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To: Joanne Miller
 Product Manager 23
 Registration Division H7505C

From: Anthony F. Maciorowski, Chief
 Ecological Effects Branch/EFED (H7507C)

Attached, please find the EEB review of...

Reg./File # : S397204, S410345, S411447, S410349
 Chemical Name : Fenoxaprop-ethyl
 Type Product : Herbicide
 Product Name : Bugle, Tiller EC
 Company Name : Hoechst Celanese Corp
 Purpose : Review application to register under section
3 for aerial application for cotton, peanut, wheat,
set-asides

Action Code : 161, 320 Date Due : _____
 Reviewer : Mike Davy Date In EEB: 2/12/92

EEB Guideline/MRID Summary Table: The review in this package contains an evaluation of the following:

GDLN NO	MRID NO	CAT	GDLN NO	MRID NO	CAT	GDLN NO	MRID NO	CAT
71-1(A)			72-2(A)			72-7(A)		
71-1(B)			72-2(B)			72-7(B)		
71-2(A)			72-3(A)			122-1(A)		
71-2(B)			72-3(B)			122-1(B)		
71-3			72-3(C)			122-2		
71-4(A)			72-3(D)			123-1(A)		
71-4(B)			72-3(E)			123-1(B)		
71-5(A)			72-3(F)			123-2		
71-5(B)			72-4(A)			124-1		
72-1(A)			72-4(B)			124-2		
72-1(B)			72-5			141-1		
72-1(C)			72-6			141-2		
72-1(D)						141-5		

Y=Acceptable (Study satisfied Guideline)/Concur
 P=Partial (Study partially fulfilled Guideline but additional information is needed)
 S=Supplemental (Study provided useful information but Guideline was not satisfied)
 N=Unacceptable (Study was rejected)/Nonconcur

EEB Review

Chemical: Bugle and Tiller EC (Fenoxaprop-ethyl) Herbicides

100 Submission Purpose and Label Information

100.1 Submission Purpose and Pesticide Use

Hoechst Celanese is proposing to register for section 3 Fenoxaprop-ethyl for aerial application as Bulge and Tiller EC (Fenoxaprop-ethyl plus 2,4-D IOE and MCPA tank mix). Tiller EC use sites are spring wheat and winter wheat (excluding durum wheat). Bugle use sites are wheat (excluding durum wheat), soybeans, cotton, peanuts, and acreage conservation reserve (Set-Aside).

100.2 Formulation Information

BUGLE

ACTIVE INGREDIENTS:

fenoxaprop - P-ethyl: (+)-ethyl 2-[4(6-chloro-2-benzoxazolyl) oxy] phenoxy] propanoate...8.29%*

INERT INGREDIENTS:91.71%**

* Equivalent to 0.67 pounds ai/gallon

** Contains petroleum distillates

TILLER EC

ACTIVE INGREDIENTS:

fenoxaprop - P-ethyl: (+)-ethyl 2-[4(6-chloro-2-benzoxazolyl) oxy] phenoxy] propanoate...8.29%*

2,4-D, isooctylester: 2-ethylhexyl-2,4-dichlorophenoxyacetate.....10.35%**
(Equivalent to 6.86% of pure 2,4-dichlorophenoxyacetic acid)

MCPA, isooctylester: isooctyl 2-methyl-4-chlorophenoxyacetate.....32.11%***
(Equivalent to 20.59% of pure 2-methyl-4-chlorophenoxyacetic acid)

INERT INGREDIENTS:53.13%

* Equivalent to 0.375 pounds ai/gallon (d isomer)

** Equivalent to 0.58 pounds ai/gallon (acid)

*** Equivalent to 1.75 pounds ai/gallon (acid)

Application Methods, Directions, RatesA. Bugle1. Application methods

Bugle is a selective postemergence herbicide used for control of annual and perennial grassy weeds. The weeds turn yellow 4-10 days after application and die in 12-21 days. The label cautions "Since many monocot grass crops (such as sorghum and corn) are sensitive to Bugle herbicide, avoid all direct or indirect contact to neighboring fields." Bugle herbicide does not control broadleaf/weeds or sedges.

Bugle can be applied with ground or aerial application equipment. The following recommendations are made for aerial application: use spray nozzles that give 200-350 micron size droplets, do not use raindrop nozzles and make applications at the maximum of 10 feet above the crop with low drift nozzles at a maximum pressure of 40 psi and with wind speeds not exceeding 10 mph.

