



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

DEC 6 1992

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: Flumetsulam Herbicide: New Chemical Science Chapter
DP Barcode D181973, D181964, D182891, D181979

FROM: Anthony F. Maciorowski, Chief *Anthony F. Maciorowski*
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TO: Joanne Miller, PM-23
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The Ecological Effects Branch has completed a Science Chapter on a new sulfonylurea herbicide, Flumetsulam and a new end-use product. Nine new studies submitted by Dow Elanco have been reviewed for this new chemical. These studies were submitted under DP Barcode D181973, D181964, D182891, D181979 for Registration under section 3.

Proposed Use: Flumetsulam and XRM-5313 (Flumetsulam and Trifluralin) will be used for soybeans and corn. The label shows that no aerial application will be used.

Data Adequacy (123-1 a,b) Germination, Seedling Emergence, & Vegetative Vigor of Plants studies using the technical grade are required for flumetsulam and are outstanding.

Concerns a. Flumetsulam

Limited plant data on flumetsulam show that this herbicide appears to be more phytotoxic in aquatic environments than most other sulfonylurea herbicides. The use site, persistence, and amount of estimated environmental concentrations raise some serious concerns of the potential adverse effects this new herbicide may have on non-target aquatic plants and subsequent fish and other aquatic organisms by indirect effects. Effects on non-target terrestrial plants are not known due to insufficient data. This herbicide may leach into groundwater. With the extremely phytotoxic effects, EEB is concerned about possible ramifications this may have on the 46.4 million acres of irrigated crops in this country. EEB also has concerns for endangered plant species.



(Cont. flumetsulam)

Attached is EEB's Science Chapter, Data Requirements table for EEB, DERs, and Comparative Analysis Chart of Sulfonylurea Herbicides for the flumetsulam herbicide.

b. XRM-5313 (Flumetsulam and trifluralin)

EEB has concerns for Trifluralin due to this chemical being highly toxic to fish. Endangered species concerns have been triggered. EEB has initiated formal consultations with U.S. Fish and Wildlife Service (FWS) for trifluralin as of April 15, 1991. Registration under Section 3 should be postponed until FWS issues a biological opinion on trifluralin.

If you have questions regarding this review, please contact Mike Davy at 305-7081.

**Ecological Effects Branch
New Chemical Science Chapter For
Flumetsulam and New End-Use Product of Flumetsulam & Trifluralin**

A. Ecological Hazard

1. Ecological Effects Topical Summaries

a. Effects on Non-Target Birds

In order to establish the toxicity to birds, the following tests are required using the technical grade material: an avian single-dose oral acute study (71-1) on one species (preferably mallard duck or bobwhite quail); two subacute dietary studies (71-2) on one species of waterfowl (preferably mallard duck) and on one species of upland game bird (preferably bobwhite quail); and because of persistence, two avian reproduction studies (71-4) on mallard duck and bobwhite quail.

Five studies were evaluated under this topic. All were acceptable for use in hazard assessment.

The acceptable toxicity studies for use in a hazard assessment are listed below:

<u>Guide line</u>	<u>Species</u>	<u>% ai</u>	<u>Tox value</u>	<u>MRID No.</u>	<u>Fulfills Guideline Requirements</u>
71-1	Bobwhite	99.6	LD ₅₀ >2250 mg/kg	41263218	YES
71-2	Bobwhite	99.6	LC ₅₀ >5620 ppm	41263220	YES
71-2	Mallard	99.6	LC ₅₀ >5620 ppm	41263219	YES
71-4	Bobwhite	99.6	NOEL>600 ppm	41931741	YES
71-4	Mallard	99.6	NOEL=300 ppm	41931742	YES

b. Effects to Non-Target Fish

Four studies were evaluated under this topic. All were acceptable for use in hazard assessment.

In order to establish the toxicity to fish, the following tests are required using the technical grade material: two 96-hour acute fish studies (72-1); one on a species of coldwater fish (preferably rainbow trout) and one on a species of warmwater fish (preferably bluegill sunfish). In addition, (72-4) Early Life Stage of Fish is required due to the persistence of flumetsulam in aquatic environment.

The acceptable toxicity studies for use in a hazard assessment are listed below:

<u>Guide line</u>	<u>Species</u>	<u>% ai</u>	<u>Tox value</u>	<u>MRID No.</u>	<u>Fulfills Guideline Requirements</u>
72-1	Bluegill	99.6	LC ₅₀ >300 ppm	41263222	YES
72-1	Trout	99.6	LC ₅₀ >300 ppm	41263221	YES
72-1	Fathead Minnow	99.6	LC ₅₀ >293 ppm	41263223	YES
72-4A	Fathead Minnow	99.6	MATC >197 ppm	42465101	YES

C. Effects to Non-Target Aquatic Invertebrates

Two studies were evaluated under this topic. These were acceptable for use in hazard assessment. In order to establish the toxicity to aquatic invertebrates, a 48-hour aquatic invertebrate acute toxicity test is required using the technical grade material on first instar Daphnia magna or early instar amphipods, stoneflies or mayflies. In addition, (72-4) Aquatic Invertebrate Life Cycle is required due to the persistence of flumetsulam in aquatic environment.

The acceptable toxicity study for use in a hazard assessment is listed below:

<u>Guide line</u>	<u>Species</u>	<u>% ai</u>	<u>Tox value</u>	<u>MRID No.</u>	<u>Fulfills Guideline Requirements</u>
72-2	<u>Daphnia magna</u>	99.6	LC ₅₀ =250 ppm	41263224	YES
72-4B	<u>Daphnia magna</u>	99.6	111>MATC<200 ppm	42465102	YES

D. Effects to Non-Target Estuarine and Marine Organisms

Three studies were evaluated under this topic. All were acceptable for use in hazard assessment.

In order to establish the toxicity to estuarine and marine organisms, the following tests are required using the technical grade material: either a Mollusc 48-hour embryo larvae study using Pacific oyster, Eastern oyster, mussel (preferably Mytilus edulis) or Quahog (Mercenaria) or a Mollusc 96-hour Flow-Through Shell Deposition study using Pacific oyster or Eastern oyster; and a Shrimp 96-hour acute toxicity test using white, pink, brown, grass or mysid shrimp species; an estuarine fish (preferably silverside or sheepshead minnow).

