NOT MAKE OR AUTHORIZE ANY AGENT OR REPRESENTATIVE TO MAKE ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, AND EXPRESSLY EXCLUDES AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

**BUYER'S EXCLUSIVE REMEDY AND AMERICAN CYANAMID'S EXCLUSIVE LIABILITY, WHETHER IN CONTRACT, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, SHALL BE LIMITED TO REPAYMENT OF THE PURCHASE PRICE OF ALERT Insecticide-Miticide.** In no case shall Cyanamid or the seller be liable for consequential, special or indirect damages resulting from the use or handling of this product.

**American Cyanamid Company**
**North America Agricultural Products Division**
**Crop Protection Products Department**
**One Campus Drive, Parsippany, NJ 07054 ©1997**

# Appendix 3

## Summary of Results of Aquatic Toxicity Studies with Chlorfenapyr

### 1. Studies with AC 303630

| Species / Test | Guideline | LC50 / EC50 | NOEC | MATC |
|---|---|---|---|---|
| Bluegill LC50 | 72-1; 850.1075 | 11.6 µg/L | 5.03 µg/L | ----- |
| Catfish LC50 | 72-1; 850.1075 | 12.3 µg/L | 7.23 µg/L | ----- |
| Rainbow Trout LC50 | 72-1; 850.1075 | 7.4 µg/L | 2.61 µg/L | ----- |
| *Daphnia magna* EC50 | 72-2; 850.1010 | 6.1µg/L | 2.52 µg/L | ----- |
| Sheepshead Minnow LC50 | 72-3; 850.1025 | 60.4 µg/L | 30.7µg/L | ----- |
| Eastern Oyster EC50 | 72-3; 850.1025 | 9.29 µg/L | 5.46 µg/L | ----- |
| Mysid LC50 | 72-3; 850.1025 | 2.0 µg/L | 0.32 µg/L | ----- |
| Rainbow Trout ELS | 72-4; 850.1300 | ----- | 3.68 µg/L | 5.66 µg/L |
| Sheepshead Minnow ELS | 72-4; 850.1300 | ----- | 8.72 µg/L | 12.7 µg/L |
| *Daphnia magna* Life-Cycle | 72-4; 850.1400 | ----- | 3.6 µg/L | 5.2 µg/L |
| *Mysid* Life-Cycle | 72-4; 850.1400 | ----- | 0.17 µg/L | 0.28 µg/L |
| Fathead Minnow Life-Cycle | 72-5; 850.1500 | ----- | 5.92 µg/L | 8.87 µg/L |
| Sheepshead Minnow Life-Cycle | 72-5; 850.1500 | ----- | 1.01 µg/L | 1.39 µg/L |
| *Hyalella* - Sediment Toxicity* | 72-3 | 20.6 mg/kg | 10.9 mg/kg | ----- |
| *Chironomus* - Chronic Toxicity | Supplemental | 49.9 µg/L | 18.8 µg/L | 26.5 µg/L |

*Results of this study are based on the measured concentrations in the test sediment.

### 2. *Studies with Metabolites / Degradates of Chlorfenapyr*

| Species / Test | Guideline | LC50 / EC50 | NOEC |
|---|---|---|---|
| Bluegill LC50 - CL 312094 | Supplemental | 928 µg/L | 242 µg/L |
| *Daphnia* EC50 - CL 312094 | Supplemental | 560 µg/L | 360 µg/L |
| Bluegill LC50 - CL 303267 | Supplemental | 70 µg/L | 36 µg/L |
| *Daphnia* EC50 - CL 303267 | Supplemental | 107 µg/L | 79 µg/L |
| Bluegill LC50 - CL 325195 | Supplemental | 2,100 µg/L | 1,000 µg/L |
| *Daphnia* EC50 - CL 325195 | Supplemental | 1,700 µg/L | 610 µg/L |

# Appendix 4

## Summaries of the Acute and Chronic Toxicity Studies of Chlorfenapyr (AC 303630) to Aquatic Organisms

### A. Acute Toxicity to Freshwater Fish (72-1)

Acute Toxicity to Bluegill Sunfish (72-1, 850.1075)

Report Number: ECO 941-91-104
MRID No. 42807801

The acute toxicity of AC 303630 to the bluegill sunfish (*Lepomis macrochirus*) was evaluated under flow-through renewal test conditions. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty bluegill were exposed to either dilution water only (no-treatment control), 6 µL of DMF/L (vehicle blank), or one of five concentrations of AC 303630 for a period of 96 hours. The mean measured concentrations during the 96-hour exposure were: 5.03, 9.53, 14.7, 26.2, and 43.2 µg of AC 303630/L (parts per billion). After 96 hours of exposure, the percentage of dead bluegill ranged from 5% at 5.03 µg of AC 303630/L to 100% at 26.2 and 43.2 µg of AC 303630/L. Mortality in the no-treatment control and the vehicle blank was 5% and 0%, respectively. In the 43.2 µg of AC 3030630/L treatment, all of the mortalities occurred within 24 hours. In the 26.2 µg of AC 303630/L treatment, 40% of the mortalities occurred within 24 hours, and 100% of the mortalities occurred within 48 hours. In the three lowest treatments, the majority of the mortalities occurred between 48 and 96 hours. The 96-hour LC50 was determined to be 11.6 µg of AC 303630/L, and the 95% confidence limits were 9.53 and 14.7 µg of AC 303630/L. The no-observed-effect concentration was 5.03 µg of AC 303630/L.

Acute Toxicity to Channel Catfish (72-1; 850.1075)

Report Number: ECO 95-226
MRID No. 44364801

The acute toxicity of AC 303630 to the channel catfish (*Ictalurus punctatus*) was evaluated under flow-through renewal test conditions. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty catfish were exposed to either dilution water only (no-treatment control), 5 µL of DMF/L (vehicle blank), or one of five concentrations of AC 303630 for a period of 96 hours. The mean measured concentrations during the 96-hour exposure were: 7.23, 11.7, 24.9, 39.5, and 56.2 µg of AC 303630/L (parts per billion). After 96 hours of exposure, the percentage of dead catfish ranged from 0% at 7.23 µg of AC 303630/L to 100% at 24.9, 37.5, and 56.2 µg of AC 303630/L. There were no mortalities in the no-treatment and the solvent controls. In the 24.9, 37.5, and 56.2 µg of AC 303630/L treatments, all of the mortalities occurred within 24 hours. The 96-hour LC50 was determined to be 12.3 µg of AC 303630/L, and the 95% confidence limits were 7.23 and 24.9 µg of AC 303630/L. The no-observed-effect concentration was 7.23 µg of AC 303630/L.

Acute Toxicity to Rainbow Trout (72-1; 850.1075)

Report Number: ECO 941-91-103
MRID No. 42770231

The acute toxicity of AC 303630 to the rainbow trout (*Oncorhynchus mykiss*) was evaluated under flow-through renewal test conditions. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty rainbow trout were exposed to either dilution water only (no-treatment control), 4.3 µL of DMF/L (vehicle blank), or one of five concentrations of AC 303630 for a period of 96 hours. The mean measured concentrations during the 96-hour exposure were: 2.61, 4.68, 8.01, 18.4, and 32.4 µg of AC 303630/L (parts per billion). After 96 hours of exposure, the percentage of dead rainbow trout ranged from 0% at 2.61 µg of AC 303630/L to 100% at 18.4 and 32.4 µg of AC 303630/L. No mortalities occurred in either the no-treatment control or the vehicle blank. In the 32.4 µg of AC 303630/L treatment, 85% of the rainbow trout were dead within 24 hours, and 100% were dead within 48 hours. In the 18.4 µg of AC 303630/L treatment, 55% of the rainbow trout were dead within 24 hours, and 100% were dead within 48 hours. In the 8.01 µg of AC 303630/L treatment, the majority of the mortalities occurred after 24 hours of exposure. The 96-hour LC50 was determined to be 7.44 µg of AC 303630/L, and the 95% confidence limits were 6.48 and 8.95 µg of AC 303630/L. The no-observed-effect concentration was 2.61 µg of AC 303630 /L.

