

CHEMICAL FACT SHEET FOR

FLURIDONE

FACT SHEET NUMBER: 81

DATE ISSUED: MARCH 31, 1986

Description of Chemical

- Generic Name: 1-methyl-3-phenyl-5-3-(trifluoromethyl)phenyl| - 41H| - pyridinone
- Common Name: fluridone
- Trade Name: Sonar
- EPA Shaughnessy Code: 112900
- Chemical Abstracts Service (CAS) Number: 59756-60-4
- Year of Initial Registration: 1986
- Pesticide Type: Aquatic herbicide
- Status: General use
- U.S. and Foreign Producers:

Elanco Products Co.
Div. of Eli Lilly and Co.
740 South Alabama St.
Indianapolis, IN 46285

Summary of Regulatory Position and Rationale (Source: NPIRS):

- Risk/benefit review: None of the risk criteria set forth in Title 40 Code of Federal Regulations Section 162.11 have been exceeded for fluridone.
- Fluridone has been proposed only for direct application to aquatic sites. No groundwater contamination issue is associated with this use.

Use Patterns and Formulations (Source: NPIRS):

- Application sites: Freshwater ponds, lakes, reservoirs, drainage canals, irrigation canals, and rivers.
- Types of formulations: Aqueous suspension, pellet
- Types and methods of application: Surface spray, weighted hose

- dragged near bottom; broadcast (pellet)
- Application rates: 0.5 lb. a.i./surface acre - 4.0 lb. a.i./surface acre
 - Usual carrier: water

I. EFFICACY

Fluridone controls most submerged and emerged aquatic plants.

Some of the weeds controlled by fluridone include fanwort (Cabomba caroliniana), coontail (Ceratophyllum demersum), elodea (Elodea canadensis), parrot feather (Myriophyllum brasiliense), watermilfoil (Myriophyllum spp.) naiad (Najas quadalupensis), pickerelweed (Pontederia lanceolata), pondweed (Potamogeton spp.), arrowhead (Sagittaria spp), bladderwort (Utricularia spp.), Vallisneria (Vallisneria spp.), hydrilla (Hydrilla verticillata) and certain shoreline grasses such as maidencane (Panicum hemitomon), paragrass (Panicum purpurascens), torpedograss (Panicum repens), and reed canarygrass (Phalaris arundinacea). Fluridone has little effect on algae and provides only partial control of the cattails (Typha spp.). In addition, most floating aquatic weeds are only partially affected by fluridone applications (58).

Important Weeds Controlled: Aquatic weeds, barnyardgrass, Bermudagrass, blackgrass, cocklebur, crabgrass, foxtails, jimsonweed, Johnsongrass, lambsquarters, morningglory, nightshade, nutsedge, pigweed, purslane, ragweed, velvetleaf and many others (8b).

As little as 0.1 inch of rainfall will activate the material. A long residual activity, so further investigation is needed to determine what crops can be planted the following season after treatment. Weeds may germinate and emerge from the soil before they get a chlorotic condition and then die. A very broad spectrum herbicide. Effective at extremely low rates. In aquatics, little or no weed control is noted for 2-4 weeks (8b).

II. PHYSICAL PROPERTIES

- Chemical Characteristics

Fluridone is a white (to off-white) crystalline solid with no odor. The melting point is 154-155 C. The flash point for the aqueous suspension formulation is greater than 200 degrees. Fluridone is not corrosive to application equipment (NPIRS).

Molecular Formula: C₁₉ H₁₄ F₃ NO (62)

Molecular Weight: 329.3 (62)

Physical State: Off-white crystalline solid (pure compound)
(62)

Melting Point: 151-154 C (pure compound) (62)

Vapor Pressure: 13 uPa at 25 C (pure compound) (62)

Solubility: 0.0012 g/100 ml water (pure compound) (58)

III. SCIENTIFIC INFORMATION

Osha Standard: NA

NIOSH Recommended Limit: NA

ACGIH Recommended Limit: NA

A. Toxicology Characteristics (Sources other than NPIRS):

1. Acute toxicity:

Fluridone was administered to rats and mice as a single dose given either orally or subcutaneously. Dogs and cats received a single oral dose administered in capsules. The acute toxicity of an aqueous suspension formulation containing 45 percent fluridone was evaluated by administering a single application of the material to the skin or eyes of rabbits. Inhalation was evaluated in rats exposed for 1 hr to an atmosphere containing the compound or formulation. The toxic effects of these treatments are summarized below (58).

