



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

MAR 27 1992

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: Conditional Registration of Amitraz on cotton.

FROM: Douglas Urban, Acting Branch Chief
Ecological Effects Branch
Environmental Fate and Effects Division

TO: Dennis Edwards, PM 19
Insecticide-Rodenticide Branch
Registration Division

The registrant, NOR-AM Chemical Company, is seeking a conditional registration for the use of the insecticide, Amitraz (OVASYN), on cotton. The Ecological Effects Branch has reviewed the proposed conditional registration and concludes that there is not enough information to complete a risk assessment (see Section 101.4 of attached review). However, existing information indicates that the proposed use of Amitraz may result in potential risk to nontarget species (particularly aquatic).

In order to further explore the fate and estimated environmental concentrations of Amitraz in aquatic systems, the EEB is requesting the Environmental Fate and Ground Water Branch to run a computer model on cotton for both parent Amitraz and the degradates BTS 27271 and 27919. In addition, the EEB requests a preliminary report on the feeding regime being used in the current avian reproduction studies with parent Amitraz. A complete risk assessment cannot be performed without this information.

After personal communication with the EFGWB, the EEB concurs with NOR-AM's response supporting the toxicological equivalency of BTS 27271 and BTS 27271-HCl. Therefore, studies conducted with the degradate BTS 27271-HCl (MRID Nos. 418272-02, 418272-03, and 418272-04) are now upgradeable from supplemental to core.

If you have any questions, please contact Tracy Perry at 305-6451 or Henry Craven at 305-5320.



DP BARCODE: D172557

CASE: 193369
SUBMISSION: S408863

DATA PACKAGE RECORD
BEAN SHEET

DATE: 12/23/91
Page 1 of 1

* * * CASE/SUBMISSION INFORMATION * * *

CASE TYPE: REGISTRATION ACTION: 180 NEW PROD-OC-NEW F/F USE
CHEMICALS: 106201 Amitraz (N'-(2,4-dimethylphenyl)-N-(((2,4-dimethyl 19.8000%

ID#: 045639-RUA Ovasyn

COMPANY: 045639 NOR-AM CHEMICAL COMPANY

PRODUCT MANAGER: 19 DENNIS JR EDWARDS

703-305-6386 ROOM: CM2 207

PM TEAM REVIEWER: MEREDITH JOHNSON

703-305-7080 ROOM: CM2 201

RECEIVED DATE: 12/10/91

DUE OUT DATE: 06/17/92

* * * DATA PACKAGE INFORMATION * * *

DP BARCODE: 172557 EXPEDITE: Y DATE SENT: 12/23/91 DATE RET.: / /
CHEMICAL: 106201 Amitraz (N'-(2,4-dimethylphenyl)-N-(((2,4-dimethylphenyl)im

DP TYPE: 001 Submission Related Data Package

ADMIN DUE DATE: 04/21/92

CSF: N

LABEL: N

ASSIGNED TO	DATE IN	DATE OUT
DIV : EFED	12/24/91	03/26/92
BRAN: EEB	/ /	/ /
SECT:	/ /	/ /
REVR :	/ /	/ /
CONTR:	/ /	/ /

* * * DATA REVIEW INSTRUCTIONS * * *

The 15 volumes associated with this data package have been submitted to support a conditional registration for amitraz ("Ovasyn") on cotton. Volume no. "2" contains the request and justification for the conditional registration, volume no. "21" is a summary and discussion of the environmental fate and ecological impact following an application of Ovasyn to cotton, and the other 13 volumes contain studies conducted with the amitraz metabolites. The review of this data package is requested as an expedite. If you have any questions, please contact me at 305-7080 (Meredith Johnson).