**B. Acute Toxicity to Freshwater Invertebrates (72-2)**

Acute Toxicity to *Daphnia magna* (72-2; 850.1010)

Report Number : ECO 941-91-102
MRID No. 42770232

The acute toxicity of AC 303630 to *Daphnia magna* was evaluated under flow-through renewal test conditions. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty *D. magna* were exposed to either dilution water only (no-treatment control), 100 µL of DMF/L (vehicle blank), or one of five concentrations of AC 303630 for a period of 96 hours. The mean measured concentrations during the 96-hour exposure were: 1.40, 2.52, 3.86, 6.31, and 10.7 µg of AC 303630/L (parts per billion). After 6 hours of exposure, the percentage of dead or immobile *D. magna* ranged from 0% at 1.40 and 2.52 µg of AC 303630/L to 100% at 10.7 µg of AC 303,630/L. There were no mortalities in either the no-treatment control or the vehicle blank. In the 10.7 µg of AC 303630/ L treatment, 65% of the *D. magna* were immobile within 24 hours, and 100% were immobile within 48 hours. In the 6.31 and 3.86 µg of AC 303630/L treatments, the majority of the mortalities occurred after 24 hours of exposure. The 96-hour EC50 was determined to be 6.11 µg of AC 303630/L, and the 95% confidence limits were 5.35 and 7.04 µg of AC 303630/L. The no-observed-effect concentration was 2.52 µg of AC 303630/L.

## C. Acute Toxicity to Estuarine and Marine Organisms (72-3)

Acute Toxicity to Sheepshead Minnow (72-3a; 850.1025)

Report Number: ECO 92-104
MRID No. 43492816

The acute toxicity of AC 303630 to the sheepshead minnow (*Cyprinodon variegatus*) was evaluated under flow-through renewal test conditions. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty sheepshead minnow were exposed to either dilution water only (no-treatment control), 40 µL of DMF/L (vehicle blank), or one of five concentrations of AC 303630 for a period of 96 hours. The mean measured concentrations during the 96-hour exposure were: 16.2, 30.7, 48.4, 84.9, and 155 µg of AC 303630/L (parts per billion). After 96 hours of exposure, the percentage of dead sheepshead minnow ranged from 0% at 16.2 and 30.7 µg of AC 303630/L to 100% at 155 µg of AC 303630/L. There were no mortalities in either the no-treatment control or the vehicle blank. In the 155 µg of AC 303630/L treatment, 55% of the sheepshead minnows were dead within 24 hours, 60% were dead within 48 hours, 80% were dead within 72 hours and 100% were dead within 96 hours. In the 84.9 µg of AC 303630/L treatment, 25% of the sheepshead minnows were dead within 24 hours, 55% were dead within 48 hours, 90% were dead within 72 hours, and 95% were dead within 96 hours. In the 48.4 µg of AC 303630/L treatment, 15% mortalities occurred, and all mortalities occurred after 72 hours of exposure. The 96-hour LC50 was calculated to be 60.4 µg of AC 303630/L, and the 95% confidence limits were 53.5 and 68.6 µg of AC 303630/L. The no-observed-effect concentration was 30.7 µg of AC 303630/L.

Effect on New Shell Growth in the Eastern Oyster (72-3b; 850.1025)

Report Number: ECO 92-106
MRID No. 43492817

The effect of AC 303630 on new shell growth in the eastern oyster (*Crassostrea virginica*) was evaluated under flow-through renewal test conditions. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty eastern oysters were exposed to either dilution water only (no-treatment control), 70 µL of DMF/L (vehicle blank), or one of five concentrations of AC 303630 for a period of 96 hours. The mean measured concentrations during the 96-hour exposure period were: 1.81, 4.32, 5.46, 8.17, and 13.2 µg of AC 303630/L (parts per billion). After 96 hours of exposure, inhibition of new shell growth in relation to the controls ranged from 12% at 4.32 µg of AC 303630/L to 89% at 13.2 µg of AC 303630/L. In the lowest treatment (1.81 µg of AC 303630/L), the shell growth increased an average of 12% in relation to the controls. The 96-hour EC50 for new shell growth inhibition was calculated to be 9.29 µg of AC 303630/L, and the 95% confidence limits were 8.17 and 13.2 µg of AC 303630/L. The no-observed-effect concentration was 5.46 µg of AC 303630/L.

Although the average shell growth in this study did not meet the current EPA requirement of 2 mm average in the controls, the study should be considered valid for the following reasons: 1) The study was initiated prior to the new requirement becoming effective (The memo notifying registrants of this policy issued on October 29, 1992, while this study was initiated on April 3, 1992) and the EPA memo clearly states that studies initiated prior to the notification would be

evaluated on a case by case basis; 2) There was a clear and adequate concentration-response in this study for shell growth inhibition, which allowed for the calculation of an EC50 value; and 3) The oyster is not the most sensitive marine species to AC 303630, therefore, repeating the study will not change the overall marine organism hazard assessment.

Acute Toxicity to the Mysid (72-3c; 850.1025)

Report Number: ECO 93-157
MRID No. 43492818

The acute toxicity of AC 303630 to the mysid (*Mysidopsis bahia*) was evaluated under flow-through renewal test conditions. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty mysids were exposed to either dilution water only (no-treatment control), 38 µL of DMF/L (vehicle blank), or one of six concentrations of $^{14}$C-radiolabeled AC 303630 for a period of 96 hours. The mean measured concentrations during the 96-hour exposure were: 0.32, 0.73, 0.89, 1.5, 2.5, and 5.1 µg of $^{14}$C-AC 303,30 equivalents/L (parts per billion). After 96 hours of exposure, the percentage of dead mysid ranged from 0% at 0.32 µg of $^{14}$C-AC 303630 equivalents/L to 100% at 5.1 µg of $^{14}$C-AC 303630 equivalents/L. There were no mortalities in either the no-treatment control or the vehicle blank. In the 5.1 µg of $^{14}$C-AC 303630 equivalents/L treatment, 95% of the mysids were dead within 24 hours and 100% were dead within 48 hours. In the 2.5 µg of $^{14}$C-AC 303630 equivalents/L treatment, 25% of the mysids were dead within 24 hours, 35% were dead within 48 hours, and 45% were dead at 72 and 96 hours. In the 1.5 µg of $^{14}$C-AC 303630 equivalents/L treatment, there was 0% mortalities by 24 hours, 30% by 48 hours, 40% by 72 hours and 45% by 96 hours. Any mortalities that occurred in the lower treatment levels occurred after 24 hours of exposure. The 96-hour LC50 was calculated to be 2.0 µg of $^{14}$C-AC 303630 equivalents/L, and the 95% confidence limits were 1.7 and 2.5 µg of $^{14}$C-AC 303630 equivalents/L. The no-observed-effect concentration was 0.32 µg of $^{14}$C-AC 303630 equivalents/L.