DERMAL: LD₅₀ = >2,000 g/kg (rat, technical); >500 mg/kg (rabbit, technical; no irritation); >2 ml/kg (rabbit, 2 AS; slight irritant) (58).

LD₅₀ = >2,000 mg/kg (mouse, technical) (58).

ORAL: LD50 = >10,000 mg/kg (rat, technical); >10,000 mg/kg (mouse, technical) (58).
LD50 = >0.5 ml/kg (rat, 4 AS); >250 mg/kg (cat, technical); >500 mg/kg (dog, technical) (58).

INHALATION: LC0 = >2,130 mg/m³ of air (rat, technical);
>9.6 ml/m³ of air (rat, 4AS) (58).

EYES: Moderate irritant (rabbit, 44 mg/eye, technical);
very slight irritant (rabbit, 0.1 ml/eye, 4 AS) (58).

2. Subacute and chronic toxicity:

Fluridone has been evaluated for a period of three months in rats, mice and dogs. An increase in liver and kidney weights as well as the histological identification of liver centrilobular hypertrophy occurred in rats fed diets containing 1,400 ppm of fluridone. Liver centrilobular hypertrophy was also observed in mice receiving diets containing 560 ppm of fluridone. No treatment-related effects were noted in rats at dietary doses of 330 ppm or noted in mice at dietary doses of 62 ppm. No toxic effects were observed in dogs receiving up to 200 mg/kg/day of fluridone (58).

B. Toxicology Characteristics (Source: NPIRS):

- Acute toxicology: Technical fluridone is in Category IV for acute oral effects in the rat, and is moderately toxic through acute inhalation exposure. Eye irritation potential has been demonstrated as moderate to severe (Category III and Category II).
The aqueous suspension and pellet formulations are in Category III for oral, dermal, skin, and eye irritation effects.

- Chronic toxicology: A complete, acceptable chronic toxicity data base is available, except for a rat teratology study (second species). A valid rabbit teratology study indicates no teratogenic response up to a dose level of 300 mg/kg/day. Fluridone is not considered to have produced an oncogenic response in the mouse or rat. Mutagenicity assays submitted do not indicate genotoxic potential, gene mutation, or structural chromosomal aberration.

C. Physiological and Biochemical Behavioral Characteristics (Source: NPIRS):

Fluridone is a systemic herbicide; it is absorbed from water by plant shoots and from hydrosol by roots. It inhibits carotenoid synthesis, which enhances degradation of chlorophyll, producing white (chlorotic) growing points in susceptible plants.

D. Tolerance Assessment (Source: NPIRS):

- A tolerance is proposed for residues of the herbicide fluridone (1-methyl-3-phenyl)-5-3-(trifluoromethyl)phenyl|-4(1H)-pyridinone) and its metabolite (1-methyl-3-(4-hydroxyphenyl)-5-3-(trifluoromethyl)phenyl|-4(1H)-pyridinone) in fish at 0.5 ppm.
- Tolerances are proposed for residues of the herbicide fluridone in the following raw agricultural commodities:

Commodity	Parts per million
Cattle, fat	0.05
Cattle, kidney	0.1
Cattle, liver	0.1
Cattle, meat byproducts	0.05
Cattle, meat (except liver and kidney)	0.05
Eggs	0.05
Goats, fat	0.05
Goats, kidney	0.1
Goats, liver	0.1
Goats, meat byproducts	0.05
Goats, meat (except liver and kidney)	0.05
Hogs, fat	0.05
Hogs, kidney	0.1
Hogs, liver	0.1
Hogs, meat byproducts	0.05
Hogs, meat (except liver and kidney)	0.05
Horses, fat	0.05
Horses, kidney	0.1
Horses, liver	0.1
Horses, meat byproducts	0.05
Horses, meat (except liver and kidney)	0.05
Milk	0.05
Poultry, fat	0.05
Poultry, kidney	0.1
Poultry, liver	0.1
Poultry, meat byproducts	0.05
Poultry, meat (except liver and kidney)	0.05
Sheep, fat	0.05
Sheep, kidney	0.1
Sheep, liver	0.1
Sheep, meat byproducts	0.05
Sheep, meat (except liver and kidney)	0.05