2. Rate of Application

A maximum of 1.5 pints/A (0.1256 lb ai/A) Bugle is allowed in **soybeans, peanut, and cotton** in the following states: AL, AR, FL, GA, KY, LA, MS, MO, NM, NC, OK, SC, TN, and TX. Each application can range from 0.5 to 1.5 pints per acre. A maximum of 1.1 pints/A (0.0921 lb ai/A) Bugle is allowed in soybeans, peanut, and cotton in the following states: CO, CT, DE, IL, IN, IA, KS, ME, MD, MA, MI, MN, MO (EXCLUDING Ripley, Butler, Stoddard, Scott, Mississippi, New Madrid, Pemiscot, and Dunkin counties), ne, NH, NJ, NY, ND, OH, PA, RI, SD, VT, VA, WV, and WI. Each application can range from 0.4 to 1.1 pints per acre. **Do not make more than two treatments per growing season and do not apply more than 1.5 pt/A/year.** Do not apply Bugle less than 90 days before harvesting soybeans, 60 days before harvesting peanuts, and 40 days before harvesting cotton.

On **set aside acres (acreage conservation reserve)**, up to 16 fluid ounces (1.0 pt) per acre (0.0837 lb ai/A per treatment) are recommended with no limitation or maximum number of treatments per year.

For use on **wheat**, Bugle must be tank-mixed with MCPA herbicide or injury to wheat may result. Up to 16 fluid ounces (0.0837 lb ai/A) of Bugle may be used on wheat. Use only one application per season. Cool wet conditions at the time of application may result in temporary stunting or chlorosis of the wheat. Bugle should be applied when wheat plants are from 3-leaf stage

to the end of the tillering stage. Do not spray with bugle after wheat jointing begins.

3. Other Directions

Application to grasses under stress may result in reduced control. Bugle will control susceptible grassy weeds from the 2-leaf stage to the 2-tiller stage. Application should be made to young actively growing weeds. Bugle has no effect via soil and will only control emerged grassy weeds. Do not plant any rotational crops in an Bugle treated field for 30 days after application. Do not cultivate within 4 days before or after the application of Bugle. Do not use in irrigation systems. Bugle can be tank mixed with several different herbicides. See attached labels for more complete information.

B. Tiller EC

1. Application Methods

Tiller EC is a mixture of fenoxaprop-ethyl with 2,4-D IOE and MCPA to control post emergence grass weeds and broadleaves in winter and spring wheat (excluding durum wheat.) It can be applied to the following soft white spring wheat varieties: Wakanz, Sprite, Owens, Twin and Centennial. Tiller EC can be used on all winter wheat varieties except NK 751.

Tiller EC can be applied with ground or aerial application equipment. The following recommendations are made for aerial application: use spray nozzles that give 200-350 micron size droplets, do not use raindrop nozzles and make applications at the maximum of 10 feet above the crop with low drift nozzles at a maximum pressure of 40 psi and with wind speeds not exceeding 10 mph. Do not use in irrigation systems.

2. Rate of Application

Tiller EC is to be used only for winter wheat and spring wheat. Tiller EC is not to be used on Durum wheat or other small grains. Application rate range from 1.0 pt/A to 1.7 pt/A (0.0469 lb ai/A to 0.0797 lb ai/A). Only one application per season is to be used.

Use only one application per season. Cool wet conditions at the time of application may result in temporary stunting or chlorosis of the wheat. Bugle should be applied when wheat plants are from 3-leaf stage to the end of the tillering stage. Do not spray with

bugle after wheat jointing begins. Do not apply Tiller EC within 70 days of harvest. See attached labels for more complete information.

100.4 **Target Organisms**

Fenoxaprop-ethyl controls merged annual and perennial grassy weeds (foxtail, volunteer corn, wild sorghum/millet species, panicum, wild oats, crabgrass, sandbur, barnyardgrass, wirestem muhly, wooly cupgrass, johnsongrass).

100.5 **Precautionary Labeling**

A. Bugle

ENVIRONMENTAL HAZARDS

"This pesticide is toxic to fish. 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 apply when weather conditions favor runoff or drift. Do not contaminate arable land and/or water when disposing of equipment washwaters.

B. Tiller EC

ENVIRONMENTAL HAZARDS

"This pesticide is toxic to fish and aquatic invertebrates. Drift or runoff may adversely affect aquatic invertebrates and non-target plants. 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 washwaters or rinsewater.

101. **Hazard Assessment**

101.1 **Discussion**

Soybean exposure will be addressed in this review because of updated estimated exposures and soybean has the same use as peanut and cotton.