The acceptable toxicity study for use in a hazard assessment is listed below:

Guide line	Species	% ai	Tox value	MRID No.	Fulfills Guideline Requirements
72-3	Grass	99.6	LC ₅₀ >350 ppm	41263226	YES
	Shrimp				
72-3	Atlantic Silversides	99.6	LC ₅₀ >380 ppm	41263225	YES
72-3	Eastern Oyster	99.6	LC ₅₀ >108 ppm	41263227	YES

E. Effects to Non-Target Insects (Beneficial Insects)

One study was evaluated under this topic. This was acceptable for use in hazard assessment. In order to establish the toxicity to insects, an acute oral toxicity test to honey bees is required using the technical grade material.

The acceptable toxicity study for use in a hazard assessment is listed below:

Guide line	Species	% ai	Tox value	MRID No.	Fulfills Guideline Requirements
141-1	Honey Bee	99.6	LD ₅₀ >100 µg/bee	41263228	YES

F. Effects to Non-Target Plants

Five aquatic plant study were evaluated under this topic. These are acceptable for use in hazard assessment. In order to establish the toxicity to aquatic plants, an aquatic plant growth study (123-2) comprising of Selenastrum capricornutum, Lemna gibba, Skeletonema costatum, Anabaena flos-aquae, and freshwater diatom is required using the technical grade material.

The acceptable toxicity study for use in a hazard assessment is listed below:

Guide line	Species	% ai	Tox value	MRID No.	Fulfills Guideline Requirements
123-2	<u>Selenastrum capricornutum</u>	99.6	EC ₅₀ =3.31 ppb	41931743	YES
123-2	<u>Anabaena flos-aquae</u>	99.6	EC ₅₀ =0.16 ppm	42473101	YES
123-2	<u>Navicula pelliculosa</u>	99.6	EC ₅₀ =41.6 ppm	42473102	YES
123-2	<u>Skeletonema costatum</u>	99.6	EC ₅₀ =54.7 ppm	42473103	YES
123-2	<u>Lemna gibba</u>	99.6	EC ₅₀ = 3.1 ppb	42473104	YES

2. Ecological Effects Disciplinary Review Summation

A. Non-Target Terrestrial

Flumetsulam is practically non-toxic to mammals with an oral LD₅₀ >2000 mg/kg rabbits. The one-year feeding test on dogs concluded with an indication of toxic liver effects in dogs with a NOEL= 20 mg/kg/day and the LOEL= 100 mg/kg/day. No evidence of oncogenic or mutagenic effects in mammals was noticed. The maternal weight loss NOEL for rabbits was 100 mg/kg/day and systemic NOEL for mice is >1000 mg/kg/day.

Data from avian single-dose oral and dietary studies indicate that flumetsulam is practically non-toxic to birds (bobwhite quail LD₅₀>2250 mg/kg; bobwhite and mallard dietary LC₅₀'s >5620 ppm/day). Reproductive studies show the mallard duck to have NOEL= 300 ppm.

B. Non-Target Aquatic

Flumetsulam is practically non-toxic to aquatic organisms (*Daphnia* spp. LC₅₀= 250 ppm; bluegill and trout LC₅₀= 300 ppm; Eastern Oyster LC₅₀>108 ppm; grass shrimp LC₅₀> 350 ppm).

C. Non-Target Insects

Flumetsulam is practically non-toxic to insects with LD₅₀> 100 µg/bee.

D. Non-Target Plants

Data are incomplete for plants (no data from 123-1 Germination, Seedling Emergence and Vegetative Vigor). It is known that flumetsulam is extremely toxic to the green algae, *Selenastrum capricornutum*, with EC₅₀= 3.31 ppb and to a macrophyte, *Lemna gibba*, with EC₅₀= 3.1 ppb. This herbicide is a member of a class of very phytotoxic herbicides called sulfonylurea.

B. Ecological Effects Risk Assessment

1. Use Profile

A. Application Usage

Application is by ground equipment only; 10 to 40 gallons water per acre; 20 to 40 lbs. pressure/sq. in. Flumetsulam will be applied pre-plant incorporated (PPI), pre-emergence to the soil surface with no incorporation, and as a postemergence foliar spray to corn and to

soybean. PPI applications are incorporated in the top 2 to 3 inches of soil 0 to 30 days before planting. Flumetsulam can also be applied to reduced tillage or no-till fields before, during or after planting prior to crop emergence. No aerial application will be permitted.

Application rates for field corn and soybean are the same for pre-plant incorporated and pre-emergence to the soil surface with no incorporation. The soil application rates range from 0.04 to 0.09 lb/A (0.03 to 0.067 lb ai/A).

The post-emergence foliar application is applied after the weeds are in the 2 to 4 true leaf stage.

1. For corn, application may be made to field corn up to 12 inches tall. The rates for postemergence application for corn ranges from 0.02 to 0.08 lb/A (0.015 to 0.06 lb ai/A).

2. For soybeans, Application may be made to soybeans from the first to the fifth trifoliolate leaf stage of growth. The rates of application ranges from 0.01 to 0.02 lb/A (0.0075 to 0.0150 lb ai/A).

2. Environmental Fate and Exposure

A. Fate

Data from 3/24/91 review from EFGWB are summarized below. Available data are insufficient to fully assess the environmental fate of Flumetsulam at this time. In twenty-three soils ranging in texture from sandy loam to clay, the adsorption coefficients (K_d) ranged from 0.05 to 2.42 and K_{oc} values ranged from 5 to 182. Soil photodegradation shows $t_{1/2}$ = 90 days on sterile and non-sterile soil; aerobic soil metabolism $t_{1/2}$ = varies from 2 to 3 months; flumetsulam tends to degrade faster in soils with higher pH and lower organic carbon; field dissipation study shows $t_{1/2}$ = 1.5 to 3 months; and is very mobile in soil from adsorption and column leaching studies. Flumetsulam may exhibit some leaching in the environment. In addition, confined rotational crops data indicated that flumetsulam may accumulate at concentrations of about 10 ppb at 365 days and about 100 ppb at 30-120 days posttreatment. Vapor pressure for this chemical is 0.8×10^{-15} Torr (very low).