* * * ADDITIONAL DATA PACKAGES FOR THIS SUBMISSION * * *

DP BC	BRANCH/SECTION	DATE OUT	DUE BACK	INS	CSF	LABEL
D172559	EF6WB					

ECOLOGICAL EFFECTS BRANCH REVIEW

AMITRAZ (OVASYN)

100.0 Submission Purpose and Label Information

100.1 Submission Purpose and Pesticide Use

The registrant, NOR-AM Chemical Company, is seeking a conditional registration for the use of Amitraz (OVASYN) on cotton. OVASYN is an insecticide/miticide with ovicidal and synergistic activity on a variety of insect pests. Twelve new studies conducted with Amitraz degradates (BTS 27271, BTS 27919) were included with this submission and reviewed by EEB (see attached DER's).

100.2 Formulation Information

Active Ingredient:

Amitraz (N'-(2,4-dimethylphenyl)-N-[[(2,4-dimethylphenyl) imino]methyl]-N-methylmethanimidamide).....19.8%

InertIngredients:.....80.2%

Contains 1.5 lb. Amitraz per gallon.

100.3 Application Methods, Directions, and Rates (from proposed label)

Equipment:

Apply OVASYN by air or ground, using low drift nozzles. When applying by air, use 1-5 gallons of water per acre. For applications made with ground equipment, use 10-50 gallons of water per acre. Use of the higher volume of water will assure better coverage for mite and whitefly control in larger, more dense cotton.

Mite Control:

Apply OVASYN as a single treatment of 2 2/3 to 5 pints per acre, or two sequential applications of 2 2/3 pints per acre. DO NOT exceed 5 1/3 pints per acre per season. Treatments should be applied when mite populations begin to build. OVASYN may be applied from the time cotton plants are 4-6 inches tall and up until boll opening. DO NOT apply after cotton bolls are open.

Insect Control (Ovicide/Synergist):

In fields where bollworm, tobacco budworm, pink bollworm or other insect pests have reached economic levels, apply OVASYN at 2/3 to 1 1/3 pints per acre as needed or on an appropriate

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schedule. To control whitefly, apply 1 1/3 to 5 1/3 pints per acre in sufficient water to ensure complete coverage. DO NOT exceed 5 1/3 pints per acre per season. DO NOT apply after cotton bolls are open.

100.4 Target Organisms

Target organisms include the following: bollworm, tobacco budworm, pink bollworm, whitefly and mites (two-spotted spider mite, strawberry mite, pacific mite, and carmine mite).

100.5 Precautionary Labeling:

Environmental Hazards

This product is toxic to fish. Do not apply directly to water. Drift and runoff from treated areas may be hazardous to fish in adjacent sites. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters. Apply this pesticide only as specified on this label. Do not apply this product through any type of irrigation system.

Beneficial Insect Cautions

OVASYN has a broad spectrum acaricidal activity and is largely nonselective to predacious mites such as *Typhlodromus occidentalis*, *Amblyseius fallacis* and mites of the family Stigmaeidae.

101.0 Hazard Assessment

101.1 Discussion

OVASYN, an EC formulation containing the active ingredient Amitraz, is an insecticide/miticide engaging ovicidal and synergistic activity on a variety of pests. The registrant is seeking a conditional registration (restricted use) for the use of OVASYN on cotton; an estimated 10,407,200 acres of cotton were planted in 1987 (Census of Agriculture, 1987). During the past five years, OVASYN has been experimented with, under EUP conditions, on a total of 20,000 acres of cotton. OVASYN has also been shown to improve the activity of a number of cotton insecticides (i.e. pyrethroid, BT, organophosphate and carbamate).

Amitraz is currently registered for use on pears (to control pear psylla) and cattle and swine (to control ectoparasites). Under the terms of this conditional registration, the registrant has proposed to "monitor residues in various environmental matrices" to support the conclusion that the use of OVASYN will not result in unreasonable adverse effects to

the environment (a draft residue monitoring protocol has been submitted to the Agency).

As parent Amitraz is very unstable in both terrestrial and aquatic ecosystems, testing with the two major degradates (BTS 27271 and BTS 27919) was requested.