Fenoxaprop-ethyl is insoluble (solubility=0.7 ppm), the vapor pressure is low (1.90×10^{-8} Torr) and it appears to be somewhat persistence in soil (aerobic soil half-life= 5-14 days, terrestrial field dissipation half-life = 4-14 days loam soil and 14-30 days in clay soil). The hydrolysis data indicates that Fenoxaprop-ethyl may be either very persistence or has some persistence because the formulated product Tiller EC has a half-life at Ph 7 of 100 days and fenoxaprop technical was 8 days. EFGWB reviewer indicates that the formulated product tends to be more persistence. A free radical acid of fenoxaprop-

ethyl forms rapidly from the parent material and is biologically active. Preliminary data indicates that this degradate is mobile in the soil. Much of the data available from EFGWB is from measurements of the ester and the acid together. There are currently no data available on this degradate only.

The following discussion is based in part from 8/21/90 EEB review by R. Petrie. Super Whip, Whip and Bugle contain different amounts of active enantiomers (isomer d). The Super Whip formulation contains a higher percentage of the d enantiomer than Whip, making it more biologically active. The ratios are: Whip, 50:50, d to 1; Super Whip 85:15, d to 1. The Bugle formulation contains a higher percentage of the d enantiomer than Super Whip, making it even more biologically active. The ratios are: Super Whip, 85:15, d to 1; Bugle 89:11, d to 1. The rates of application have been compensated to allow for the higher level of biological activity from the increased ratio of d-isomers.

101.2 Likelihood of Adverse Effects on Non-Target Organisms

1. Effects to Non-Target Terrestrial Organisms

Acute contact LD50 data previously submitted for Whip herbicide indicates that fenoxaprop-ethyl at Bugle label rates should pose no hazard to honey bees.

Fenoxaprop-ethyl was classified as "practically nontoxic" to birds as follows:

<u>Bird Study</u>	<u>Formulation</u>	<u>LD/LC50</u>
mallard duck dietary	96.6% tech	>5620 ppm
bobwhite quail "	96.6% tech	>5620 ppm
bobwhite acute oral	96.6% tech	>2510 mg/kg

Below are the maximum expected residues (ppm) on vegetation immediately after one application of 1.5 pt Bugle per acre (0.1256 lb ai/A) (based on Hoerger and Kenaga, 1972).

<u>range and short grass</u>	<u>long grass</u>	<u>leaves & leafy crop</u>	<u>forage crop & insects</u>
30	14	16	7

These values are well below the LC₅₀ values for mallard duck, bobwhite quail, and mammalian species (Mammal LD₅₀ >2000 mg/kg). Based on these data, the risk from use of Bugle and the Fenoxaprop-ethyl portion of Tiller EC is expected to be minimal to birds, mammals, and insects.

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2. Exposure for Aquatic Organisms and Non-Target Plants (Aquatic and Terrestrial)

Of both labels (Bugle and Tiller EC) the highest rate of Fenoxaprop-ethyl applied is for soybean, peanut and cotton at 1.5 pt/A. The total number of applications per acre per year is two with a total amount that can be applied per year at 1.5 pt/A. Bugle is applied to wheat at 1 pt/A/YR.

For the set-asides, one pint per acre is recommended but no indication is given as to what the maximum number of applications and amount of active ingredient per year is.

For estimating the preliminary Estimated Environmental Exposure (EEE), we are assuming one application of 0.1256 lb ai/A (for soybean, peanut and cotton at 1.5 pt/A) and two applications (reflecting the set-asides) of 0.0837 lb ai/A for each application (a total of 0.1674 lb ai/A/yr) to be used within two weeks.

a) Aerial EEE

Set-Asides

Assuming 5% of applied material were to drift into an adjacent body of water during set-asides application, the amount would be 0.00837 lb ai/A (5% x 0.1674 lb ai/A) drift. As that drift hits the water, the concentration in 6 feet of water would be 0.51 ppb (0.00837 x 61).

Peanut, Soybean or Cotton

Assuming 5% of applied material were to drift into an adjacent body of water during peanut or cotton application, the amount would be 0.00628 lb ai/A (5% x 0.1256 lb ai/A) drift. As that drift hits the water, the concentration in 6 feet of water would be 0.38 ppb (0.00628 x 61).

Wheat

Assuming 5% of applied material were to drift into an adjacent body of water during set-asides application, the amount would be 0.00418 lb ai/A (5% x 0.0837 lb ai/A) drift. As that drift hits the water, the concentration in 6 feet of water would be 0.25 ppb (0.00418 x 61).

b) Aerial and Runoff from Aerial EEE

Set-Asides

Assuming 5% of the applied material were to drift onto an adjacent area and the applied acreage runs-off into nearby water, the total amount would be **0.01841 lb ai/A** or **1.11 ppb** in 6 feet of water [(10 acre x 1% runoff x 0.1674 lb ai/A x 60% efficiency factor) + 5% drift = 0.01004 lb ai/A + 0.00837 lb ai/A). If the runoff is sheet runoff from one acre to an adjacent one acre, then the total amount of this runoff would be **0.00937 lb ai/A** (1 acre x 1% x 0.1674 lb ai/A x 60% efficiency factor) + 5% drift = 0.00937 lb ai/A).