Solubility of this chemical is 5650 ppm at pH7 and 49.1 ppm at pH 2.5. It is expected to be very mobile in water and soil surface runoff. Flumetsulam is stable in aquatic systems with a hydrolytic t1/2 >60 days; photodegradation in water t1/2= 161 days at pH5 and 727 days at pH 7; and anaerobic aquatic metabolism t1/2= 183 days. Flumetsulam is not expected to bioaccumulate in fish.

B. Exposure

1. Aquatic Estimated Environmental Concentration (EEC)- assuming the product is applied to a 10 acre field by ground equipment and 5% runoff occurs (solubility= 5650 ppm at pH 7); the water concentration in an adjacent 1 acre pond 6 feet deep could be 2 ppb (0.002 ppm) (10A x 0.067 lb. ai/A x 5% x 61 ppb). In 6 inches of water, the concentration could be 24.6 ppb (0.025 ppm).

2. Terrestrial EEC- Below are the maximum expected residues (ppm) on vegetation immediately after one application of 0.067 lb. ai/A (based on Hoerger and Kenaga, 1972).

range grass	grass	leaves & leafy crop	forage crop & insect	Pods with seeds	grain	fruits
16	7	8	4	0.8	0.7	0.5

3. Risk Assessment

A. Non-Endangered Species

Flumetsulam

1. Terrestrial Organisms- the maximum expected residues do not exceed the avian acute LC₅₀ (>5650 ppm/day) and the mammalian acute LC₅₀ (>20,000 ppm/day¹). These residues do not exceed the avian NOEL (mallard= 300 ppm) or the mammalian NOEL (dog= 20 ppm/day). According to the LD₅₀ dose, (>100 µg/bee) it appears that there will be minimal adverse effects for beneficial insects. It appears that the use of flumetsulam at the labeled rate will have minimal adverse effects on insects, birds and mammals.

¹ Based on oral LD₅₀ >2000 mg/kg for mammals converted to an LC₅₀ value with assumptions that mammals consume 10% of their body weight in food.

2. Aquatic Organisms- the aquatic EEC (2 ppb in 6 feet of water) do not exceed the LC_{50} for fish (300 ppm) or the LC_{50} for aquatic invertebrates (250 ppm). It appears that the use of flumetsulam at the labeled rate will have minimal adverse effects on aquatic organisms.

3. Plants- the aquatic EEC (2 ppb in 6 feet of water) approach the LC_{50} for an algae, Selenastrum capricornutum (3.31 ppb) and for a macrophyte, Lemna gibba (5.1 ppb). It is possible, given variation in sensitivity of plants, that certain aquatic plants **may be adversely effected** from runoff in the use of flumetsulam at the labeled rates. There are no data in EEB files concerning terrestrial plants. Flumetsulam is in a class of sulfonyleurea herbicides that are noted for having phytotoxic effects on plants at extremely low rates. Therefore, we **assume** that terrestrial plants **may be adversely effected** from runoff onto an adjacent field, irrigation from contaminated runoff water or wind blown soil particles adhering with this chemical from corn or soybean fields treated at the labeled rates with flumetsulam. There are incident reports of other sulfonyleurea herbicides affecting crops from wind blown soil particles adhering with a sulfonyleurea herbicide. In addition, preliminary fate data show that this chemical has the potential persistence (soil adsorption and column leaching studies) to leach into groundwater. This contaminated groundwater may cause adverse effects on irrigated crops at extremely low doses of this sulfonyleurea herbicide. There are 114 million acres in this country in corn and soybeans (1987 Census of Agriculture). This amount of acreage can potentially be treated with flumetsulam, with possible widespread adverse effects on irrigated crops that are not corn or soybean as a result of this groundwater contamination. There are approximately 46.4 million agricultural acres irrigated in this country (1987 Census of Agriculture).

Flumetsulam and Trifluralin (XRM-5313)

Trifluralin has an EEB Science Chapter and is currently registered for soybean and corn. The rate of application for trifluralin is about the same as if it is used alone. Therefore, the risk from this proposed use of trifluralin is the same as the registered use on soybean and corn. EEB has expressed concerns for trifluralin regarding fish. The trout LC_{50} = 41 ppb. The aquatic EEC for a 6 feet pond is 31 ppb (10 acres x 1 lb ai/A x 5% runoff x 61 ppb). There is a presumption of unacceptable risk since EEC is greater than $1/2 LC_{50}$. The chronic MATC = 5.1 ppb (LEL) for fathead minnow.

In this mixture, flumetsulam is applied at the same rate as if alone. Therefore, the risk assessment in this document for flumetsulam will be applicable for the flumetsulam in this mixture. EEB has concerns for flumetsulam adversely affecting non-target aquatic plants. Please see discussion of risk assessment in A.3. on page 7 of this document for further details.

B. Endangered Species

Flumetsulam

1. Endangered Species Risk Assessment

The endangered species triggers are as follows:

Birds:	562 ppm	(LC ₅₀ 5620/10)
Mammals:*	2000 ppm	(LC ₅₀ 20000 ppm/10)
Fish:	15 ppm	(LC ₅₀ 300 ppm/20)
Aquatic Invertebrates:	17.5 ppm	(LC ₅₀ 350 ppm/20)
Plants:	3.31 ppb	(EC ₅₀ 3.31 ppb)

* Based on oral LD₅₀ >2000 mg/kg for mammals converted to an LC₅₀ value with assumptions that mammals consume 10% of their body weight in food.

The maximum estimated residues on terrestrial food items (16 ppm) do not exceed 1/10th the lowest mammalian or avian LC₅₀'s. The aquatic EEC (2 ppb in 6 feet of water) in water adjacent to treated areas does not exceed that for endangered aquatic invertebrates and fish.