Environmental Fate (see Attachment A)

Amitraz breaks down from the parent compound into two major degradates: BTS 27271 and BTS 27919. This process occurs rapidly with a half-life in aerobic soils of less than one day and a soil photolytic half-life of less than 30 minutes. The degradates are more persistent and relatively mobile in the top 12 inches of the soil surface. Aerobic laboratory soil studies indicate half-lives of 75 days for BTS 27271 and 89 days for BTS 27919.

Hydrolytic half-life values of Amitraz technical at pH 5, 7, and 9 were 2.1, 22.1 and 25.5 hours respectively. Aqueous photolytic half-life was approximately 7 hours. Hydrolytic half-lives of the two major degradates at the same pH's are much longer: BTS 27271 - 2800 days, 14 days, 5.1 days; BTS 27919 - 2.28×10^3 days, 1.45×10^4 days, 496 days.

The parent compound appears to bioaccumulate from 280x to 2118x in various fish tissues. Due to the rapid breakdown of parent Amitraz, bioaccumulation of this compound in a field situation is unlikely. Bioaccumulation of Amitraz degradates is also unlikely due to their relatively low octanol/water partition coefficients (BTS 27271 $K_{ow} = 0.1472$, BTS 27919 $K_{ow} = 43.1$).

101.2 Likelihood of Adverse Effects to Nontarget Organisms

A. Terrestrial Organisms

1. Avian Toxicity

a) Technical Amitraz

Technical Amitraz is slightly toxic to bobwhite quail on an acute oral basis ($LD_{50}=788$ mg/kg). On a subacute dietary basis, Amitraz is practically non-toxic to mallards ($LC_{50}=7000$ ppm) and slightly toxic to bobwhite quail ($LC_{50}=3081$ ppm).

Supplemental avian reproduction studies (bobwhite and mallard) using Amitraz suggest that the NOEL is <40 ppm (a repeat study may show the NOEL to be well below this number).

b) Amitraz Degradates

BTS 27271-HCl is moderately toxic to bobwhite quail on an acute oral basis (LD_{50} =71 mg/kg). On a subacute dietary basis, BTS 27271-HCl is slightly toxic to the bobwhite quail (LC_{50} =1,276 ppm) and practically non-toxic to the mallard (LC_{50} >5,200 ppm).

BTS 27919 is slightly toxic to bobwhite quail on an acute oral basis (LD_{50} = 1,827 mg/kg). On a subacute dietary basis, BTS 27919 is practically non-toxic to mallard and bobwhite quail (LC_{50} >5,200 ppm).

2. Mammalian Toxicity

Technical Amitraz is considered moderately toxic to rats (LD_{50} =200-400 mg/kg), guinea pigs, rabbits and dogs and slightly toxic to mice on an acute oral basis. A 2-year rat feeding study established a NOEL of 50 ppm and a 3-generation rat reproduction study found a NOEL of 15 ppm.

Data from EEB's files indicate that the degradate BTS 27271 is more toxic on an acute oral basis to mice, guinea pigs and dogs than is the parent compound. BTS 27271 is considered moderately toxic to mice, rats, and guinea pigs and highly toxic to dogs. The other major degradate (BTS 27919) has a limited toxicity data base, but indications are that it is similar in toxicity to that of the parent compound.

3. Terrestrial Organism Exposure

According to Gusey and Maturgo (1973), a variety of avian and mammalian organisms use cotton fields for feeding, cover and brooding. These organisms include both nongame and game species: bobwhite quail, wild turkey, ring-necked pheasant, mourning dove, ducks, geese, sandhill crane, songbirds, prairie chicken, deer, rabbit, raccoon, opossum and antelope.