## E. Fish Early Life-Stage Toxicity (72-4)

Early Life-Stage Toxicity in Rainbow Trout (72-4a; 850.1300)

Report Number: ECO 92-103
MRID No. 43492819

The toxicity of AC 303630 during the early life-stages of the rainbow trout (*Oncorhynchus mykiss*) was evaluated under flow-through renewal test conditions. The biological endpoints evaluated were hatching, and survival and growth of the post-hatch fry. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of 160 fertilized rainbow trout eggs were exposed to either dilution water only (no-treatment control), 2.3 µL of DMF/L (vehicle blank), or one of five concentrations of $^{14}$C-radiolabeled AC 303630 for a period of 94 days (61 days post-hatch). The mean measured concentrations during the 94-day exposure were: 0.459, 0.907, 1.78, 3.68, and 7.64 µg of $^{14}$C-AC 303630 equivalents/L (parts per billion). There was no statistical difference in the hatching success between the controls and any of the test substance treatment groups. There was a

statistical difference in the post-hatch survival between the highest treatment level (7.64 µg of $^{14}$C-AC 303630 equivalents/L) and the controls. Post-hatch survivals between the remaining treatment levels and the controls were statistically equivalent. After 94-days of exposure, there was no statistical difference in the weights or lengths of fish exposed to concentrations ≤ 3.68 µg of $^{14}$C-AC 303630 equivalents/L in comparison to the controls. The effect of the test substance on growth in the highest treatment level (7.64 µg of $^{14}$C-AC 303630 equivalents/L) could not be statistically evaluated because there was only one surviving fish in this group.

In summary, the lowest-observed-effect concentration in this study was 7.64 µg of $^{14}$C-AC 303630 equivalents/L, the no-observed-effect concentration was 3.68 µg of $^{14}$C-AC 303630 equivalents/L, and the maximum acceptable toxicant concentration was 5.66 µg of $^{14}$C-AC 303630 equivalents/L. The most sensitive endpoint to AC 303630 during the early life-stages of the rainbow trout was post-hatch survival.

Early Life-Stage Toxicity in the Sheepshead Minnow (72-4; 850.1400)

Report Number: ECO 93-117
MRID No. 43492820

The toxicity of AC 303630 during the early life-stages of the sheepshead minnow (*Cyprinodon variegatus*) was evaluated under flow-through renewal test conditions. The biological endpoints evaluated were hatching, and survival and growth of the post-hatch fry. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of 80 fertilized sheepshead minnow eggs were exposed to either dilution water only (no-treatment control), 6.0 µL of DMF/L (vehicle blank), or one of five concentrations of AC 303630 for a period of 33 days (29 days post-hatch). The mean measured exposure concentrations during the 33-day exposure were: 1.08, 2.00, 4.21, 8.72, and 18.6 µg of AC 303630/L (parts per billion). There was a significant difference in hatching success between the highest treatment group (18.6 µg of AC 303630/L) and the pooled controls; the hatching success in the remaining test substance treatment groups was statistically comparable to the controls. In comparison to the controls, there was a significant reduction in post-hatch survivals in the 18.6 and 2.00 µg of AC 303630/L treatment groups; the post-hatch survivals in the remaining test substance treatment groups were statistically comparable to the controls. Since post-hatch survivals in the 4.21 and 8.72 µg/L treatments were statistically comparable to the controls, the reduction in survival in the 2.00 µg/L treatment was not considered to be test substance related. After 33 days of exposure, there was a significant reduction in wet weights in the 4.21 µg of AC 303630/L treatment in comparison to the controls; the wet weights of the fish in the remaining test substance treatment groups were statistically comparable to the controls. Since the wet weights in the two higher concentration treatment groups were statistically comparable to the controls, the reduction of wet weights in the 4.21 µg/L treatment was not considered to be test substance related. After 33 days of exposure, there were no statistical differences in the standard lengths of the fish in any of the test substance treatment groups in comparison to the controls.

In summary, the lowest-observed-effect concentration in this study was 18.6 µg of AC 303630/L, the no-observed-effect concentration was 8.72 µg of AC 303630/L, and the maximum acceptable toxicant concentration was 12.7 µg of AC 303630/L. The most sensitive endpoints to

AC 303630 during the early life-stages of the sheepshead minnow were hatching and post-hatch survival.

## F. Chronic Toxicity to Aquatic Invertebrates (72-4)

*Daphnia magna* Life-Cycle Toxicity (72-4b; 850.1400)

Report Number: ECO 92-102
MRID No. 43492822

The chronic toxicity of AC 303630 during the complete life-cycle of *Daphnia magna* was evaluated under flow-through renewal test conditions. The biological endpoints evaluated were survival, growth (dry weights and total lengths), and reproduction of first generation daphnids. Reproduction was evaluated by statistically comparing the number of offspring produced per adult reproductive day between treatment and control groups. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of 40 daphnids that were less than 24 hours old were exposed to either dilution water only (no-treatment control), 24 µL of DMF/L (vehicle blank), or one of six concentrations of $^{14}C$-radiolabeled AC 303630 for a period of 21 days. The mean measured concentrations during the 21-day exposure were: 0.28, 0.45, 0.99, 1.9, 3.6, and 7.7 µg of $^{14}C$-AC 303630 equivalents/L (parts per billion). In comparison to the controls, there was a significant reduction in survival, reproduction (number of offspring produced per adult reproductive day) and lengths of the daphnids in the highest treatment group (7.7 µg/L) only; survival, reproduction and lengths of daphnids in the remaining test substance treatment groups were statistically comparable to the control. In comparison to the controls, there was no significant difference in the dry weights in any of the test substance treatment groups.

In summary, the lowest-observed-effect concentration in this study was 7.7 µg of $^{14}C$-AC 303630 equivalents/L, the no-observed-effect concentration was 3.6 µg of $^{14}C$-AC 303630 equivalents/L, and the maximum acceptable toxicant concentration was 5.2 µg of $^{14}C$-AC 303630 equivalents/L. The most sensitive endpoints to AC 303630 during the complete life cycle of *Daphnia magna* were survival, reproduction and effects on daphnid length.

Mysid Life-Cycle Toxicity (72-4b; 850.1400)

Report Number: ECO 93-116
MRID No. 43492821

The chronic toxicity of AC 303630 during the complete life-cycle of the mysid (*Mysidopsis bahia*) was evaluated under flow-through renewal test conditions. The biological endpoints evaluated were survival, growth (dry weights and total lengths), and reproduction of first generation mysids during 28 days of exposure, and survival of second generation mysids during 96 hours of exposure. Reproduction was evaluated by statistically comparing the number of live offspring produced per female reproductive day between treatment and control groups. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of 40 mysids that were less than 24 hours old were exposed to either

dilution water (no-treatment control), 9.8 µL of DMF/L (vehicle blank), or one of five concentrations of $^{14}$C-radiolabeled AC 303630 for a period of 28 days. In addition, the survival of groups of 20 offspring from each test substance treatment and control group was evaluated for 96 hours of exposure. The mean measured concentrations during the entire exposure period were: 0.17, 0.39, 0.97, 1.9, and 3.9 µg of $^{14}$C-AC 303630 equivalents/L (parts per billion). In comparison to the controls, survival in the test substance treatments was significantly lower in all treatments ≥ 0.39 µg of $^{14}$C-AC 303630 equivalents/L, reproduction was significantly lower in all treatments > 0.97 µg of $^{14}$C-AC 303630 equivalents/L, and the was a significant reduction in dry weights of the mysids in the 3.9 µg of $^{14}$C-AC 303630 equivalents/L exposure group only. In comparison to the controls, the total lengths of first generation mysids and the 96-hour survival of the second generation mysids were not significantly different at any treatment level.