The aquatic EEC in water adjacent to treated areas is approximate to the EC₅₀ for aquatic plants. Therefore, **adverse effects are anticipated** for endangered/threatened aquatic plants. Data on terrestrial plants are not available. It is not known for certain whether flumetsulam will adversely effect endangered/threatened terrestrial plants. However it is known that other sulfonylurea herbicides (of which flumetsulam is one) will adversely affect such plants growing in areas where streams, bogs, swamps and wetlands by runoff. Therefore we can assumed that flumetsulam is **expected to adversely affect** endangered/threaten plants from runoffs. A list of endangered plants that may be affected from corn or soybean growing areas have been compiled as follows:

List of Endangered Plants exposed to Aquatic EEC

<u>Common Name</u>	<u>Scientific Name</u>
<u>Family Name</u>	<u>State- Counties where plants located</u>
Mohr's Barbara's Buttons	<u>Marshallia mohrii</u>
Asteraceae;	AL- Cherokee, Bibb, Etowah; GA- Bartow, Floyd, Murray
Alabama Canebrake Pitcher Plant	<u>Sarracenia rubra</u> spp. alabamensis
Sarraceniaceae;	AL- Autauga, Cherokee, Chilton, Elmore
Green Pitcher Plant	<u>Sarracenia oreophila</u>
Sarraceniaceae;	AL- Cherokee, Dekalb, Etowah, Jackson, Marshall; GA- Towns; NC- Clay
Kral's Water Plantain	<u>Sagittaria secundifolia</u>
Alismataceae	AL- Cherokee, Dekalb; GA- Chattooga;
Harperella	<u>Ptilimnium nodosum</u>
Apiaceae;	AL- Dekalb; NC- Chatham, Granville; SC- Aiken, Saluda; MD- Allegany; WV- Morgan
Tennessee Yellow-Eyed Grass	<u>Xyris tennesseensis</u>
Poaceae;	TN- Lewis; AL- Franklin
Little Amphianthus	<u>Amphianthus pusillus</u>
Scrophulariaceae;	AL- Randolph, Chambers; GA- Butts, Newton, Pike, Walton, Gwinnett, Henry, Merriwether, Douglas, Hancock, Heard; SC- Lancaster, Saluda, York
Pondberry	<u>Lindera melissifolia</u>
Lauraceae;	AR- Clay, Jackson, Lawrence, Woodruff; GA- Baker, Wheeler; MO- Ripley; MS- Sharkey, Bolivar, Sunflower; NC- Bladen; SC- Berkeley
Swamp Pink	<u>Helonia bullata</u>
Liliaceae;	DE- Kent, New Castle, Sussex; MD- Anne Arundel, Cecil; NJ- Cape May, Sussex, Morris, Middlesex, Salem, Camden, Cumberland, Atlantic, Burlington, Gloucester, Ocean; SC- Greenville; VA- Augusta, Henrico, Nelson; NC- Henderson, Jackson, Transylvania;
Chapman Rhododendron	<u>Rhododendron chapmanii</u>
Ericaceae;	FL- Gadsden
Cooley's Meadowrue	<u>Thalictrum cooleyi</u>
Ranunculaceae;	FL- Walton; NC- Brunswick, Columbus, Onslow, Pender

- Canby's Dropwort Oxypolis canbyi
 Apiaceae; GA- Burke, Dooly, Lee, Sumter; MD- Queen
 Anne; NC- Scotland; SC- Allendale, Bamberg,
 Clarendon, Hampton, Barnwell, Berkeley,
 Colleton, Lee, Orangeburg, Richland,
 Williamsburg
- Black-Spored Quillwort Isoetes melanospora
 Isoetaceae; GA- Gwinnett; SC- Lancaster
- Eastern Prairie Fringed Orchid Platanthera leucophaea
 Orchidaceae; IL- Cook, DuPage, Grundy, Henry, Iroquois,
 Kane, Lake, McHenry; MI- Bay, Huron,
 Livingston, Monroe, Saginaw, St. Clair, St.
 Joseph, Tuscola, Washtenaw, Wayne; VA-
 Augusta; WI- Dane, Jefferson, Kenosha,
 Ozaukee, Rock, Walworth, Waukesha, Winnebago
- Decurrent False Aster Boltania decurrens
 Asteraceae; IL- Jersey, Marshall, Morgan, Putnam,
 Schuyler, woodford, St. Clair;
 MO- St. Charles
- Cumberland Rosemary Conradina verticillata
 Lamiaceae; Ky- McCreary; TN- Cumberland, Fentress,
 Morgan, White, Scott
- Dwarf Lake Iris Iris lacustris
 Iridaceae; MI- Presque Isle, Menominee, Emmet, Delta,
 Cheboygan, Chippewa, Charlevoix, Alpena
- Rough-Leaved Loosestrife Lysimachia asperulaefolia
 Primulaceae; NC- Scotland, Bladen, Brunswick, Carteret,
 Cumberland, Hoke, Pender
- Dwarf-Flowered Heartleaf Hexastylis naniflora
 Aristolochiaceae; SC- Cherokee, Greenville, Spartanburg;
 NC- Burke, Catawba, Cleveland, Lincoln,
 Rutherford
- Small-Anthered Bittercress Cardamine micranthera
 Brassicaceae; NC- Stokes
- Northeastern Bulrush Scirpus ancistrochaetus
 Cyperaceae; MD- Washington; PA- Clinton, Monroe,
 Lackawanna; VT- Windham; VA- Augusta, Bath,
 Rockingham; WV- Berkeley
- Knieskern's Beaked Rush Rhynchospora knieskernii
 Cyperaceae; NJ- Atlantic, Burlington, Monmouth, Ocean

Bunched Arrowhead Sagittaria fasciculata
 Alismataceae; SC- Greenville; NC- Henderson

Mountain Sweet Pitcher Plant Sarracenia rubra ssp. jonesii
 Sarraceniaceae; SC- Greenville; NC- Henderson,
 Transylvania

Sensitive Joint-Vetch Aeschynomene virginica
 Fabaceae; MD- Somerset; NJ- Burlington, Cumberland;
 VA- Charles City, Essex, James City, King
 George, King William, New Kent, Westmoreland

Fassett's Locoweed Oxytropis campestris var. chartacea
 Fabaceae; WI- Portage, Waushara

Butte County Meadowfoam Limnanthes floccosa ssp. californica
 Fabaceae; CA- Butte

Ute Ladies-Tresses Spiranthes diluvialis
 Orchidaceae; CO- Boulder; UT- Unitah, Utah, Weber,
 Duchesne, Salt Lake