Peanut, Soybean or Cotton

Assuming 5% of the applied material were to drift onto an adjacent area and the applied acreage runs-off into nearby water, the total amount would be **0.01382 lb ai/A** or **0.84 ppb** in 6 feet of water [(10 acre x 1% runoff x 0.1256 lb ai/A x 60% efficiency factor) + 5% drift = 0.00754 lb ai/A + 0.00628 lb ai/A). If the runoff is sheet runoff from one acre to an adjacent one acre, then the total amount of this runoff would be **0.00703 lb ai/A** (1 acre x 1% x 0.1256 lb ai/A x 60% efficiency) + 5% drift = 0.00703 lb ai/A).

Wheat

Assuming 5% of the applied material were to drift onto an adjacent area and the applied acreage runs-off into nearby water, the total amount would be **0.00918 lb ai/A** or **0.56 ppb** in 6 feet of water [(10 acre x 1% runoff x 0.0837 lb ai/A x 60% efficiency factor) + 5% drift = 0.0050 lb ai/A + 0.00418 lb ai/A). If the runoff is sheet runoff from one acre to an adjacent one acre, then the total amount of this runoff would be **0.00469 lb ai/A** ((1 acre x 1% x 0.0837 lb ai/A x 60% efficiency) + 5% drift = 0.00469 lb ai/A).

c) Runoff EEE From Ground Application

Set-Asides

When the herbicide is applied by ground, runoff can occur from rain. Assuming 1% of the applied material were to runoff from 10 acres to one acre of pond or low-lying wet area, the total amount would be **0.01674 lb ai/A** or **1.02 ppb** in 6 feet of water (10 acre x 1% runoff x 0.1674 lb ai/A = 0.01674 lb ai/A). If the runoff is sheet runoff from one acre to an adjacent one acre, then the total amount of this runoff would be **0.001674 lb ai/A** (1 acre x 1% x 0.1674 lb ai/A = 0.001674 lb ai/A).

Peanut, Soybean or Cotton

Assuming 1% of the applied material were to runoff from 10 acres to one acre of pond or low-lying wet area, the total amount would be **0.01256 lb ai/A or 0.77 ppb** in 6 feet of water (10 acre x 1% runoff x 0.1256 lb ai/A = 0.01256 lb ai/A). If the runoff is sheet runoff from one acre to an adjacent one acre, then the total amount of this runoff would be **0.001256 lb ai/A** (1 acre x 1% x 0.1256 lb ai/A = 0.001256 lb ai/A).

Wheat

Assuming 1% of the applied material were to runoff from 10 acres to one acre of pond or low-lying wet area, the total amount would be **0.00837 lb ai/A or 0.51 ppb** in 6 feet of water (10 acre x 1% runoff x 0.0837 lb ai/A = 0.00837 lb ai/A). If the runoff is sheet runoff from one acre to an adjacent one acre, then the total amount of this runoff would be **0.000837 lb ai/A** (1 acre x 1% x 0.0837 lb ai/A = 0.000837 lb ai/A).

3. Aquatic Organisms

Based on LC₅₀ tests conducted on the Whip formulation, and the limited tests conducted on the Super Whip formulation the following comparisons were made:

Species and Formulated (F)	Technical (T)	LC ₅₀ values	
		Whip	Super Whip
Bluegill	T	NO DATA	0.58 ppm
Bluegill	F*	3.4 ppm	4.7 ppm
Trout	F*	3.4 ppm	2.4 ppm
Trout	T	0.58 ppm	0.46 ppm
<u>Daphnia magna</u>	F*	11.5 ppm	6.0 ppm
Mysid Shrimp	F*	1.7 ppm	NO DATA
Mysid Shrimp	T	107 ppb	109 ppb

* 7% percent formulation; LC₅₀ values are for the formulation, and were not adjusted to account for the percent purity.

The EEB concluded that the most sensitive aquatic species is Mysid shrimp. Based on the above EEE, the EEB concludes that fish and aquatic invertebrates would have minimal adverse affects from the aerial application of Bugle or Fenoxaprop-ethyl portion in Tiller EC.

4. Non-Target Plants

a) Aquatic Plants : The following aquatic plant toxicity data are available to EEB:

Species and Formulated (F) <u>Technical (T)</u>	<u>EC₅₀ values</u>	
	<u>Whip</u>	<u>Super Whip</u>
<i>Selenastrum capricornutum</i> T	0.65 ppm	0.43 ppm ¹
<i>Selenastrum capricornutum</i> F	N/A	34.0 ppm

No data are available for aquatic macrophytes (*Lemna gibba*), *Skeletonema costatum*, *Anabaena flos-aquae*, and freshwater diatom. The technical of Bugle or Super Whip should be used in the testing of the above aquatic plants.