At the maximum label rate of 1.0 lbs a.i./A, the following maximum residue levels would be expected immediately after application:

<u>Substrate</u>	<u>Residue (ppm)</u>
short range grass	240
long grass	110
leaves and leafy crops	125
forage (alfalfa and clover)	58

pod containing seeds
fruit

12
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Technical Amitraz does not appear to be a problem in terms of acute toxicity to non-endangered avian and mammalian species as the restricted use classification ($EEC > 1/5 LC_{50}$) is not triggered. Potential adverse effects to endangered (birds) and mammals feeding on short range grass may be expected as the EEC for this substrate exceeds $1/10 LC_{50}$. However, due to the rapid breakdown of parent Amitraz on soil (aerobic soil metabolism $t_{1/2} < 1$ day), potential adverse effects to nontarget terrestrial organisms is expected to be minimal.

The degradate, BTS 27271, however, may be a potential hazard to avian species (both endangered and non-endangered) as it is relatively persistent in the environment (aerobic soil metabolism $t_{1/2} = 75$ days). Using the hazard ratio of the number of single dose oral LD_{50} per day (see Attachment B), a 1.0 lb a.i./A application results in $0.28 LD_{50}$ per day (19.88 mg/kg/day). This value exceeds the restricted use trigger (mg/kg/day $> 1/5 LD_{50}$) and therefore indicates risk. An application rate of 0.50 lb a.i./A would reduce the risk to non-endangered avian species as the restricted use trigger is not exceeded; risk to endangered avian species, however, would still remain.

In terms of chronic effects to nontarget birds and mammals, the EEC's on most substrates exceed the NOEL (no-observed-effect-level) of < 40 ppm in a supplemental avian reproduction study and the NOEL of 15 ppm in a 3-generation rat reproduction study. No data on chronic toxicity of Amitraz degradates to avian and mammalian species exists. However, since the degradate BTS 27271 appears to be more toxic than the parent compound, the reproductive NOEL's may be even lower than these figures. In addition, this degradate is very persistent in the environment, thus increasing risk of chronic effects.

B. Aquatic Organism Toxicity

1. Freshwater Organisms

a) Technical Amitraz

Technical Amitraz is highly toxic to the rainbow trout ($LC_{50}=0.74$ ppm) and the bluegill sunfish ($LC_{50}=0.34$ ppm) and very highly toxic to *Daphnia magna* ($EC_{50}=0.035$ ppm).

In a 21-day life-cycle study, technical Amitraz was found to adversely affect *Daphnia* length and reproduction at 2.21 ppb (LOEC). The NOEC for this study was determined to be 1.10

ppb. In a fish early life-cycle study, technical Amitraz was found to adversely affect larval growth of fathead minnows at 2.71 ppb (LOEC). The NOEC for this study was 1.48 ppb.

2) Amitraz Degradates

BTS 27271-HCl is slightly toxic to the rainbow trout (LC_{50} = 28.36 ppm) and the bluegill sunfish (LC_{50} = 29.33 ppm) and moderately toxic to Daphnia (EC_{50} = 2.59 ppm).

BTS 27919 is practically non-toxic to the bluegill sunfish (LC_{50} > 100 ppm) and Daphnia (EC_{50} > 100 ppm) and slightly toxic to the rainbow trout (LC_{50} = 66.23 ppm).

No chronic studies with Amitraz degradates have been submitted.

3) 20% Formulation

Technical Amitraz in a 20% EC formulation appears to be less toxic to aquatic organisms than Amitraz itself. Amitraz as a 20% EC formulation is moderately toxic to rainbow trout (LC_{50} =2.2ppm a.i.), bluegill sunfish (LC_{50} =3.14 ppm a.i.) and Daphnia (EC_{50} =3.38 ppm a.i.).