Mat-Forming Quillwort Isoetes tegetiformans
 Isoetaceae; GA- Hancock

Michigan Monkey-Flower Mimulus glabratus var. michiganesis
 Scrophulariaceae; MI- Benzie, Emmet, Leelanau, Cheboygan

Bradshaw's Lomatium Lomatium bradshawii
 Apiaceae; OR- Marion

Texas Wild Rice Zizania texana
 Poaceae; TX- Hays

Virginia Round-Leaf Birch Betula uber
 Betulaceae; VA- Smyth

Houghton's Goldenrod Solidago houghtonii
 Asteraceae; MI- Emmet, Chippewa, Delta, Charlevoix,
 Cheboygan, Presque Isle

Minnesota Trout Lily Erthronium propullans
 Liliaceae; MN- Goodhue, Rice

2. Recommended Risk Reduction For Endangered Species

Since endangered/threatened plant species may be adversely affected, a formal biological consultation with USFWS may be required unless this herbicide is labelled to protect these species. Such labelling may be:

Endangered Species Restrictions:

"The use of any pesticide in a manner that may kill or otherwise harm an endangered or threatened species or adversely modify their habitat is a violation of Federal laws."

"The use of this product is controlled to prevent death or harm to endangered species. Do not use this herbicide in the following counties."

Alabama- Autauga, Bibb, Chambers, Cherokee, Chilton, Elmore, Etowah, Dekalb, Franklin, Jackson, Marshall, Randolph

Arkansas- Clay, Jackson, Lawrence, Woodruff

California- Butte

Colorado- Boulder

Delaware- Kent, New Castle, Sussex

Florida- Gadsden, Walton

Georgia- Baker, Bartow, Burke, Butts, Chattooga, Dooly, Douglas, Floyd, Gwinnett, Hancock, Heard, Henry, Lee, Merriwether, Murray, Newton, Pike, Sumter, Towns, Walton, Wheeler

Illinois- Cook, DuPage, Grundy, Henry, Iroquois, Jersey, Kane, Lake, Marshall, McHenry, Morgan, Putnam, Randolph, Schuyler, St. Clair, Woodford

Kentucky- McCreary

Maryland- Allegany, Anne Arundel, Cecil, Queen Anne's, Somerset, Washington

Michigan- Alpena, Bay, Benzie, Charlevoix, Cheboygan, Chippewa, Delta, Emmet, Huron, Leelanau, Livingston, Monroe, Presque Isle, Menominee, Saginaw, St. Clair, St. Joseph, Tuscola, Washtenaw, Wayne

Minnesota- Goodhue, Rice

Mississippi- Sharkey

Missouri- Ripley, St. Charles

New Jersey- Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Middlesex, Monmouth, Morris, Ocean, Salem, Sussex

North Carolina- Bladen, Brunswick, Burke, Carteret, Catawba, Cleveland, Chatham, Clay, Columbus, Cumberland, Granville, Henderson, Hoke, Jackson, Lincoln, Macon, Onslow, Pender, Rutherford, Scotland, Stokes, Transylvania

Oregon- Marion

Pennsylvania- Clinton, Lackawanna, Monroe

South Carolina- Aiken, Allendale, Bamberg, Barnwell, Berkeley, Cherokee, Colleton, Clarendon, Greenville, Hampton, Lancaster, Lee, Orangeburg, Richland, Saluda, Spartanburg, Williamsburg, York

Tennessee- Cumberland, Fentress, Lewis, Morgan, Scott, White

Texas- Hays

Utah- Duchesne, Salt Lake, Uintah, Utah, Weber

Vermont- Windham

Virginia- Augusta, Bath, Charles City, Essex, Henrico, James City, King George, King William, Nelson, New Kent, Rockingham, Smyth, Westmoreland

West Virginia- Berkeley, Morgan

Wisconsin- Dane, Jefferson, Kenosha, Ozaukee, Portage, Rock, Walworth, Waushara, Waukesha, Winnebago

Formal consultation with USFWS may be initiated regarding the use of this herbicide and the possible detrimental effects to federally listed endangered or threatened species of plants. The formal consultation with USFWS should be considered before section 3 registration of flumetsulam is granted unless the label indicates that flumetsulam products are not to be used in the above mentioned counties.

EEB is willing to consider the registrant's proposals for risk reduction measures that may diminish EEB's concern for endangered plants if they are intended to replace restrictions above or preclude formal consultations. Such measures must protect the endangered plants. This may be one way to reduce the number of counties where flumetsulam is prohibited.

If aerial application is requested, many more endangered species of plants may be adversely affected. EEB should do another risk assessment if aerial application is requested.

C. Risk Assessment Conclusions

Although important plant data are still outstanding, EEB may have serious concerns regarding adverse effects on non-target aquatic plant/crops from runoff with flumetsulam used at the labeled rates assuming aerial applications are prohibited. Please see attached table 1 (Comparative Analysis of Sulfonylurea herbicides as of 10/27/92). The following are reasons that give rise to EEB's concerns:

1. Flumetsulam is considered to be extremely phytotoxic to aquatic macrophytes (duckweed EC_{50} at 3.1 ppb). This chemical causes phytotoxic effects at the lowest known concentration of any of the sulfonylurea class of herbicides for algae (EC_{50} of 3.3 ppb for Selenastrum capricornutum) which may adversely effect aquatic ecosystems including aquatic fishes and invertebrates via indirect effects.

2. Flumetsulam is more resistant to breaking down in the aquatic and terrestrial environment than any of the soybean sulfonylurea herbicides. With aerobic soil metabolism $t_{1/2}$ of up to 90 days, aquatic photolysis $t_{1/2}$ of 727 days, and a maximum labeled crop rotation of 22 months; this chemical is assured of staying in the environment for a long time. If flumetsulam is used on a regular basis with a continuing rotation of soybean and corn (the most common type of row crop rotation in this country), the amount of this extremely phytotoxic chemical may increase in slow moving aquatic environment such as wetlands, lakes and some estuaries.