There are insufficient data to assess risk to aquatic macrophytes and other aquatic plants because of the above outstanding data requirements.

b) Terrestrial plants : Based on Tier II vegetative vigor and seed germinating studies submitted to EEB in October 1989, the monocot plants are the most sensitive to Super Whip herbicide. These studies were done on the 7.2% formulated Super Whip. These tests are summarized as follows:

	<u>Lowest EC₂₅ values in lb ai/A</u>	
	<u>Emergence/Germ</u>	<u>Veg. Vigor</u>
Corn -	0.0020 (RL)	0.0025 (H)
Oat -	0.0096 (RL)	0.0078 (W)
Ryegrass-	0.0578 (H)	0.0817 (H)

(RL = radicle length, H = Height, W = Weight)

Based on the above data, off-target movement of Fenoxaprop-ethyl herbicide via aerial drift and aerial runoff from treated acreage are expected to adversely affect non-target monocot terrestrial plants. The risk quotient for non-target monocot plants in **low-lying wet areas** is calculated from the aerial and runoff EEE with the emergence toxicity data. They are as follows:

¹ This study is supplemental and can be upgradeable to core upon submission of data and clarification of method of stock solution preparation.

<u>Use Sites</u>	<u>RQ</u>	<u>Calculations</u>
Set-Asides	9.2	0.01841 ÷ 0.0020
Peanut, Cotton and Soybean	6.9	0.01382 ÷ 0.0020
Wheat	4.6	0.00918 ÷ 0.0020

The risk quotient for non-target monocot plants in **non-wet areas** that is exposed to **drift alone** is calculated from the aerial EEE with the vegetative vigor toxicity data. They are as follows:

<u>Use Sites</u>	<u>RQ</u>	<u>Calculations</u>
Set-Asides	3.3	0.00837 ÷ 0.0025
Peanut, Cotton and Soybean	2.5	0.00628 ÷ 0.0025
Wheat	1.7	0.00418 ÷ 0.0025

The risk quotient for non-target monocot plants in **non-wet areas** that is exposed to **drift plus sheet runoff** is calculated from the aerial and runoff EEE with the vegetative vigor toxicity data. They are as follows:

<u>Use Sites</u>	<u>RQ</u>	<u>Calculations</u>
Set-Asides	3.7	0.00937 ÷ 0.0025
Peanut, Cotton and Soybean	2.8	0.00703 ÷ 0.0025
Wheat	1.9	0.00469 ÷ 0.0025

The EEB concludes that non-target terrestrial monocot plants may be affected from the use of aerial application of Tiller EC or Bugle.

5. Comparative Analysis of Aerial vs. Runoff Exposure

The runoff from either aerial or ground application will affect the non-target plants that are located in **low-lying wet areas**. The comparative risk quotient between aerial and ground applications of Fenoxaprop-ethyl are as follows:

<u>Use Sites</u>	<u>Proposed Aerial + Ground RQ</u>	<u>Current Ground RQ</u>
Set-Asides	9.2	8.4
Peanut, cotton soybean	6.9	6.3
Wheat	4.6	4.2

The runoff from either aerial or ground application will affect the non-target plants that are located in **adjacent drier acreage**. The comparative risk quotient between aerial and ground applications of Fenoxaprop-ethyl are as follows:

<u>Use Sites</u>	<u>Proposed Aerial + Ground RO</u>	<u>Current Ground RO</u>
Set-Asides	3.7	0.8
Peanut, cotton soybean	2.8	0.6
Wheat	1.9	0.4

Discussion of Comparative Assessment

Preliminary estimated environmental exposure (EEE) of runoff from ground application has been modified from previous EEB reviews because the previous reviews used the exposure in 6 inches of water. EEB now uses the preliminary EEE in 6 feet of water unless special circumstances call for 6 inches of water. The preliminary EEE (lb ai/A x %runoff x 10 acre) for runoff going into one acre pond/wet area from 10 acre and (lb ai/A x %runoff x 1 acre) for sheet runoff going into one acre from one acre ground application of Fenoxaprop-ethyl is as follows:

<u>Use Sites</u>	(10 to 1) <u>EEE in ppb</u>	(10 to 1) <u>EEE =lb ai/A</u>	(1 to 1) <u>EEE =lb ai/A</u>
Set-Asides	1.02	0.01674	0.00167
Peanut, Cotton and Soybean	0.77	0.01256	0.00126
Wheat	0.51	0.00837	0.00084