In summary, the lowest-observed-effect level in this study was 0.39 µg of $^{14}$C-AC 303630 equivalents/L, the no-observed-effect concentration was 0.17 µg of $^{14}$C-AC 303630 equivalents/L, and the maximum acceptable toxicant concentration was 0.28 µg of $^{14}$C-AC 303630 equivalents/L. The most sensitive endpoint of AC 303630 during the complete life-cycle of *Mysidopsis bahia* was survival of the first generation mysids.

## G. Fish Life-Cycle Toxicity (72-5)

Life-Cycle Toxicity to the Fathead Minnow (72-5; 850.1500)

Report Number: ECO 95-120
MRID No. 44364803

The chronic toxicity of AC 303630 during the complete life-cycle of the fathead minnow (*Pimephales promelas*) was evaluated under flow-through renewal test conditions. The biological endpoints evaluated were viability and hatchability of the $F_0$ embryos, survival and growth of the $F_0$ fry (wet weights and standard lengths), reproduction (i.e., egg production) of $F_0$ generation, viability and hatchability of the $F_1$ embryos and growth of the $F_1$ fry. The exposure period of the $F_0$ fish was 300 days. The test was extended for an additional 8 days (to 308 days total) to complete the 8-week exposure of the $F_1$ fry.

The mean measured concentration of AC 303630 during the $F_0$ phase of the definitive test (i.e., day 0 through 300) were 0.88, 1.47, 2.91, 5.92, and 13.3 µg/L. The mean measured concentrations of AC 303630 during the $F_1$ phase of the definitive test (i.e., day 187 through 308) were 1.11, 1.82, 3.66, 7.59, and 16.6 µg/L. The results of the study were based on the mean measured concentrations of AC 303630 during wither the $F_0$ or $F_1$ phase of the definitive test.

The lowest observed effect concentration (i.e., LOEC; lowest concentration where a statistically significant effect was observed) and the no-observed effect concentration (NOEC; highest concentration where there was not a statistically significant effect) for each of the biological endpoints evaluated during the study are summarized in the following table.

| BIOLOGICAL ENDPOINT | LOEC | NOEC |
|---|---|---|
| **Fo Generation** | | |
| Fo Hatching | > 13. 3 µg/L | 13.3 µg/L |
| Fo Survival at 6 days post-hatch | > 13.3 µg/L | 13.3 µg/L |
| Fo Survival at 4 weeks post-hatch | 13.3 µg/L | 5.92 µg/L |
| Fo Survival at 8 weeks post-hatch | > 13.3 µg/L | 13.3 µg/L |
| Fo Survival at 175 days | > 13.3 µg/L | 13.3 µg/L |
| Fo Survival at 300 days | 13.3 µg/L | 5.92 µg/L |
| Fo Growth at 4 weeks post-hatch | > 13.3 µg/L | 13.3 µg/L |
| Fo Growth at 8 weeks post-hatch | > 13.3 µg/L | 13.3 µg/L |
| Fo Growth at 300 days post-hatch | > 13.3 µg/L | 13.3 µg/L |
| Egg Production | > 13.3 µg/L | 13.3 µg/L |
| **F1 Generation** | | |
| F1 Hatching | > 16.6 µg/L | 16.6 µg/L |
| F1 Survival at 5 days post-hatch | > 16.6 µg/L | 16.6 µg/L |
| F1 Survival at 4 weeks post-hatch | > 16.6 µg/L | 16.6 µg/L |
| F1 Survival at 8 weeks post-hatch | > 16.6 µg/L | 16.6 µg/L |
| F1 Growth at 4 weeks post-hatch | > 16.6 µg/L | 16.6 µg/L |
| F1 Growth at 8 weeks post-hatch | > 16.6 µg/L | 16.6 µg/L |

In summary, the most sensitive endpoints to the fathead minnow after continuous exposure to AC 303630 during a complete reproductive life cycle were survival of $F_0$ generation at 4 weeks post-hatch and after 300 days of exposure. There were no effects on hatching, growth or reproduction of the $F_0$ generation up to 13.3 µg/L, and no effects on hatching, survival and growth of the $F_1$ generation up to 16.6 µg/L. The LOEC and NOEC values for this study were 13.3 and 5.92 µg/L, respectively. The maximum acceptable toxicant concentration (MATC) was 8.87 µg/L.

Life-Cycle Toxicity to the Sheepshead Minnow (72-5; 850.1500)

Report Number: ECO 95-121
MRID No. 44364802

The chronic toxicity of AC 303630 during the complete life-cycle of the sheepshead minnow (*Cyprinodon variegatus*) was evaluated under flow-through renewal test conditions. The biological endpoints evaluated were viability and hatchability of the $F_0$ embryos, survival and growth of the $F_0$ fry (wet weights and standard lengths), reproduction (i.e., egg production) of $F_0$ generation, viability and hatchability of the $F_1$ embryos and growth of the $F_1$ fry. The exposure period of the $F_0$ fish was 187 days, while the $F_1$ fry were exposed for a total of 8 weeks post-hatch. The mean measured exposure concentrations of AC 303630 during the definitive test were: 1.01, 1.91, 3.27, 6.97, and 18.1 µg/L.

The lowest observed effect concentration (i.e., LOEC; lowest concentration where a statistically significant effect was observed) and the no-observed effect concentration (NOEC; highest concentration where there was not a statistically significant effect) for each of the biological endpoints evaluated during the study are summarized in the following table.

| BIOLOGICAL ENDPOINT | LOEC | NOEC |
|---|---|---|
| **Fo Generation** | | |
| Fo Hatching | > 18.1 µg/L | 18.1 µg/L |
| Fo Survival at 9 days | 18.1 µg/L | 6.97 µg/L |
| Fo Survival at 28 days | 18.1 µg/L | 6.97 µg/L |
| Fo Survival at 56 days | 18.1 µg/L | 6.97 µg/L |
| Fo Survival from 56 to 119 days | > 18.1 µg/L | 18.1 µg/L |
| Fo Survival from 119 to 187 days | > 18.1 µg/L | 18.8 µg/L |
| Fo Growth at 28 days | 3.27 µg/L | 1.91 µg/L |
| Fo Growth at 56 days | 1.91 µg/L | 1.01 µg/L |
| Fo Growth at 187 days | > 18.1 µg/L | 18.1 µg/L |
| Egg Production | > 18.1 µg/L | 18.1 µg/L |
| **F1 Generation** | | |
| F1 Hatching | > 6.97 µg/L | 6.97 µg/L |
| F1 Survival at 4 weeks post-hatch | > 6.97 µg/L | 6.97 µg/L |
| F1 Survival at 8 weeks post-hatch | > 6.97 µg/L | 6.97 µg/L |
| F1 Growth at 4 weeks post-hatch | > 6.97 µg/L | 6.97 µg/L |
| F1 Growth at 8 weeks post-hatch | > 6.97 µg/L | 6.97 µg/L |

In summary, the most sensitive endpoints to the sheepshead minnow after continuous exposure to AC 303630 during a complete reproductive life cycle were growth of $F_0$ generation after 56 days of exposure. There were no effects on hatching or reproduction of the $F_0$ generation up to 18.1 µg/L, and no effects on hatching, survival and growth of the $F_1$ generation up to 6.97 µg/L. Due to excessive mortalities in the highest treatment group (i.e., 18.1 µg/L) during the first generation exposure, evaluating effects to the F1 generation at this level was not possible. The LOEC and NOEC values for this study were 1.91 and 1.01 µg/L, respectively. The maximum acceptable toxicant concentration (MATC) was 1.39 µg/L.