3. Data from 3/24/91 review from EFGWB are summarized on page 5 of section 2.A. Available data are insufficient to fully assess the environmental fate of Flumetsulam at this time. Confined rotational crops data indicated that flumetsulam may accumulate at concentrations of about 10 ppb in 365 day posttreatment and about 100 ppb in the 30- and 120 day posttreatment. The solubility of this herbicide indicates that it is expected to be very mobile in water and soil surface runoff. The data show that this chemical may leach into groundwater that can discharge into lakes, wetlands or estuaries or be used for irrigation. Although terrestrial plant data are not available at this time, it may be assumed that there can be adverse effects to non-target crops/plants by irrigation from contaminated groundwater. About 46.4 million acres of crops are irrigated in this country (1987 Census on Agriculture).

4. Many federal and state scientists working on the Chesapeake Bay Program have logical suspicions that herbicides may play a part in the degradation of the estuaries by destruction of plants in the estuaries. Large acreages of corn and soybean crops are also grown around these estuaries.

Flumetsulam and Trifluralin (XRM-5313)

EEB has concerns for endangered plants and fish from a blend of flumetsulam and trifluralin. A discussion on endangered species of plants have been covered in the flumetsulam sections above.

Since trifluralin may affect endangered fish species, EEB has consulted with FWS on April 15, 1991. EEB is awaiting the results of the formal consultation. Registration of this blend under section 3 should wait until the FWS gives a biological opinion on the use of trifluralin and the restrictions or other considerations for EEB's concerns are made for flumetsulam.

C. Labelling

1. Manufacturing Use

Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or public waters unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

2. End Use

a. Precautionary Statements: "Do not apply directly to water, 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." For endangered/threatened plants, please see statements in section B.2. under Endangered Species Restrictions.

b. Restricted Use: This pesticide does not meet the ecological effects criteria recommending that it be labeled as a restricted use pesticide.

Flumetsulam and Trifluralin (XRM-5313)

a. Precautionary Statements: "This pesticide is toxic to fish. Do not apply directly to water, 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."

b. Restricted Use: Trifluralin use **does exceed** the ecological effects criteria for restricted use.

D. Data Requirements

Flumetsulam

The following studies using the technical grade are required and are outstanding:

123-1(a,b) Germination, Seedling Emergence & Vegetative Vigor of Plants- Due to phytotoxicity at extremely low concentrations, the likelihood of exposure through windblown soil and surface and groundwater contamination, and several non-target plant incidents with other sulfonylurea herbicides; EEB has made a policy decision to have Tier II aquatic and terrestrial plant data requirements imposed on all sulfonylurea herbicides

The following studies are reserved pending results from studies in review or those that are outstanding:

124-1 Terrestrial Plant Field Study- pending results of 123-1 Germination, Seedling Emergence & Vegetative Vigor

124-2 Aquatic Plant Field Study- required study because the EC₅₀ of Selenastrum capricornutum and Lemna gibba approaches the EEC. 124-2 tier III testing is postponed pending guidance of tier III plant studies and the results of 123-2 Growth & Reproduction of Aquatic Plant on other required species.

For additional information pertaining to data requirements, please see enclosed data requirement table.

Trifluralin (XRM-5313)

Data requirements are outstanding per 11/12/92 memo from EEB to Walter Waldrop, PM 71, SRRD.

E. Data Evaluation Reports

The Ecological Effects Branch has reviewed three studies submitted by DowElanco. The following is a brief summary of the submitted studies:

•**CITATION:** Beavers, J.B., A. Corbitt, and M.J. Jaber. 1989. XRD-498 Herbicide, N-(2,6-difluorophenyl)-5-methyl-(1,2,4) triazolo (1,5-a)pyrimidine-2-sulfonamide: A One-Generation Reproduction Study with the Bobwhite (Colinus virginianus). Laboratory Project No. 103-297. Prepared by Wildlife International Ltd., Easton, MD. Submitted by DowElanco. MRID No. 419317-41.

Nominal dietary concentrations of XRD-498 at 100 and 300 ppm a.i. had no effects upon behavior, food consumption, or reproduction in adult bobwhite quail during the 20-week exposure period. The NOEC was 300 ppm a.i., based upon reduced ratios for viable embryos/eggs set, hatchlings/eggs set, and 14-day survivors/eggs set. This study is scientifically sound and fulfills the guideline requirements for an avian reproduction study.

•**CITATION:** Beavers, J.B., A. Corbitt, and M.J. Jaber. 1989. XRD-498 Herbicide, N-(2,6-difluorophenyl)-5-methyl-(1,2,4) triazolo (1,5-a)pyrimidine-2-sulfonamide: A One-Generation Reproduction Study with the Mallard (Anas platyrhynchos). Laboratory Project No. 103-298. Prepared by Wildlife International Ltd., Easton, MD. Submitted by DowElanco. MRID No. 419317-42.

Nominal dietary concentrations of XRD-498 at 100, 300, and 600 ppm a.i. had no effects upon behavior, food consumption, or reproduction in adult mallards during the 18-week exposure period. The NOEC was 600 ppm a.i. The study is scientifically sound and fulfills the guideline requirements for an avian reproduction study.

•**CITATION:** Hughes, J.S. 1991. The Toxicity of DE-498 Herbicide to Selenastrum capricornutum. Laboratory Project No. B460-11-1. Conducted by Malcolm Pirnie, Inc., Tarrytown, NY. Submitted by DowElanco, Indianapolis, IN. EPA MRID No. 419317-43.

This study is scientifically sound and meets the guideline requirements for a Tier 2 non-target aquatic plant study. The 5-day EC₂₅ and EC₅₀ values for S. capricornutum are 1.29 and 3.21 µg ai/l based on mean measured concentrations. The NOEC was determined to be 0.36 µg ai/l.

•**CITATION:** Weinberg, J.T., S.J. Gorzinski, D.L. Rick, M.D. Martin, and C.H. Richardson. 1992. Evaluation of the Toxicity of DE-498 Herbicide to Early Life Stages of the Fathead Minnow, Pimephales promelas Rafinesque. Conducted by The Dow Chemical Company, The Environmental Toxicology and Chemistry Research Laboratory, Midland, MI. Study ID No. DECO-ES-2475. Submitted by DowElanco, Indianapolis, IN. EPA MRID No. 424651-01.