The risk quotient for non-target monocot plants in **low-lying wet areas** is calculated from ground application runoff EEE with the emergence toxicity data. They are as follows:

<u>Use Sites</u>	<u>RQ</u>	<u>Calculations</u>
Set-Asides	8.4	0.01674 ÷ 0.0020
Peanut, Cotton and Soybean	6.3	0.01256 ÷ 0.0020
Wheat	4.2	0.00837 ÷ 0.0020

The risk quotient for non-target monocot plants in **adjacent drier acreage** is calculated from ground application sheet runoff EEE with the emergence toxicity data. They are as follows:

<u>Use Sites</u>	<u>RQ</u>	<u>Calculations</u>
Set-Asides	0.8	0.00167 ÷ 0.0020
Peanut, Cotton and Soybean	0.6	0.00126 ÷ 0.0020
Wheat	0.4	0.00084 ÷ 0.0020

The EEB concludes the following:

- Based on RQ, **aerial application does result in greater risk quotients to non-target plants** than from the ground application.

- With regard to dryland plants, aerial application affects non-target plants over a much greater area whereas the ground application affects only the dryland non-target plants located near the edge of the field.

- **Each** aerial application is expected to expose non-target plants through spray drift, whereas, the ground application would expose non-target plants **only when the conditions favor surface water runoff**. And then, exposure would be limited to areas down-hill/down-stream from treated sites and primarily in areas where the water would accumulate.

In other words, **non-target plants are exposed to higher levels and more often and over a larger area from aerial application than from ground application.**

6. Risk Reduction Measures, nonendangered species

The following risk reduction guidance applies to all uses (cotton, peanuts, wheat) **except for set-aside.**

The nozzle size of spray equipment used to apply fenoxaprop-ethyl should be no smaller than 250 VMD μ m. This will ensure larger droplet sizes, thus reducing potential for drift. This is based on Dr. Akesson's drift table. See section 101.3 Endangered Species under Risk Reduction Measures for discussion of Dr. Akesson's data table. If the nozzle size is no smaller than 250 VMD μ m nontarget off-site plants would be protected provided that the following aerial application mitigation measures are also taken:

- limiting the height of application to no more than 10 feet above the crops being sprayed,
- no application during temperature inversion (which can be detected by smoke pots on ground or thermometers on aircraft wings), and
- no aerial application is to be done during wind speeds in excess of 10 mph.

The above risk reduction would also apply to **set-asides** if, in addition, application to set-aside areas was limited to only one treatment of 0.0837 lb ai/A. At this rate the maximum distance downwind where adverse effects to plants would be minimal, i.e. 20 meters according to Dr. Akesson's drift table.

If the above recommendations are not adopted, then the EEB recommends that aerial application not be granted to avoid risk to non-target plants.

101.3

Endangered Species Considerations

1. Endangered Species Risk Assessment

The endangered species triggers are as follows:

Birds:	>562 ppm (LC ₅₀ >5620/10)
Mammals ²	2000 ppm (LC ₅₀ 20000 ppm/10)
Fish:	0.023 ppm (LC ₅₀ 0.460 ppm/20)
Aquatic Invertebrates:	0.005 ppm (LC ₅₀ 0.107 ppm/20)
Aquatic Plants:	0.43 ppm (EC ₅₀ 0.43 ppm)
Terrestrial Plants ³ ...	0.0020 lb ai/A
Terrestrial Plants ⁴ ...	0.0025 lb ai/A

The preliminary estimations of environmental concentration exposure to non-target organisms are as follows:

Birds or mammals - 30 ppm
Fish or Aquatic organisms - 0.84 ppb
Plants in low wet areas - 0.01382 to 01841 lb ai/A
Plants in other than wet areas - 0.00628 to 00837 lb ai/A

The aerial application of Bugle or Tiller EC is not expected to have an adverse affect to endangered birds, mammals, fish, and aquatic invertebrates.

Endangered species triggers have been exceeded for plants. The EEB concludes that, **endangered terrestrial monocot plants inhabiting low lying wet areas** (RQ=4.6 to 9.2) and **endangered terrestrial monocot plants on dry land** (RQ=1.7 to 3.3) may be affected from the use of aerial application of Tiller EC or Bugle.

² Based on oral LD₅₀ =2000 mg/kg converted to an LC₅₀ value with assumptions that mammals consume 10% of their body weight per day in food.

³ Value is based on seedling emergence EC₂₅ for ryegrass which is used to estimate risk to plants from runoff

⁴ Value is based on ryegrass EC₂₅ on vegetative vigor which is used to estimate risk to plants from drift.