**H. Bioconcentration in Fish**

Bioaccumulation in Bluegill Sunfish (Guideline No. 165-4; 72-6; 850.1710)

Report No. MET 93-002.01
MRID Nos. 42770245 and 43492852

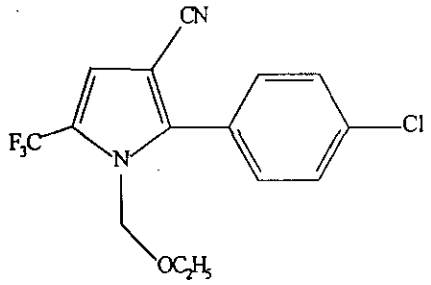
A dynamic 54-day study was conducted to evaluate the bioconcentration of AC 303630 by bluegill sunfish (*Lepomis macrochirus*). A flow-through proportional diluter system was used, which maintained a mean measured water concentration of 0.84 (±0.13) mg/L of [Phenyl(U)-14C] AC 303630 and 0.96 (±0.19) mg/L of [2-Pyrrole-14C] AC 303630 for a 33-day exposure period.

A steady-state concentration of radioactivity in fish was observed after 21-days of exposure to AC 303630. The maximum total radioactive residues (TRR) in whole fish, fillet and viscera were in the ranges 2000 to 2200, 880 to 980, and 2900 to 3700 ppb, respectively. The residue concentrations were <10% of the steady-state concentrations 21 days after the start of depuration.

The bioconcentration factors (BCF) calculated on the basis of total AC 303630-derived radioactivity in whole fish and aquaria waters were 2084 to 2136 during the exposure phase. The half-life for clearance of the total radioactive residue during the depuration phase was 3 to 4 days. Significant levels of the desbromo-metabolite CL 312094 (approximately 40%) were observed in aquaria waters during the exposure phase. Metabolite CL 325195 was also observed but to a much lesser extent (<10%). Thus, the estimated BCF factors were approximately 20X lower (83-114) in whole fish, based on the actual concentration of AC 303630 in the fish and aquaria waters on days-21 and -33.HPLC analysis of the radioprofiles in whole fish, viscera and fillet derived from the [Phenyl(U)-14C] and [2-Pyrrole-14C] AC 303630 exposures were qualitatively similar indicating that there was no fragmentation of the parent molecule. CL 312094 (the desbromo analog of AC 303630) was the only major component of the residue in fish accounting for 89 to 95% of the TRR at steady-state. AC 303630 accounted for < 5% of the TRR.

Thus, in bluegill sunfish, the principal metabolic pathway is debromination. Analysis of the water during the exposure period indicated that CL 312094 and AC 303630 were present in approximately equal amounts, and accounted for most of the radioactivity in the water.

**CL 312094**




The ecotoxicology of CL 312094 is summarized below.

## I. Whole Sediment: Acute Invertebrates, Freshwater

Whole Sediment Toxicity to *Hyalella azteca* (73-1)

Report Number: ECO 97-166

The toxicity of sediment-associated AC 303630 to the freshwater sediment-burrowing amphipod, *Hyalella azteca*, was evaluated in a 10-day flow-through toxicity test. The test was conducted by adding amphipods, between 7 and 14 days of age, into a water-sediment system containing artificial sediment (70% fine sand, 20% kaolinite clay, and 10% finely ground sphagnum peat) that had been fortified with various concentrations of $^{14}$C-AC 303630 using acetone as a carrier vehicle. There were five test substance treatments groups as well as a no-treatment (untreated sediment) and a solvent (acetone) control group. The mean measured sediment concentrations in

five treatments groups during the 10-day test were: 5.02, 10.9, 19.0, 45.5, and 79.5 mg of $^{14}C$-AC 303630 equivalents/kg of sediment.

After 10 days of exposure, mortality of amphipods was 13% at 5.02 mg/kg, 11% at 10.9 mg/kg, 46% at 19.0 mg/kg, 46% at 45.5 mg/kg, and 84% at 79.5 mg/kg. Mortality in the no-treatment and solvent controls was 6% and 4%, respectively. The 10-day LC50, based on mean measured sediment concentrations was 20.6 mg/kg with 95% confidence limits of 10.9 and 45.5 mg/kg. The NOEC was 10.9 mg/kg.

Toxicity to Larvae of the Midge, *Chironomus riparious*, in a Water-Sediment System (Supplemental)

Report Number: ECO 96-196
MRID No. 44364804

The toxicity of AC 303630 to the sediment-dwelling larvae of the freshwater midge, *Chironomus riparious*, was evaluated in a 28-day toxicity test. The test was conducted in 3.8 L glass jars containing 1.5-cm of artificial sediment (70% fine sand, 20% kaolinite clay, and 10% finely ground sphagnum peat) with approximately 15 cm of overlaying dilution water. The jars were covered with nylon screen to capture any emerged adults. Twenty five first-instar larvae (less than 4 days of age) were added to the test vessels approximately 24 hours prior to test substance application. The test substance was applied directly to the surface of the overlaying water using dimethlyformamide as a carrier vehicle. The following nominal water concentrations were tested: 0.0 (control), 0.0 (solvent control), 18.8, 37.5, 75.0, 150, and 300 µg of AC 303630/L.

Survival and growth (dry weights) of larvae were evaluated at day-10 by sacrificing two replicates for each treatment and control group and counting and weighing any remaining larvae. For the remainder of the test, the number of emerged adults was recorded, as was the time of emergence and the sex of the emerged adults. After 28 days, remaining systems were sacrificed and the sediment were sieved for any remaining larvae.

Day 10 larval mortality ranged from 11% in the 18.8 µg/L treatment to 100% in the 300 µg/L treatment. Day 10 mortality in the no-treatment and solvent control was 7% and 3%, respectively. The day 10 LC50 was 49.5 µg/L, with 95% confidence limits of 37.5 and 75.0 µg/L. In comparison to pooled controls, day 10 larval dry weights were significantly reduced in the 75.0 µg/L treatment; evaluating effects on dry weights in the two higher treatments was not possible due to high larval mortality in these treatments. Therefore, the lowest observed effect concentration (LOEC) and no-observed effect concentration (NOEC) for effects on day 10 larval dry weights were 75.0 and 37.5 µg/L, respectively.

Adult emergence by day 28 ranged from 0% in the 150 and 300 µg/L treatments to 85% in the 37.5 µg/L treatment. Adult emergence in the no-treatment and solvent controls was 79% and 93%, respectively. The 28-day LC50 based on adult emergence was 50.0 µg/L, with 95% confidence limits of 37.5 and 75.0 µg/L. There were no differences in the time to emergence in the various treatment groups.

In summary, the most sensitive endpoint in this study was survival after 10 days of exposure. The LC50 was 49.9 µg/L, with 95% confidence limits of 37.5 and 75.0 µg/L. The lowest observed effect concentration (LOEC) and no-observed effect concentration (NOEC) values

based on survival were 37.5 and 18.8 µg/L, respectively. The maximum acceptable toxicant concentration (MATC) was 26.5 µg/L.