This study is scientifically sound and meets the guideline requirements for a flow-through, early life-stage toxicity test for fathead minnows. The no-observed-effect concentration (NOEC) was 197 mg/l (mean measured). An MATC could not be determined due to no significant effects at any level tested. The results of this study classify DE-498 as practically non-toxic to fathead minnows.

•**CITATION:** Milazzo, D.P., M.F. Servinski, D.L. Rick, M.D. Martin, and D.C. Stahl. 1992. DE-498 Herbicide: Daphnia magna Straus Life-Cycle (21-Day Renewal) Toxicity Test. Laboratory Study No. DECO-ES-DR-0238-5651-24. Conducted by The Dow Chemical Company, Midland, MI. Submitted by DowElanco, Indianapolis, IN. EPA MRID No. 424651-02.

This study is scientifically sound and meets the guideline requirements for a daphnid life-cycle test. The MATC of DE-498 herbicide for Daphnia magna was between 111 and 200 mg/l, mean measured concentrations.

•**CITATION:** Hughes, J.S. and M.M. Alexander. 1992. The Toxicity of DE-498 Herbicide to Anabaena flos-aquae. Laboratory Project ID No. B460-13-1. Conducted by Malcolm Pirnie, Inc., Tarrytown, NY. Submitted by DowElanco, Indianapolis, IN. EPA MRID No. 424731-01.

This study is scientifically sound but does not meet the guideline requirements for a Tier 2 non-target aquatic plant growth and reproduction study. A precise NOEC was not determined. Based on mean measured concentrations, the 5-day LOEC and EC₅₀ for A. flos-aquae exposed to DE-498 were 0.12 and 0.16 mg ai/l, respectively.

•**CITATION:** Hughes, J.S. and M.M. Alexander. 1992. The Toxicity of DE-498 Herbicide to Navicula pelliculosa. Laboratory Project ID No. B460-13-2. Conducted by Malcolm Pirnie, Inc., Tarrytown, NY. Submitted by DowElanco, Indianapolis, IN. EPA MRID No. 424731-02.

This study is scientifically sound and meets the guideline requirements for a Tier 2 non-target aquatic plant study. Based on mean measured concentrations, the 5-day NOEC, LOEC, and EC₅₀ for N. pelliculosa exposed to DE-498 were 21.8, 44.2, and 41.6 mg ai/l, respectively.

•**CITATION:** Hughes, J.S. and M.M. Alexander. 1992. The Toxicity of DE-498 Herbicide to Skeletonema costatum. Laboratory Project ID No. B460-13-3. Conducted by Malcolm Pirnie, Inc., Tarrytown, NY. Submitted by DowElanco, Indianapolis, IN. EPA MRID No. 424731-03.

This study is scientifically sound and meets the guideline requirements for a Tier 2 non-target aquatic plant study. Based on mean measured concentrations, the 5-day NOEC, LOEC, and EC₅₀ for S. costatum exposed to DE-498 were 29.5, 59.4, and 54.7 mg ai/l, respectively.

•**CITATION:** Hughes, J.S. and M.M. Alexander. 1992. The Toxicity of DE-498 Herbicide to Lemna gibba G3. Laboratory Project ID No. B460-13-4. Conducted by Malcolm Pirnie, Inc., Tarrytown, NY. Submitted by DowElanco, Indianapolis, IN. EPA MRID No. 424731-04.

This study is scientifically sound and meets the guideline requirements for a Tier 2 non-target aquatic plant study. Based on mean measured concentrations, the 14-day NOEC, LOEC, and EC₅₀ for L. gibba exposed to DE-498 were 1.4, 3.9, and 3.1 µg ai/l, respectively.

If you have any questions, please call Mike Davy at 305-7081.

Date:10/23/92
 Case No:031451
 Chemical No:129016

FLUMETSULAM
 DATA REQUIREMENTS FOR
 ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition ¹	Use Pattern ²	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation	Must Additional Data Be Submitted Under FIFRA3(c)(2)(B)?
6 Basic Studies in Bold					
71-1(a) Acute Avian Oral, Quail/Duck	(TGA1)	A	Yes	41263218	No
71-1(b) Acute Avian Oral, Quail/Duck	(TEP)		No		No
71-2(a) Acute Avian Diet, Quail	(TGA1)	A	Yes	41263220	No
71-2(b) Acute Avian Diet, Duck	(TGA1)	A	Yes	41263219	No
71-3 Wild Mammal Toxicity		A	No		No
71-4(a) Avian Reproduction Quail	(TGA1)	A	Yes	41931741	No
71-4(b) Avian Reproduction Duck	(TGA1)	A	Yes	41931742	No
71-5(a) Simulated Terrestrial Field Study		A	No		No
71-5(b) Actual Terrestrial Field Study		A	No		No
72-1(a) Acute Fish Toxicity Bluegill	(TGA1)	A	Yes	41263222	No
72-1(b) Acute Fish Toxicity Bluegill	(TEP)	A	No		No
72-1(c) Acute Fish Toxicity Rainbow Trout	(TGA1)	A	Yes	41263221	No
72-1(d) Acute Fish Toxicity Rainbow Trout	(TEP)	A	No		No
72-1(e) Acute Fish Toxicity Fathead Minnow	(TGA1)	A	Yes	41263223	No
72-2(a) Acute Aquatic Invertebrate Toxicity	(TGA1)	A	Yes	41263224	No
72-2(b) Acute Aquatic Invertebrate Toxicity	(TEP)	A	No		No
72-3(a) Acute Estu/Mari Tox Fish	(TGA1)	A	Yes	41263225	No
72-3(b) Acute Estu/Mari Tox Mollusk	(TGA1)	A	Yes	41263227	No
72-3(c) Acute Estu/Mari Tox Shrimp	(TGA1)	A	Yes	41263226	No

* In Bibliographic Citation column indicates study may be upgradeable

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Date:10/23/92
 Case No:031451
 Chemical No:129016