2. Risk Reduction Measures, Endangered Species

a) The following risk reduction measure to protect endangered plant species assumes that no endangered plant species occur within 30 meters of row-crop and plowed or otherwise cultivated fields.

The nozzle size of equipment used to spray fenoxaprop-ethyl should be no smaller than 250 VMD μm . This would reduce drift potential sufficiently to protect endangered species of plants provided that:

> only one application is used in set-asides and the set aside use rate is limited to 0.0837 lb ai/A, and

> that other precautions in aerial application are taken such as:

* limiting the height of application to no more than 10 feet above the crops being sprayed,

* no application during temperature inversion (which can be detected by smoke pots on ground or thermometers on aircraft wings), and

* no aerial application is to be done during wind speeds in excess of 10 mph.

Discussion: The label has indicated that the nozzle size is 200 to 350 μm and that no raindrop size nozzles should be used in order to achieve uniform and complete coverage of the herbicide. Providing buffer information to the applicator may also result in some protection to terrestrial plants. The applicator should be provided information to allow protection of desirable monocots. The following table below shows the amount of deposition of the herbicide that are expected from Dr. Norman B. Akesson's research as of October 6, 1992. This research as compared to that of the incomplete Spray Drift Task Force is considered by EFGWB to be more conservative towards safety of the plants. Since the risk quotient for plants that are affected by drift ranges from 1.7 to 9.2, the percentages of rate of application necessary for no injury to occur to non-target plants are calculated as the inverse of the risk quotient. This value is used in Dr. Akesson's table of downwind deposits from aircraft applications of 20 progressive swaths of 40 feet each. The nozzle size is assumed at 250 μm and during unstable ventilating lapse type of weather (some wind). No stable

temperature inversion is anticipated in the table. The table below describes the maximum distance downwind at which endangered plant species may be affected with the use of Fenoxaprop-ethyl:

Type of Exposure	Use Site	Distance Downwind in meters
runoff+aerial	set-asides	50
aerial	set-asides	15
runoff+aerial	peanut, cotton & soybean	30
aerial	peanut, cotton & soybean	15
runoff+aerial	wheat	20
aerial	wheat	15

It is noted that the 50 meters drift in the set-aside use site is due to two applications of 0.0837 lb ai/A each. **If only one application of 0.0837 lb ai/A was used, then the maximum distance downwind that will cause adverse affects to plants would be 20 meters for the set-sides.** Therefore, based on Dr. Akesson's table, it is estimated that the nozzle size of no smaller than 250 VMD μ m would be sufficient to protect endangered species of plants provided the other measure listed above are followed.

Alternatives:

If the above risk reduction measures are **not** accepted (including a limit of one application of 0.0837 lb ai/A for set-asides), then the 32 endangered species of plants that are listed below may be affected from the proposed aerial use of Fenoxaprop-ethyl.

Note that a may affect situation also exists for these species from the existing aerial use on soybeans. Please note that some of these species or populations of these species may not be affected because they are already being actively protected: e.g. through landowner agreements or on federal, state or private conservation organization land. EEB does not at this time have such information.

American Hart's-Tongue Fern,
 Alabama Streak-Sorus Fern,
 Adiantum Vivesii Fern,
 Aleutian Shield Fern,
 Elaphoglossum Serpens Fern,
 Polystichum Calderonense Fern,
 Tectaria Estremerana Fern,
 Thelypteris Inabonensis Fern,
 Thelypteris Verecunda Fern,
 Thelypteris Yaucoensis Fern,
 Large-Flowered Fiddleneck,

Santa Cruz Cypress,
California Orcutt Grass,
Carter's Panicgrass,
Poa Siphonoglossa,
Geocarpon Minimum,
Navajo Sedge,
Relict Trillium,
Persistent Trillium,
Western Prairie Fringed Orchid,
Eastern Prairie Fringed Orchid,
Minnesota Trout Lily,
White Isisette,
Bunched Arrowhead,
Dwarf Lake Iris,
Knieskern's Beaked Rush,
Kral's Water Plantain,
Northeastern Bulrush,
Tennessee Yellow-Eyed Grass,
Texas Wild Rice,
Ute Ladies-Tresses,
Hawaiian Bluegrass

Furthermore, if the above recommendations on adjusting equipment and methods to reduce drift are not accepted, then the EEB recommends one of the following measures. The first two eliminate the "may affect" situation to the above endangered species of plants, the last would provide information needed to develop specific use limitations to protect endangered plant species.

- Do not permit aerial application,
- Prohibit the aerial application of Fenoxaprop-ethyl in the counties where these species are located. A list can be made of the counties if RD desires, or
- The registrant investigates the location of the above endangered species of plants in relation to the use site of this herbicide. If it is determined by USFWS or EFED that there is a "may affect" for the endangered species of plants, then the use of the herbicide should be modified to eliminate the "may affect" situation to the species.