## J. Acute Toxicity of AC 303630 Metabolites and Degradates to Aquatic Organisms

Acute Toxicity of CL 312094 to the Bluegill Sunfish

Report Number: ECO 93-134
MRID No. 43492815

The acute toxicity of CL 312094, the major metabolite of AC 303630 that was found in a bluegill sunfish (*Lepomis macrochirus*) bioaccumulation study and a major soil degradate of AC 303630, was evaluated in the bluegill sunfish under flow-through renewal test conditions. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty bluegill were exposed to either dilution water only (no-treatment control), 92 µL of DMF/L (vehicle blank), or one of five concentrations of CL 312094 for a period of 96 hours. The mean measured concentrations during the 96 hour exposure were: 140, 242, 363, 632, and 928 µg of CL 312094/L (parts per billion).

After 96 hours of exposure, the percentage of dead bluegill was 0% at 140 and 242 µg of CL 312094/L, 5% at 363 and 632 µg of CL 312094/L, and 35% at 928 µg of CL 312094/L. There were no mortalities in either control group. In the 928 µg/L treatment group, there was 5% mortality after 24 and 48 hours of exposure, 25% after 72 hours of exposure and 35% after 96 hours of exposure. In both the 363 and 928 µg/L exposure groups, the mortalities occurred after 72 hours of exposure. The 96-hour LC50 was > 928 µg of CL 312094/L. The no-observed-effect concentration was 242 µg of CL 312094/L. These results indicate that CL 312094 is less toxic to the bluegill than AC 303630 (LC50 = 11 µg/L) under similar test conditions.

Acute Toxicity of CL 312094 to *Daphnia magna*

Report Number: ECO 97-255

The acute toxicity of CL 312094, the major metabolite of AC 303630 that was found in a bluegill sunfish (*Lepomis macrochirus*) bioaccumulation study and a known soil degradate of AC 303630, was evaluated in a 48-hour static exposure toxicity test with *Daphnia magna*. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of 20 daphnids were exposed to either dilution water (no-treatment control), a solvent (DMF) control treatment, or 1 of 5 concentrations of CL 312094. Nominal exposure concentrations for the definitive test were: 130, 220, 360, 600, and 1,000 µg of CL 312094/L.

After 48 hours of exposure, there was 100% survival in both control groups and the three lowest treatment groups (i.e., 130, 220, and 360 µg/L). In the 600 and 1,000 µg/L treatments there was 50 and 0% survival, respectively. The 48-hour EC50 was 560 µg of CL 312094/L, with 95% confidence limits of 360 to 1,000 µg/L. The NOEC was 360 µg/L. These results indicate that CL 312,094 is less toxic to *Daphnia magna* than AC 303630 (LC50 = 6.1 µg/L).

Acute Toxicity of CL 303267 to the Bluegill Sunfish

Report Number: ECO 97-253

The acute toxicity of CL 303267, a known soil degradate of AC 303630, was evaluated in a 96-hour static exposure toxicity test with the bluegill sunfish, *Lepomis macrochirus*. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty bluegill were one of six concentrations of CL 303267 for a period of 96 hours. A no-treatment and solvent (DMF) control group were also included in the test. The nominal exposure concentrations for the definitive test were: 36, 60, 100, 170, 280, and 470 µg of CL 303267/L.

After 96 hours of exposure, there was 100% survival in both control groups and the three lowest treatment groups (i.e., 36, 60, and 100 µg/L). In the 170, 280, and 470 µg/L treatments there was 0% survival. The 96-hour LC50 was 70 µg of CL 303267/L, with 95% confidence limits of 62 to 79 µg/L. The NOEC was 36 µg/L. These results indicate that CL 303267 is less toxic to the bluegill sunfish than AC 303630 (LC50 = 11 µg/L).

Acute Toxicity of CL 303267 to *Daphnia magna*

Report Number: ECO 97-257

The acute toxicity of CL 303267, a known soil degradate of AC 303630, was evaluated in a 48-hour static exposure toxicity test with *Daphnia magna*. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty *Daphnia magna* were one of six concentrations of CL 303267 for a period of 48 hrs. A no-treatment and solvent (DMF) control group were also included in the test. The nominal exposure concentrations for the definitive test were: 44, 59, 79, 105, and 140 µg of CL 303267/ L.

After 48 hours of exposure, there was 100% survival in the no-treatment control and 95% survival in the solvent control group. There was 100% survival in the three lowest treatment groups (i.e., 44, 59, and 79 µg/L). Survival was 55% at 105 µg/L to 0% at 140 µg/L. The 48-hour EC50 was 107 µg of CL 312094/L, with 95% confidence limits of 79 to 140 µg/L. The NOEC was 79 µg/L. These results indicate that CL 303267 is less toxic to *Daphnia magna* than AC 303630 (LC50 = 6.1 µg/L).

Acute Toxicity of CL 325195 to the Bluegill Sunfish

Report Number: ECO 97-254

The acute toxicity of CL 325195, a known soil degradate of AC 303630, was evaluated in a 96-hour static exposure toxicity test with the bluegill sunfish, *Lepomis macrochirus*.

Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. Groups of twenty bluegill were one of five concentrations of CL 325195 for a period of 96 hours. A no-treatment and solvent (DMF) control group were also included in the test. The nominal exposure concentrations for the definitive test were: 1000, 1,700, 2,800, 4,700 and 7,800 µg of CL 325195/L. After 96 hours of exposure, bluegill mortality ranged from 0% at 1,000 µg/L to 100% at 4,700 and 7,800 µg/L. There was 0% mortality in both the no-treatment and solvent controls.

The 96-hour LC50 of CL 325195 to bluegill sunfish was 2,100 µg/L, with 95% confidence limits of 1,800 to 2,400 µg/L. The NOEC was 1,000 µg/L. These results indicate that CL 325195 is less toxic to the bluegill than AC 303630 (LC50 = 11 µg/L).

Acute Toxicity of CL 325195 to *Daphnia magna*

Report Number: ECO 97-256

The acute toxicity of CL 325195, a known soil degradate of AC 303630, was evaluated in a 48-hour static exposure toxicity test with *Daphnia magna*. Dimethylformamide (DMF) was used as a carrier vehicle to introduce the test substance into the dilution water. The nominal exposure concentrations for the definitive test were: 610, 1,000, 1,700, 2,800, and 4,700 µg of CL 325195/L.

After 48 hours of exposure, there was 100% survival in both control groups and the lowest treatment groups (i.e., 610 µg/L). Survival in the remaining treatments ranged from 95% at 1,000 µg/L to 0% at 2,800 and 4,700 µg/L. The 48-hour EC50 was 1,700 µg of CL 312094/L, with 95% confidence limits of 1,500 to 1,900 µg/L. The NOEC was 610 µg/L. These results indicate that CL 325195 is less toxic to *Daphnia magna* than AC 303630 (LC50 = 6.1 µg/L).

## K. Simulated or Actual Field Testing for Aquatic Organisms (72-7)

Pilot Microcosm Study (72-7; 850.1950)

Report Number: ECO 93-149
MRID No. 43492823

The chemical fate and biological effects of the 3SC (Suspension Concentrate) formulation of AC 303630 were evaluated in an outdoor aquatic microcosm system. The test design consisted of five treatments and a control, with a single microcosm tank per treatment. The tanks were seeded with pond sediment and water from a natural pond. The water from the pond contained the natural assemblages or aquatic organisms except for fish. Approximately one month after the systems were established, twenty juvenile bluegill (*Lepomis macrochirus*) were introduced into each tank.