C. Estuarine Organisms

a) Technical Amitraz

Technical Amitraz is slightly toxic to the grass shrimp (96-hour LC_{50} =65.1 ppm) and practically non-toxic to fiddler crabs (96-hour LC_{50} >1000 ppm). No chronic studies with technical Amitraz have been submitted.

b) Amitraz Degradates

BTS 27271-HCl is slightly toxic to the sheepshead minnow (LC_{50} = 11.5 ppm) and the eastern oyster (LC_{50} =13.1 ppm) and moderately toxic to the mysid shrimp (LC_{50} = 5.81 ppm).

BTS 27919 is slightly toxic to the mysid shrimp (LC_{50} = 25.2 ppm) and practically non-toxic to the sheepshead minnow (LC_{50} > 102 ppm). No chronic studies with Amitraz degradates have been submitted.

c) 20% Formulation

Amitraz as a 20% EC formulation is moderately toxic to the sheepshead minnow (LC_{50} =7.9 ppm a.i.), highly toxic to the mysid shrimp (LC_{50} =0.48 ppm a.i.) and very highly toxic to the

eastern oyster ($EC_{50}=0.085$ ppm a.i.).

3. Aquatic Organism Exposure

To assess potential hazard to aquatic organisms, aquatic EEC's were calculated from runoff and drift originating from a 10 acre cotton field and emptying into a 6 foot, 1 acre pond (Attachment C). An application rate of 1 lb a.i./A would produce an EEC of 10.4 ppb, which exceeds the NOEL's found in the chronic daphnia (1.1 ppb) and fish early-life stage (1.48 ppb) studies. An application rate of 0.25 lb a.i./A would result in an EEC of 2.6 ppb. Although this value still exceeds the above mentioned NOEL's, the risk of adverse effects to aquatic organisms would be reduced.

Although it appears that Amitraz degradates are of low acute toxicity to aquatic organisms, chronic effects of these degradates are not known. These degradates raise a concern, however, as they are persistent in aquatic habitats for greater than 4 days.

D. Beneficial Insects

Amitraz demonstrates low toxicity from direct contact to honey bees (*Apis sp.*) and ladybird beetles (*Stethorus punctum*). It is not known what effects amitraz may have on the life cycle of beneficial insect species. Potential adverse effects may be expected, however, as amitraz is an ovicide.

101.3 Endangered Species Considerations

According to EEB's Endangered Species files, a large number of endangered species, including birds, mammals, molluscs, reptiles and insects, are found in counties where cotton is produced. The proposed use of Amitraz on cotton may result in hazard to some of these species. Pending the results of additional toxicity and fate information, an OES opinion may be pursued.

101.4 Adequacy of Toxicity Data

Technical Amitraz

The following data requirement with technical grade Amitraz is still outstanding:

71-4 Avian reproduction with the bobwhite quail and mallard. In addition, a preliminary report on the feeding regime used in these studies is requested.

Amitraz Degradates

Pending the evaluation of environmental fate modeling data, the following studies are reserved for both degradates BTS 27271 and BTS 27919:

- 72-4 Freshwater Invertebrate Life-Cycle with *Daphnia magna*.
- 71-4 Avian Reproduction (mallard and bobwhite quail).
- 72-4 Freshwater fish early life-stage (rainbow trout).
- 72-4 Estuarine fish early life-stage (sheepshead minnow)
- 72-4 Estuarine invertebrate life-cycle (mysid shrimp).
- 72-5 Fish full life-cycle.
- 165-5 Aquatic Organism Accumulation.

The following studies with the degradates BTS 27271 and/or BTS 27919 need to be repeated (see attached DER's):

- 72-3 Acute EC₅₀ estuarine - eastern mollusc (BTS 27919, 27271)
- 72-3 Acute EC₅₀ estuarine - mysid shrimp (BTS 27919)

The following studies are repairable to core upon receipt of test diet analyses:

- 71-2 Avian Dietary LC₅₀ - mallard and bobwhite (BTS 27271 and 27919).

The following field testing with the formulated product (20% EC) may be required depending on the results of the above studies and environmental fate modeling data:

- 71-5 Simulated or actual field testing -- mammals and birds.
- 72-7 Simulated or actual field testing -- aquatic organisms.