- Tolerances are proposed in the following irrigated crops and crop groupings for residues of the herbicide fluridone resulting from use of irrigation water containing residues of 0.15 ppm following applications on or around aquatic sites. Where tolerances are established at higher levels from other uses of fluridone on the following crops, the higher tolerance also applies to residues in the irrigated commodity. The tolerances follow:

Commodity	Parts per million
Avocados	0.1
Citrus	0.1
Cottonseed	0.1
Cucurbits	0.1
Forage grasses	0.15
Forage legumes	0.15
Fruiting vegetables	0.1
Grain crop	0.1
Hops	0.1
Leafy vegetables	0.1
Nuts	0.1
Pome fruit	0.1
Root crops - vegetables	0.1
Seed and pod vegetables	0.1
Small fruit	0.1
Stone fruit	0.1

- Based on the NOEL of 8 mg/kg/day in the chronic rat feeding study and a 100-fold safety factor, the Acceptable Daily Intake (ADI) has been set at 0.08 mg/kg/day, with a Maximum Permissible Intake (MPI) of 4.8 mg/day for a 60-kg person. There are no previously established tolerances for this herbicide.

- The Agency is designating an acceptable residue level for fluridone in potable water at 0.15 ppm. This concentration reflects the maximum application rate for the herbicide registration(s) issued pursuant to FIFRA. Consumption of water is estimated at 2.0 liters per day for a 60-kg adult. These tolerances and the acceptable residue level in potable water result in a Theoretical Maximum Residue Contribution of 0.4112 mg/day in a 1.5-kg diet (including 2 liters of water), and use 8.57% of the ADI.

- No Mexican, Canadian, or Codex maximum residue levels have been established. Residue studies are adequate to support the proposed tolerances. Plant and animal metabolism is adequately understood, and adequate analytical methods are available to enforce the tolerance levels. The residue of concern in drinking water is parent compound, i.e. fluridone.

E. Summary Science Statement (Source: NPIRS)

Supporting data base for fluridone registration and tolerance proposals supporting aquatic use is complete and acceptable, except

for a second species (rat) teratogenic study. Original study submitted did not produce teratogenic response at any level tested.

The study, however, is not adequate for regulatory purposes, because

the highest dose tested did not produce frank maternal toxicity or

fetotoxicity. The study is presently being repeated.

F. Summary of Major Data Gaps (Source: NPIRS)

An additional rat (second species) teratology study is underway. Schedule for submission is July 1, 1986.

G. Contact Person at EPA:

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IV. ENVIRONMENTAL/ECOLOGICAL CONSIDERATIONS

A. Environmental Characteristics (Source: NPIRS):

- Degradation: Fluridone is stable to hydrolysis. It will photo-degrade (half-life is 34 hours in neutral pond water).

- Persistence: Under anaerobic aquatic conditions, fluridone has a half-life of nine months. The half-life for fluridone in water is estimated to be 20 days; for hydrosol, 90 days.

1. Behavior In or On soils (58):

a. Adsorption and leaching characteristics in basic soil types:
Fluridone is strongly adsorbed to organic matter in soil. Regression analysis suggests that organic matter can be

used to

predict the rate of fluridone required for herbicidal activity.

There is also good correlation between adsorption/desorption

coefficients and the organic matter content of the soil.

Column

leaching studies indicate that fluridone leaches slowly in the

soil.

b. Microbial breakdown: Microorganisms appear to be the major factor responsible for the degradation of fluridone in terrestrial soils.

c. Loss from photodecomposition: In an aquatic environment fluridone appears to be degraded principally by photolytic processes; however, microorganisms and aquatic vegetation may also be factors in the dissipation process.

d. Resultant average persistence at recommended rates: The persistence of fluridone in terrestrial soils is complex and not well defined. In most cotton producing areas, residues may carry over to the next cropping season and may cause injury to crops such as corn, sorghum, soybeans, sugar beets, and tomatoes that follow in rotation. There appears to be little relation-ship between the rainfall pattern, soil texture and land tillage to soil persistence of fluridone. When used for the control of aquatic vegetation, fluridone exhibits a half-life in water of approximately 21 days.