FLUMETSULAM
 DATA REQUIREMENTS FOR
 ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition ¹	Use Pattern ²	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
72-3(d) Acute Estu/Mari Tox fish	(TEP)	A	No		No
72-3(e) Acute Estu/Mari Tox Mollusk	(TEP)	A	No		No
72-3(f) Acute Estu/Mari Tox Shrimp	(TEP)	A	No		No
72-4(a) Early Life-Stage Fish	(TGAI)	A	No	42465101	No
72-4(b) Live-Cycle Aquatic Invertebrate	(TGAI)	A	No	42465102	No
72-5 Life-Cycle Fish	(TGAI)	A	No		No
72-6 Aquatic Org. Accumulation	(TEP)	A	No		No
72-7(a) Simulated Aquatic Field Study	(TEP)	A	No		No
72-7(b) Actual Aquatic Field Study	(TEP)	A	No		No
122-1(a) Seed Germ./Seedling Emerg.	(TGAI)	A	No		No ³
122-1(b) Vegetative Vigor	(TGAI)	A	No		No ³
122-2 Aquatic Plant Growth	(TGAI)	A	No		No ³
123-1(a) Seed Germ./Seedling Emerg.	(TGAI)	A	No		Yes ⁴
123-1(b) Vegetative Vigor	(TGAI)	A	No		Yes ⁴
123-2 Aquatic Plant Growth	(TGAI)	A	No	41931743, 42473101, 42473102, 42473103, 42473104	No ⁵
124-1 Terrestrial Field Study	(TEP)	A	No		Reserved ⁶
124-2 Aquatic Field Study	(TEP)	A	No		Yes ⁷
141-1 Honey Bee Acute Contact	(TGAI)	A	Yes	41263228	No
141-2 Honey Bee Residue on Foliage	(TEP)	A	No		No ⁸
141-5 Field Test for Pollinators	(TEP)	A	No		No ⁸

* In Bibliographic Citation column indicates study may be upgradeable

1. Composition: TGA1=Technical grade of the active ingredient; PALRA=Pure active ingredient, radiolabeled; TEP=Typical end-use product

2. Use Patterns: A=Terrestrial Food Crop; B=Terrestrial Feed Crop; C=Terrestrial Non-Food Crop; D=Aquatic Food Crop; E=Aquatic Non-Food Outdoor; F=Aquatic Non-Food Industrial; G=Aquatic Non-Food Residential; H=Greenhouse Food Crop; I=Greenhouse Non-Food Crop; J=Forestry; K=Outdoor Residential; L=Indoor Food; M=Indoor Non-Food; N=Indoor Medical; O=Indoor Residential; Z=Use Group for Site 00000

3. It is assumed that herbicides will kill plants. Therefore, this study is not needed since Tier II is triggered.

4. Data are required because of phytotoxicity at extremely low concentrations, persistence and several non-target plant incidents. Therefore, EEB has made a policy decision to uniformly have Tier II aquatic and terrestrial plant data requirements imposed on all sulfonylurea herbicides .

5. Although the study on Anabaena flos-aquae was supplemental, no further testing is required because this species was found not to be the most sensitive algae species.

6. Study is reserved pending results of the tier II tests.

7. EC₅₀ of Selenastrum capricornutum and Lemna gibba approaches the EEC. 124-2 tier III testing is postponed pending guidance of tier III plant studies.

8. Data from the acute contact study show low toxicity, no further testing is required.

Comparative Analysis of Sulfonylurea Herbicides as of 10/27/92

Herbicide	Shaughnessy Number	Aerobic Soil t1/2 Metabolism	Photolysis Hydrolysis pH 7 t1/2	Solubility at pH 7 t1/2 (ppm)	Lemna gibba EC50	Selenastrum EC50 (ppb)	Terrestrial plant EC50 gm/HA	Max Crop Rotation (Months)	Terre EEC gm/ha	Aqua EEC ppb	Use Site
Allyl metsulfuron methyl	122010	120-180 days	P=H=Stable	17800	0.36	286	V=0.02 P=0.01	34	0.736	0.122 1.468	4 corn
Accent nicosulfuron	129008	26 days	P=250 day H=Stable	18000	N/A	N/A	N/A	12	N/A	N/A	5 corn
Glenn chlorosulfuron	118601	60 days	P=14 day H=Stable	27900	N/A	N/A	N/A	48	N/A	N/A	6 rice
Harmony thifensulfuron	128845	4 days	P=H >30 day	24700	N/A	N/A	N/A	2	N/A	N/A	7 rice
Classic chlorimuron ethyl	128901	83 days	P=27 day H=Stable	1200	N/A	N/A	N/A	15	N/A	N/A	8 rice
Amber trifluralin	128969	86 days	P=87 day H=3.1 YR	1500	0.19	35	V=0.038 P=0.050	36	7.8	1.6 39.0	9 rice
Express trifluralin methyl	128887	7 days	P=H=3-6 day	732	N/A	N/A	N/A	2	N/A	N/A	10 rice
Londax bensulfuron methyl	128820	84 days	P=H=Stable	120	N/A	800	N/A	3	N/A	N/A	11 rice
Beacon proflaqualuron methyl	128973	47 days	P=56 day H=Stable	70	0.8	24	V=0.14 P=0.14	18	20 to 0.52 ¹⁰	0.24 2.9	12 rice
Oust sulfamuron methyl	122001	30 days	P=H >30 day	244	N/A	N/A	N/A	12	N/A	N/A	13 rice
flumetsulam	129016	60-90 days	P=727 days H >60 days	5650	3.1	3.3	N/A	22	N/A	2.0 24.0	14 rice

1. Values are in ppb

2. P= pre-emergence; germination or emergence test.
V= Vegetative vigor test; post-emergence

3. first line is EEC in 6 feet of water, second line is EEC in 6 inches of water
4. Ally is used for turf, Rights-of-Way, Forestry, Pasture, barley, wheat, corn, sorghum, sunflower
5. Glean is used for wheat, barley and forage
6. Harmony is used for wheat, barley, potato, tomato and soybean
7. Classic is used for corn, barley, wheat, sorghum, soybean, peanut, turf, forage, Rights-of-Way
8. Amber is used for wheat, barley, turf and non-cropland
9. Express is used for tomato, potato, wheat and barley
10. 20 gm/Ha= maximum per year, 0.52 gm/Ha= average per year
11. Beacon is used for corn and Rights-of-Way
12. Oust is used for forestry, Rights-of-Way, and grass crops
13. Flumetsulam is used for corn and soybean