101.5 Adequacy of Labeling

The following environmental hazard labeling should be required: This pesticide is toxic to fish and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal zones below the mean high water mark. Drift and runoff may be hazardous to organisms in adjacent aquatic sites. Do not contaminate water when disposing of equipment washwaters or rinsate.

103 Conclusions

EEB has reviewed the proposed conditional registration for the use of OVASYN to control insect pests in cotton. Due to insufficient information (see Section 101.4), EEB concludes that a risk assessment cannot be completed at this time. However, existing information indicates that the proposed use of Amitraz may result in hazard to nontarget organisms (particularly aquatic).

In order to further explore the fate and estimated environmental concentrations of Amitraz in aquatic systems, EEB is requesting EFGWB to run a computer model on cotton for both parent Amitraz and the degradate BTS 27271 and BTS 27919. In addition, EEB requests a preliminary report on the feeding regime being used in the current avian reproduction studies with parent Amitraz. EEB cannot perform a complete risk assessment without this information.

Tracy L. Perry, Wildlife Biologist
Ecological Effects Branch
Environmental Fate and Effects Division (H7507C)

Tracy L. Perry 3/13/92

Henry T. Craven, Head, Section IV
Ecological Effects Branch
Environmental Fate and Effects Division (H7507C)

Henry T. Craven 3/13/92

Douglas Urban, Acting Branch Chief
Ecological Effects Branch
Environmental Fate and Effects Division (H7507C)

Douglas Urban 3/25/92

Study	Amitraz	Results With BTS 27271	BTS 27919	Report References ^a
1.3 Water Solubility	0.094 mg/l	99.2 g/l ⁽¹⁾	680 mg/l	C142, C278, C262
1.4 Octanol/H ₂ O Partition Coefficient (K_{ow})	3×10^5	0.1472 ⁽¹⁾	43.1	C141, C279, C265
1.5 Log K_{ow}	5.5	-0.83 ⁽¹⁾	1.63	C141, C279, C265
1.6 pK_a	4.2	9.3	14.1	C182, C280, C261
1.7 Hydrolysis Half Life	pH5 2.1 Hours pH7 22.1 Hours pH9 25.5 Hours	2800 Days 14 Days 5.1 Hours	2.28×10^3 Days 1.45×10^4 Days 496 Days	W89, W65, W66
1.8 Aerobic Laboratory Soil Half-Life	$T_{1/2} = 7$ Hours	$T_{1/2} = 75$ Days	$T_{1/2} = 89$ Days	Data Derived from W5-2 nd Edition
1.9 Field Soil Half-Life	$T_{1/2} < 1$ Day	$T_{1/2} = 50$ Days	$T_{1/2} = 41$ Days	W115
1.10 Sediment/Water Microcosm Half-Life	DT ₅₀ - Water: 1.7 - 3.4 Hours	3.3 - 7.0 Days	9 - 20 Days	W150
	DT ₅₀ - Whole Microcosm: 3.4 - 6 Hours	6.1 - 7.7 Days	10 - 21 Days	

⁽¹⁾Since BTS 27271 has a pK_a of 9.3 it will exist predominantly as a cation under normal environmental conditions (i.e., $pH < 9$). The values quoted for the physicochemical properties are derived at pH values close to neutrality.

"Report References" refer to NOR-AM Report Numbers and are cross-referenced to MRID Numbers in Appendix V.