B. Ecological Characteristics (Source: NPIRS):

1. Avian studies:

- Acute oral (bobwhite quail), >2,000 mg/kg (slightly toxic). Avian dietary (bobwhite quail and mallard duck), >5,000 ppm. No impairment on reproduction for above species up to 1,000 ppm dietary exposure.

2. Aquatic species studies:

- Daphnia magna 48-hour acute is 6.3 mg/L (moderately toxic).
- Bluegill sunfish 96-hour acute is 12 mg/L (moderately toxic).
- Rainbow trout 96-hour acute is 11.7 mg/L (moderately toxic).
- Sheepshead minnow 96-hour acute is 10.91 mg/L (moderately toxic).
- Oyster embryo-larvae 48-hour acute is 16.51 mg/L (moderately toxic).

- Maximum Acceptable Theoretical Concentration (MATC) value for fathead minnow (second generation fry) was calculated to be >0.48 <0.96 mg/L. No treatment-related effects were observed at or below 0.48 mg/L. Total length of 3-day-old fry was reduced at 2 mg/L fluridone.

3. Potential problems for endangered species:

- Acute and MATC values indicate a potential hazard for aquatic organisms in shallow areas at higher treatment rates described on the label. Formal consultation with Office of Endangered Species (OES) has been initiated. To minimize hazard, label directions provide for use of lowest listed rates for shallow areas, and consultation with Fish and Game Agency or U.S. Fish and Wildlife Service if questions arise concerning aquatic resources in the area to be treated.

4. General Toxicity to Wildlife and Fish (58):

- Fluridone was administered to one-week old mallard and bobwhite as a component of the diet for four days or to adult bobwhite as a single dose. Bluegills and rainbow trout were exposed to the compound for 96 hr in static toxicity tests. Similar static tests were conducted with *Daphnia magna* for a duration of 48 hr. The LD50 and LC50 values determined by these tests are summarized as follow:

	Species	Route	Toxicity
>5,000 ppm	Mallard (<i>Anas platyrhynchos</i>)	Diet (4 days)	LC50
>5,000 ppm	Bobwhite (<i>Colinus virginianus</i>)	Diet (4 days)	LC50
>5,000 mg/kg	Bobwhite (<i>Colinus virginianus</i>)	Oral (acute)	LD50
>9<12.5 ppm	Bluegill (<i>Lepomis macrochirus</i>)	Water (static)	LC50

11.7 ppm	Rainbow (<i>Salmo gairdneri</i>)	Water (static)	LC50 =
6.3 ppm	Daphnia (<i>Daphnia magna</i>)	Water (static)	LC50 =

V. EMERGENCY AND FIRST AID PROCEDURES

The chemical information provided below has been condensed from original source documents, primarily from "Recognition and Management of Pesticide Poisonings", 3rd ed. by Donald P. Morgan, which have been footnoted. This information has been provided in this form for your convenience and general guidance only. In specific cases, further consultation and reference may be required and is recommended. This information is not intended as a substitute for a more exhaustive review of the literature nor for the judgement of a physician or other trained professional.

If poisoning is suspected, do not wait for symptoms to develop. Contact a physician, the nearest hospital, or the nearest Poison Control Center.

SYMPTOMS OF POISONING: No cases of poisoning have been reported or observed (58).

SKIN CONTACT: Wash affected areas with soap and water (58).

EYE CONTACT: Flush eyes with large quantities of water (58).

VI. FIRE AND EXPLOSION INFORMATION

None of the formulations are flammable (58).

VII. COMPATIBILITY

Incompatibility with water of any hardness has not been experienced. Fluridone has been successfully tank-mixed with many other herbicides. None of the formulations have demonstrated

corrosiveness (58).

VIII. PROTECTIVE MEASURES

STORAGE AND HANDLING: Keep out of reach of children. Avoid freezing.

Store above 32 F. Harmful if swallowed, inhaled, or absorbed through skin. Avoid breathing vapors or spray mist. Avoid contact with skin, eyes, or clothing (56).

IX. PROCEDURES FOR SPILLS AND LEAKS

IN CASE OF EMERGENCY, CALL, DAY OR NIGHT
(800) 424-9300
PESTICIDE TEAM SAFETY NETWORK/CHEMTREC

X. LITERATURE CITED

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62. The Pesticide Manual: A World Compendium, 7th ed. 1983. C.R. Worthing, ed. The British Crop Protection Council, Croydon, England. 695 pp.