Treatments to the tanks consisted of applications simulating either spray drift, surface runoff or a combination of both. Spray drift simulations were made by mixing the test substance into water and applying the water directly to the tanks with a specially designed applicator. Runoff

simulations were made by mixing the test substance into soil and then applying the soil directly to the tanks after a 24-hour aging period. Nominal treatment concentrations were established based on various theoretical levels of spray drift and runoff after a field application rate of 0.4 lbs of AC 303630 (ai)/acre. The treatments were as follows: 1) 300 µg of ai/L (parts per billion) by direct application (simulating direct overspray of a 6"-deep pond); 2) 30 µg of ai/L by direct application (simulating 10% spray drift to 6"-deep pond); 3) 45 µg of ai/L combination application; 15 µg ai/L by direct application and 30 µg of ai/L by soil application (simulating 5% spray drift and 1% runoff from a 10-acre field into a 6"-deep, 1-acre pond); 4) 30 µg of ai/L by soil application (simulating 1% runoff from a 10-acre filed into a 6"-deep, 1-acre pond); 5) 3.7 µg of ai/L combination application; 1.2 µg of ai/L by direct application and 2.5 µg of ai/L by soil application (simulating 5% spray drift and 1% runoff from a 10-acre field into a 6'-deep, 1-acre pond); and 6) a control which was treated with uncontaminated water and soil. The soil treatments were made 24 hours after the direct applications were made.

The fate of the test substance was evaluated by measuring water and sediment concentrations of AC 303630 during a two-week post-application period. The measured water and sediment concentrations in the various treatments during the two-week post-application period are summarized in the following tables.

**Water Concentrations of AC 303630 (µg/L; ppb)**

| | Time After First Application | | | | | |
|---|---|---|---|---|---|---|
| Treatment | 2 hours | 26 hours | 2 days | 4 days | 8 days | 15 days |
| 300 µg/L (direct) | 221 | 159 | 152 | 113 | 105 | 103 |
| 30 µg/L (direct) | 24 | 20 | 19 | 19 | 16 | 11 |
| 45 µg/L (combination) | 14 | 12 | 13 | 13 | 11 | 10 |
| 30 µg/L (soil) | < 1 | 2.8 | 3.7 | 3.5 | 3.9 | 3.6 |
| 3.7 µg/L (combination) | < 1 | 2.6 | 1.4 | 1.6 | 2.8 | 1.2 |
| Control | < 1 | < 1 | < 1 | < 1 | < 1 | <1 |

**Sediment Concentrations of AC 303630 (µg/Kg; ppb)**

| | Time After First Application | | | | | |
|---|---|---|---|---|---|---|
| Treatment | 2 hours | 26 hours | 2 days | 4 days | 8 days | 15 days |
| 300 µg/L (direct) | <10 | 61.6 | 280 | 488 | 355 | 271 |
| 30 µg/L (direct) | < 10 | 13.7 | 20.9 | 24.1 | 13.2 | 12.9 |
| 45 µg/L (combination) | < 10 | 131 | 61.2 | 72.4 | 67.8 | 201 |
| 30 µg/L (soil) | < 10 | 43.0 | < 10 | 16.5 | 12.2 | 292 |
| 3.7 µg/L (combination) | < 10 | < 10 | 33.2 | < 10 | 24.2 | < 10 |
| Control | < 10 | < 10 | < 10 | < 10 | < 10 | < 10 |

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Biological endpoints that were evaluated included fish survival and abundances of zooplankton, phytoplankton, emergent insects and benthic macroinvertebrates. These endpoints were evaluated during both the pretreatment period and the two-week post-treatment period. During the two-week post-application period, 100% bluegill mortality occurred in the 300 and 30 µg of ai/L direct application treatments. No mortalities were observed in any of the remaining treatments or the control during the two-week post-application period. In the 300 µg of ai/L treatment, 90% of the mortalities occurred within one day of the application, and the remaining fish died within six days post-application. In the 30 µg of ai/L direct application treatment, 80% of the mortalities occurred during the second week of the post-application period. Although no fish died in the 45 µg of ai/L combination treatment during the two-week post-application period, four dead fish (20 %) were found between eighteen and twenty days post-application, while the tank was being drained to retrieve the fish.

When average abundances of zooplankton, phytoplankton, and benthic macroinvertebrates of organisms collected during the final two weeks of the pre-application period were compared with the mean abundances of organisms collected during the two-week post-application period some negative trends were noticeable. For zooplankton, there was a decrease in copepod nauplii in the 300 and 30 µg of ai/L direct application treatments and in the 45 µg of ai/L combination application treatment in comparison to the control populations, while there was a decrease in rotifers and total zooplankton abundance in the 300 µg of ai/L direct application treatment only. In comparison to the controls, there were no effects on cladocerans, copepods or ostracods in any treatment. For phytoplankton, in relation to abundance in the controls, there was no effect on Bacillariophyta, Chlorophyta, Cyanophyta, Euglenophyta or Pyrrophyta in any treatment. In the 300 µg of ai/L treatment, there was a decrease in Cryptophyta in comparison to the controls, while there was an increase in total phytoplankton in the 30 µg of ai direct application treatment in comparison to the controls. The increase in total phytoplankton in this treatment was due to the appearance of an unknown unicellular flagellate during the post-treatment phase. For benthic macroinvertebrates, there was a decrease in total insects in all treatments in relation to control abundance, while nematode abundance decreased in the 300 and 30 µg of ai/L direct application treatments and in the 3.7 µg of ai/L combination application treatment. In comparison to control abundance, annelids were not affected in any treatment. The abundance of emergent insects was low throughout the pre- and post-treatment periods in all tanks. Therefore, treatment related effects on emergent insects could not be evaluated.

In summary, residue analysis during the test indicated that water residues were higher when applications simulated spray drift rather than runoff. Regardless of how the test substance was applied, AC 303630 did concentrate in the sediment and did not degrade significantly during the two-week post-application period. Bluegill survival was affected in those treatments receiving direct applications > 30 µg of ai/L. However, bluegill survival was unaffected in the 30 µg of ai/L soil treatment, indicating that spray drift of AC 303630 3SC is potentially more hazardous to fish than surface runoff of the compound. Of the zooplankton, copepod nauplii appeared to be the most sensitive, with a decrease in abundance observed in the 300 and 30 µg of ai/L direct application treatments and the 45 µg of ai/L combination application treatment. Epibenthic insects appeared to be the most sensitive group of organisms because their abundances decreased in all treatments in relation to the controls.

# Appendix 5. Summary of the Geographic Information System (GIS) Study to Support the Evaluation of Chlorfenapyr

## EXECUTIVE SUMMARY

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| Report Number: | ECO 94-159 | Study Initiation Date: | 94JUL26 |
| Type of Report: | Final | Experimental Start Date: | 94JUL26 |
| Type of Study | Geographical Information System | Experimental Termination Date: | 96OCT15 |
| Study Number: | 954-94-159 | Study Completion Date: | 97DEC15 |
| Reported By: | J. Gagne<br>R. Troup<br>C. Crabtree<br>S. Kay<br>R. Pearson<br>E. Hendriksen<br>C. Holmes | Report Issue Date: | 97DEC15 |

This study was designed to quantify environmental parameters associated with cotton production that might influence the exposure of sensitive habitats (avian and aquatic) to an insecticide for the control of lepidopterous pests in cotton. The results of this study are intended to be interpreted in conjunction with other laboratory and field studies towards refining the ecological risk assessment for this insecticide. This was accomplished through the analysis of Land-Use/Land-Cover (LU/LC) classifications derived from satellite imagery, high resolution aerial imagery/photography and other digital data sets describing hydrology, elevation and soils for 15 study sites across the cotton belt using remote sensing techniques and Geographic Information Systems (GIS). Remote sensing sources selected for this study included satellite derived data (10 and 20 meter resolution) to identify land features (cotton, water, and avian habitats) and aerial imagery (2 m resolution) acquired over a statistically representative subset of the water bodies in order to characterize the physical buffers surrounding water bodies.