ATTACHMENT B

Number of Single Dose Oral LD₅₀ per Day

Kilograms Consumed = Daily Kilograms body Weight x Percent body weight consumed daily (decimal)

Milligrams of Toxicant per Day = Application rate (lbs a.i./A) x Expected Dietary Residues (ppm) x Kilograms Consumed Daily x 10⁶ mg/kg

Single Dose Oral LD₅₀ = per Day =
$$\frac{\text{Milligrams of toxicant per Day}}{\text{LD}_{50} \text{ milligrams per kg} \times \text{kilograms body weight}}$$

Assumptions

Species: Carolina Wren

Body Weight: 0.019 kg

Kg consumed daily: 0.00653

LD₅₀ = 71 mg/kg (BTS 27271 - Bobwhite Quail)

Expected Dietary Residues at 1 lb a.i./A: 58 ppm (insects)

A 1 lb a.i./A application of Amitraz yields a maximum of 1 lb a.i./A of BTS 27271

1) 1 lb a.i./A application

$$58 \text{ ppm} \times 0.00653 \text{ kg} \times 10^6 \text{ mg/kg} = 0.379 \text{ mg of toxicant/day}$$

$$\frac{0.379 \text{ mg}}{71 \text{ mg/kg} \times 0.019 \text{ kg}} = 0.28 \text{ LD}_{50}/\text{day}$$

2) 0.50 lb a.i./A application

$$29 \text{ ppm} \times 0.00653 \text{ kg} \times 10^6 \text{ mg/kg} = 0.189 \text{ mg toxicant/day}$$

$$\frac{0.189 \text{ mg}}{71 \text{ mg/kg} \times 0.019 \text{ kg}} = 0.14 \text{ LD}_{50}/\text{day}$$

ATTACHMENT C

AQUATIC EEC CALCULATION SHEET

1) For aerial application of Amitraz at a rate of 1.0 lb a.i./A to cotton fields:

A. Runoff

$$\begin{array}{ccccccc} \underline{1.0} \text{ lb} & \times & 0.6 & \times & 0.02 & \times & 10 \text{ (A)} & = & \underline{0.12} \text{ lb} \\ & & \text{APPLICATOR} & & 2\% \text{ RUNOFF} & & 10\text{A DRAINAGE} & & \text{TOTAL} \\ & & \text{EFFICIENCY} & & & & \text{BASIN} & & \text{RUNOFF} \end{array}$$

B. Drift

$$\begin{array}{ccc} \underline{1.0} \text{ lb} & \times & 0.05 \\ & & 5\% \text{ DRIFT} \end{array} = \begin{array}{c} \underline{0.05} \text{ lb} \\ \text{TOTAL DRIFT} \end{array}$$

$$\text{Total Loading} = \underline{0.12} \text{ lb} + \underline{0.05} \text{ lb} = \underline{0.17} \text{ lb}$$

$$\text{Therefore, EEC} = 61 \text{ ppb} \times \underline{0.17} \text{ lb} = \underline{10.4} \text{ ppb (6' depth)}$$

2) For aerial application of Amitraz at a rate of 0.25 lb a.i./A to cotton fields:

A. Runoff

$$\begin{array}{ccccccc} \underline{0.25} \text{ lb} & \times & 0.6 & \times & 0.02 & \times & 10 \text{ (A)} & = & \underline{0.03} \text{ lb} \\ & & \text{APPLICATOR} & & 2\% \text{ RUNOFF} & & 10\text{A DRAINAGE} & & \text{TOTAL} \\ & & \text{EFFICIENCY} & & & & \text{BASIN} & & \text{RUNOFF} \end{array}$$

B. Drift

$$\begin{array}{ccc} \underline{0.25} \text{ lb} & \times & 0.05 \\ & & 5\% \text{ DRIFT} \end{array} = \begin{array}{c} \underline{0.0125} \text{ lb} \\ \text{TOTAL DRIFT} \end{array}$$

$$\text{Total Loading} = \underline{0.03} \text{ lb} + \underline{0.0125} \text{ lb} = \underline{0.0425} \text{ lb}$$

$$\text{Therefore, EEC} = 61 \text{ ppb} \times \underline{0.0425} \text{ lb} = \underline{2.6} \text{ ppb (6' depth)}$$