Affects to Endangered Species from CURRENT use of Fenoxaprop

b) The EEB notes that regardless of whether this new aerial application is permitted, the existing ground use on the set asides, peanuts, cotton, wheat, and soybeans already creates a may affect situation for a subset of

the species listed above. Triggers for endangered species of plants have been exceeded. Even with prohibition of aerial application, ground application alone may affect the following 10 endangered plant species:

Eastern Prairie Fringed Orchid,
White Isisette,
Bunched Arrowhead,
Dwarf Lake Iris,
Knieskern's Beaked Rush,
Kral's Water Plantain,
Northeastern Bulrush,
Tennessee Yellow-Eyed Grass,
Texas Wild Rice,
Ute Ladies-Tresses

For the above species, the EEB recommends the following. The first would eliminate the "may affect", the second would provide information to allow development of specific use limitations to eliminate the affects to endangered plant species.

- For these species where EEB does not have readily available information indicating "No Effect", prohibit the use of Fenoxaprop-ethyl in the counties where these species are located. A list can be made of the counties upon request, or
- The registrant should be requested to investigate the location of the above endangered species of plants in relation to the existing use sites of this herbicide. If it is determined from this investigation that endangered species of plants may be affected, then the use of the herbicide should be modified to eliminate the affects.

101.4 Adequacy of Toxicity Data

Per EEB review of 2/28/92 (Petrie), the following studies using the technical of Super Whip or Bugle are outstanding:

- 1) 123-2 Aquatic Plant Growth using *Lemna gibba*, *Skeletonema costatum*, *Anabaena flos-aquae*, and freshwater diatom.
- 2) 72-4 (a) Fish Early Life Cycle
- 3) 72-4 (b) Mysid Early Life Cycle
- 4) 201-1, 202-1 Drift Studies

72-2(a) Invertebrate Toxicity may be required for full risk assessment since EEB has only the toxicity data for *Daphnia magna* using the formulated product. A test using the technical product of Super Whip or Bugle would be required if the test is requested. The value of additional information from this test is low because another aquatic invertebrate, mysid shrimp, is more sensitive than *Daphnia magna* and preliminary exposure data indicate that minimal adverse affects are expected to the mysid shrimp from the labeled use of Fenoxaprop-ethyl.

101.5 Adequacy of Labeling

ENVIRONMENTAL HAZARDS

For Tiller EC and Bugle products, the following labeling should be used: "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 areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinseate."

Endangered Plant Species

Appropriate labeling can be recommended based on the course of action as described in section 101.3 above under Risk Reduction Measures.

Other Labeling Recommendations

In the label under "Aerial Application", it should read "...use nozzles to provide 200-350 VMD (volume median diameter) micron size droplets. VMD indicates that, by volume, 50% of the droplet will larger than the given diameter and 50% of the droplets will be smaller."

103 Conclusions

The proposed aerial use of Fenoxaprop-ethyl on cotton, peanut, wheat, and set-asides pose a potential risk to non-target terrestrial plants, such as grasses (including corn), rushes, sedges, ferns and other non-dicot plants including endangered/threatened species. Although soybean is already registered for aerial application, soybean is reconsidered in this review because it has the same use pattern as peanut and cotton and is labeled with peanut and cotton. There are insufficient data to assess risk to aquatic macrophytes and other aquatic plants.

Data currently available indicate that Fenoxaprop-ethyl hazard to avian, mammalian, and beneficial insect species is expected to be minimal.

A comparative analysis between ground application and aerial application was conducted in this review. The EEB concluded the following:

- Based on RQ, aerial application would result in higher relative risk to non-target plants (including endangered plant species) than from the ground application.
- Each aerial application may expose non-target plants due to aerial spray drift, whereas, the ground application would expose non-target plants only when conditions favor runoff.

Non-target plants would be exposed to higher levels, and more often and over a larger area from aerial application than from ground application.

Risk reduction measures have been recommended see risk reduction recommendations above, section 101.2 (6) and 101.3 (2).

The following data are outstanding:

- 1) 123-2 Aquatic Plant Growth using *Lemna gibba*, *Skeletonema costatum*, *Anabaena flos-aquae*, and freshwater diatom (from previous review, high value added).
- 2) 72-2(a) Invertebrate Toxicity (low added value).
- 3) 72-4 (a) Fish Early Life Stage (from previous review, high value added).
- 4) 72-4 (b) Mysid Early Life Cycle (from previous review, high value added).
- 5) 201-1, 202-1 Drift Studies (from previous review).

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