A. Key elements of the study site selection process:

- The study site selection process was designed to; 1) identify regions of similar cotton production characteristics within the conterminous United States; 2) identify regions of similar environmental characteristics within the cotton production regions, and; 3) identify study areas that are homogeneous based on the above parameters.
- The study site selection resulting in identifying 20 study sites across the cotton belt, of which 15 were analyzed. The 15 study sites represented cotton production in the following states: California (CA-1), Arizona (AZ-1 and AZ-2), Texas (TX-1, TX-4, TX-6, and TX-7), Oklahoma (OK-1), Louisiana (LA-1 and LA-2), Mississippi (MS-1), Tennessee (TN-1), Alabama (AL-1), Georgia (GA-1), and South Carolina (SC-2).

B. Key findings resulting from the Land Use/Land Cover (LU/LC) classification from the satellite imagery of each study site:

- Cotton was identified in each study site by using the spectral information in the satellite imagery for known cotton fields (from ground data) and then identifying all other fields as either cotton or other agriculture based on the spectral information. Cotton

composition for each study site ranged from 2% of the study site for TX-4, LA-1, and AL-1 to 29% for TN-1.

- Water that was identified from the satellite imagery was assigned to different water types using Digital Line Graph (DLG) data available from USGS. The types of aquatic habitats identified in the classification included lakes/ponds, rivers/streams, wetlands, intermittent streams, canals/ditches, mud flats, and bays. Mud flats and bays were only found along the south Texas coast. In general, the predominant aquatic habitat type for each study site went from canals/ditches in the desert southwest to lakes/ponds in the central U.S. then to wetlands in the southeast.
- Static water bodies (lakes/ponds) were divided into 6 classes based on water body surface area. The number and acreage of static water bodies in each size class was then totaled for each size class. For all study sites, the smallest size class (0.25 – 1.0 acres) accounted for the highest number of water bodies, however, the largest size class (> 25.0 acres) accounted for the greatest acres of static water bodies.

C. Key findings resulting from the analysis of cotton field size, slopes, and soils:

- Once the cotton was identified in the satellite imagery, field boundaries were delineated around each cotton field to allow for quantification of the number and size of each cotton field. In general the cotton field sizes decreased from the west to the east with an average size of 259 acres in California to an average of 13 acres in South Carolina;
- Following cotton field boundary delineation, Digital Elevation Model (DEM) data available from the USGS was overlaid on the cotton fields to determine the slopes on which cotton fields were grown. At least 96% of the cotton acreage for all study sites was grown on slopes of 2% or less, with the exception of Alabama (78%), Tennessee (90%), and one study site in Texas (88%);
- Soil associations from the STATSGO soil database available from the Soil Conservation Service (SCS) were also overlaid onto the cotton field boundaries to determine which soil associations were associated with cotton production in each study site. Soils associations are highly variable across the cotton belt.

D. Key findings resulting from the analysis of land covers that are adjacent (within 10 and 50 meters) to cotton:

- The Geographic Information System (GIS) was used to create two adjacency zones around cotton that included the area within 10 meters and 50 meters of cotton. Other agriculture was the land cover most likely to be found within 10 meters of cotton for 10 of the 15 study sites. For 4 of the other 5 sites (TX-4, OK-1, GA-1, and SC-2) grass/pasture was most likely found within 10 meters of cotton, and for AL-1, forest predominated. The results were similar for the 50 meter adjacency zone.
- For all study sites, avian habitats in the 10 meter adjacency zone around cotton accounted for < 1% to 4% of the total avian habitat acreage in each study site. These percentages rose only slightly (1 to 2 percentage points) in the 50 meter adjacency zone in the desert southwest and Texas study sites, but increased by up to 10 to 15 percentage points in some study sites in the southeast.

E. Key findings resulting from the analysis of how much cotton is adjacent (within 10 and 50 meters) to aquatic habitats:

- The GIS was used to create two adjacency zones around the waters in each water body type that included the area within 10 meters and 50 meters of the water body types. For static water bodies (lakes/ponds), 4 of the study sites (AZ-1, AZ-2, TX-1, and TX-4) had no cotton within 10 meters of any static water body. A number of study sites (TX-7, LA-1, MS-1, AL-1, and SC-2) had some cotton adjacent to static water bodies but the cotton accounted for 1% or less of the adjacency zone acreages. The study site with the most cotton within 10 meters of static water bodies was TX-6 (1% to 18% of the adjacency zone acreage, depending on size class). In general, the percentage of the 50 meter adjacency zone composed of cotton rose slightly (0 to 4 percentage points) for each static water size class in all study sites.
- For rivers/streams, the study sites with the highest percentage of the 10 meter adjacency zone in cotton were TX-6 and TN-1 with 10% and 14%, respectively. All other study sites had 10 meter adjacency zones that were composed of 4% cotton or less. In general, the percentage of the 50 meter adjacency zone composed of cotton rose slightly (0 to 4 percentage points) for rivers/streams in all study sites.
- For intermittent streams, cotton compositions of the 10 meter and 50 meter adjacency zones were highly variable (0% to 28% within 10 meters and 0% to 34% within 50 meters) and regional trends were not obvious.
- For canals, cotton compositions of the 10 meter and 50 meter adjacency zones were generally higher in the desert southwest and central U.S. than for the southeast, primarily because of their dependence on irrigation.
- For wetlands, none of the desert southwest or central U.S. study sites had cotton within either 10 meters or 50 meters of wetlands. The cotton composition of the 10 meter adjacency zones around wetlands in the southeast ranged from < 1% to 6%. These percentages rose only slightly (0 to 2 percentage points) in the 50 meter adjacency zone.
- For all study sites and for each type of water body, cotton in the 10 meter adjacency zone accounted for 1% or less of the total cotton production in each study site, with the exception of canals in TX-1 (2%). These percentages rose only slightly (0 to 4 percentage points) in the 50 meter adjacency zone for all sites.

F. Key findings resulting from the analysis of how much cotton is adjacent (within 10 and 50 meters) to avian habitats:

- The GIS was used to create two adjacency zones around avian habitats that included the area within 10 meters and 50 meters of all terrestrial avian habitats. The cotton composition of the 10 meter and 50 meter adjacency zones around avian habitats were highly variable (< 1% to 24% within 10 meters and 2% to 40% within 50 meters) and regional trends were not obvious.

G. Key findings resulting from a detailed analysis of buffer composition and width:

- Analysis using high resolution aerial imagery was conducted on a statistically representative subset of ponds to provide more detailed information describing the composition of the physical buffers present between agriculture and water bodies. The

average widths of the buffers were generally lower for the desert southwest study site (4.1 to 9.0 meters) than for the remaining study sites (11.0 to 24.1 meters)

- The composition of the buffers also varied regionally. In the desert southwest, buffers were primarily composed of roads or bare ground. The primary buffer component changes to tall dense vegetation in the southeast.

H. Key findings resulting from an analysis of the presence of threatened/endangered avian and aquatic species in each study site:

- There were a number of instances in which there were documented locations of threatened/endangered species in the study sites, however, only one of those species (snowy plover, *Charadrius alexandrinus*) was documented in one study site (CA-1) to occur within 50 meters of cotton.